ISWS
Biennial Conference
Proceedings



5-7 February, 2020
Goa, India

Supported by

NABARD

"Weed Management for Enhancing Farmers' Income and Food Security"

Organizers

Indian Society of Weed Science
ICAR - Central Coastal Agricultural Research Institute
ICAR - Directorate of Weed Research
Indian Council of Agricultural Research

Citation: Proceedings of ISWS Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", 5-7 February 2020, ICAR-CCARI, Goa, Indian Society of Weed Science, India. 270 p.

Editors:
Dr Sushilkumar
Dr. Shobha Sondhia
Dr. V.K. Choudhury

Technical support & cover design
Mr Gyanendra Pratap Singh

Further information:
Indian Society of Weed Science
ICAR-Directorate of Weed Research
Jabalpur - 482 004, (MP), India
Website: www.isws.org.in
E-mail : iswsjbp@gmail.com
Phone : 91-761-2353138; Fax : 91-761-2353129

Proceedings

ISWS
Biennial Conference

on

"Weed Management for Enhancing Farmers' Income and Food Security"

5-7 February, 2020
Goa, India

Organized by
Indian Society of Weed Science
ICAR - Central Coastal Agricultural Research Institute
ICAR - Directorate of Weed Research
Indian Council of Agricultural Research

PREFACE

Weeds are the major agricultural pests and cause tremendous loss in crop yield and quality annually, if not properly managed. Besides yield losses, weeds also deteriorate quality of agricultural products and enhance costs of weed control and therefore have a significant economic impact on crop production. Losses caused by weeds in the developing world are still at least 37% and in certain regions, losses can be up to 90-95% including total crop failure. In addition to direct effect on crop yield, weeds result in considerable reduction in input-use efficiency, and adversely affect biodiversity, animal health and environmental security. The problem of weeds is as old as the agriculture itself as almost all crop plants have been domesticated from their wild relatives only. Despite the development of weed management technologies, the weed related problems have been virtually increasing due to adoption of modern cultivation methods, and the threats posed by climate change, globalization, herbicide resistance development in weeds and commercialization of herbicide-tolerant crops.

Over the years, the discipline of weed science has also developed in many countries of the region and professional societies dealing with the subject have been established for mutual exchange and sharing of knowledge. The Indian Society of Weed Science (ISWS), established in 1968, promotes research, education, and extension outreach activities related to weeds; provides science-based information to the public and policy makers; create awareness of weeds and their impacts on managed and natural ecosystems in the country. Besides organizing various activities including conferences and symposia at the national level, the Society has also been providing a platform for sharing of international experiences on emerging issues in weed science. The Indian Society of Weed Science has completed 51 years of journey by now. The Society is organizing ISWS Biennial Conference 2020 with a theme, "Weed Management for Enhancing Farmers' income and Food Security" 5-7 February, 2020, Goa.

This e-proceedings include abstracts of Keynote address (1), Plenary presentations (4), Lead presentations (13), Oral presentations (71) and Poster presentation (170). We have undertaken the voluminous task of compiling, editing and presenting these articles in a systematic manner. It is hoped that this volume will be useful to scientists, teachers, students, administrators and policy makers who are concerned with weed management in respective countries.

5th February 2020

Sushil Kumar
Shobha Sondhia
V.K. Choudhary

ACKNOWLEDGEMENTS

Indian Society of Weed Science is pleased to present the e-Proceedings containing the abstracts of keynote lecture, plenary lectures, lead lectures, and oral & poster presentations submitted by the weed scientists for presentation at ISWS Biennial Conference on "Weed Management for Enhancing Farmers' income and Food Security" being organized at ICAR-CCARI, Goa from 5-7 February, 2020. A large number of papers were received covering a wide range of themes from all over the India and a few from abroad. These papers were thoroughly reviewed for both technical content and editorial quality and high priority papers were selected for oral presentations. We worked tirelessly to complete the process of editing in a very short time period.

It was noted that though the papers, in general, covered the main theme of the Conference well, the number of papers on weed control in individual field crops far outnumber than those on other sub-themes. Further, papers on chemical weed control / herbicides are many but very few papers focused on other control measures and habitat management approaches in integrated cropping/farming systems. The papers on other relevant sub-themes, such as economics, ecology, weed utilization, weed science education, participatory research are also minimal. It is hoped that some of these neglected areas/gaps would be addressed adequately during the Keynote/ Lead/Plenary paper presentations. It was noted that large number of papers clearly highlighted the role of weed science in contributing to agricultural productivity. However, only a few papers focusing on other developmental challenges as biodiversity conservation, environmental degradation, herbicide resistance and climate change were received indicating that weed science addressing these global challenges is yet to be intensified in this region.

We thank all the ISWS members and non-members for showing their interest in the Biennial Conference of Indian Society of Weed Science. We thank keynote, plenary, and lead, presenters. We also thank all the authors for contributing research articles for presentation at this Conference. We appreciate the efforts made by Mr. Gyanendra Pratap Singh in processing, and formatting of articles, and bringing out the proceedings in time.

We are hearty thankful to the following companies for extending financial help to society for organizing the ISWS Biennial Conference: Corteva Agriscience, UPL Limited, Bayer Crop Science Limited, Sumitomo Chemical India Ltd. AG Bio System Private Limited, BASF, PI Industries, Adama India Pvt Ltd.

The financial assistance received from Research and Development Fund of National Bank for Agriculture and Rural Development (NABARD) towards this publication is gratefully acknowledged.

Dr. Sushilkumar
(President, ISWS)

Dr. Shobha Sondhia
(Organizing Secretary)

Contents

Keynote address
and
Plenary lectures

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

Keynote

Weed management in sustainable agriculture: Farm economy and food security

Prasanta Chitta Bhowmik

Stockbridge School of Agriculture, University of Massachusetts Amherst, MA 01003 USA

Email: pbhowmik@umass.edu

The human population has the capacity to protect or exploit the biological resources. It is a challenge for us to manage biological resources to meet growing human needs for now and in the future. Sustainable agriculture is our priority and a common theme around the world for food production. Growing population and increasing demand for food and fiber in the last few decades have compelled scientists, lawmakers and farmers to give emphasis upon sustainable crop production. On the other hand, demands for food security remain at the highest priority. The world's human population is expected to rise to 8.9 billion by the year 2030. The world after 2030 must be prepared to feed a peak population of 10 billion people in 2050.

Sustainable crop production refers to agricultural production in such a way that does not impose any harm to environment, biodiversity, and quality of agricultural crops. Sustainable agriculture is more than a collection of practices. Among crop production practices weed management remains as one of the most important components to sustainable crop production. Sustainability is possible through following future plans, available biological resources and implementation of current technologies, proper education and awareness of general public. The importance of weed population dynamics with climate change, invasion of new weed species, potential use of allelopathy, conservation tillage, mulch or cover crops, and cultural practices will be highlighted. The current use of chemical control for weeds in different crops has resulted in evolution of herbicide resistant (HR) weeds. Currently, there are 500 cases of HR weeds in 2019 as compared to only 100 cases in 1985 in the world. There are over 200 species of weeds are resistant to various modes-of-action herbicides. The HR weeds in various crops has resulted severe problems in developing and adopting control methods. In addition, another dimension of weed management is evolving with the introduction of genetically modified (GM) crops in current cropping systems.

The challenge to the agricultural community is to understand the complexities of farming practices on environmental quality and climate change. We need to think holistic approach about the smart management practices for food production. We should not forget to sustain the economic viability of farm operations, and enhance the quality of life for farmers. The concept of "doubling farm income" is well conceived as proposed. However, the challenges to implement production practices into small farms remain at the high level. Technological sophistication determines a farm's productivity far more than its climatic and agricultural environments. The impact of weed management tactics on crop yield must be evaluated case by case for economic benefits to farmers. Potential higher income with any new technologies would be an incentive for framers. The farmers must be educated for implementing new and sustainable technologies. Information must be communicated via digital technology as weed ID, newsletters and fact sheets, and may be presented at local workshops and twilight meetings. We do have challenges whether we can double the farm income at current farm practices. Finally, food insecurity can be addressed by improvements in economic, political, and agricultural policies at local and national scales.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

PL-1

Weed management in the digital era

N.T. Yaduraju
Director (Retired), ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
Email: nyaduraju@gmail.com

Indian agriculture is in the cusp of a big transformation triggered by the massive pervasiveness of mobile phones, internet use and mushrooming of AgTech Startups. Advanced technologies such as artificial intelligence, machine learning, sensing technologies, robotics, cloud computing and others have the potential to disrupt the agriculture practices that are being practiced currently. The mobile phones have become pervasive. Access to internet and smart phones have added a new dimension to farming. There are currently over 600 million internet users in the country. According to Boston Study Group, by 2020 about 315 million living in rural areas will be connected to the Internet. Hundreds and thousands of farmers are active on social media, including a quite a few enterprising farmers running their own channels producing and sharing videos. Besides, a large number of digital repositories, farmers are served with a host of applications (Apps), developed by public and private agencies. The technologies Startups are evincing keen interest in agriculture. According to 2019 NASSCOM, India is a home to over 400 AgriTech Startups. Every 9thAgriTech Startup in the world focusing primarily on improving supply chain, direct marketing, traceability, real time access to information, better access to inputs, precision agriculture, mechanization etc. To overcome labour problem, there are Apps available to hire machinery much like the service provided by cab aggregators like Ola or Uber. Herbicides are increasingly being used to overcome labour problem, however, they are applied uniformly, disregarding heterogeneous distribution of weeds in time and space. Over the last two decades, the availability of new geospatial and information technologies have provided new opportunities for precise management of agricultural field operations including weed management. Satellite-based remote sensing technologies, though useful in large scale mapping and monitoring of weeds, they are not sufficient for effective weed management applications at individual field level. In the recent past, however, unmanned aircraft vehicles (UAV) popularly called 'drones' are increasingly being used in several agricultural operations. The use of UAVs for weed management is being investigated in several countries, but it is still in early stages of development.More recently, the breakthroughs made with ground vehicle-based sensors are catching the global attention. Through artificial intelligence (AI) and advanced image processing techniques, it has been made possible to identify weeds and to differentiate them from crop plants. With focus on robotics and using sensors, artificial intelligence and machine learning, the engineers in collaboration with weed scientists have been successful in designing and developing self-guided and auto-driven robots/machines that are capable of identifying weeds and eliminating them selectively, either by plucking them automatically using robotically controlled cultivation knives, or by delivering a lethal dose of laser rays or micro doses of an herbicide. While many companies are engaged in this area, Blue River Technology (USA) has recently commercialized its *See and Spray* technology. It is likely that the technology will be available in the near future for use in all crops, under all situations suiting to all farmers including the small and marginal ones in the developing countries. Deployment such machines save in chemical costs by as much as 90% thereby substantially reducing the negative environmental impact. Experts believe that such smart machines will be a reality soon and have the potential to disrupt the multibillion dollar pesticides business. Further, it is argued that with targeted application of the chemical, it is possible to make use of herbicides which are not too selective to the crop but otherwise more environmentally-friendly. This also implies that the strategy could well be employed to manage the dreaded herbicide resistant weeds and more interestingly even bypass the need for genetic engineering of herbicide-tolerant plants – another controversial technology not readily accepted/adapted in many countries. In India, where herbicide application by and large is still not very scientific, precision weed management with smart technologies discussed above may sound too farfetched. But on a positive note, we might as well leapfrog into new technology, as we did with the use of mobile phones.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

PL-2

Weed diversity mitigates crop yield losses: A perspective from European grain-based systems and insights for biodiversity-based weed management

Stéphane Cordeau
Agroécologie, AgroSup Dijon, INRAE, Univ. Bourgogne, Univ. Bourgogne Franche-Comté, F-21000 Dijon, France
Email: stephane.cordeau@inra.fr

Reconciling crop productivity and biodiversity maintenance is one of the main challenges of agriculture worldwide. Weed management is recognized to be a key point for ecological intensification in agriculture because weeds can generate severe yield losses but also represent the base of agricultural trophic networks. Therefore, research in weed science has often opposed two different schools of thought. The drastic decline of biodiversity in agricultural landscapes has either been considered as a sign of efficient weed management or an erosion of the natural capital on which sustainable crop production is founded.Weed: crop competition has historically been studied in experiments, which considered only one weed species at a time. Hence, little is known about the competitive effect of weeds in complex communities (multiple weed species), which is the most frequent scenario in agricultural fields. Nevertheless, major yield losses may simply arise from the dominance of a few competitive species. Moreover, a higher diversity of traits (characteristics) within the weed community could induce complementarity in resource use (light, water, nitrogen) and alleviate weed:crop competition. Therefore, we quantified the effect of naturally occurring weed communities and the diversity of their composition on winter wheat yield, across 54 zones (36 unweeded, 18 weeded) and 3 years.

Out of the six weed communities identified, only four generated significant yield losses in unweeded zones, ranging from 19 to 56%. Results show that when community evenness was high, weed biomass was low and weed: crop competition was alleviated. In this case, yield losses are reduced because all weed species produce low biomass. Authors also reveal a positive effect of weed functional diversity on winter wheat yield, even though no relationship with weed biomass was observed. This could hint that a higher diversity of traits within the weed community limits competition with the crop and hence, yield losses.Weeding operations should exclusively target competitive and dominant species. However, current weed control practices do not allow targeting a specific species in a complex community. Therefore, future studies need to identify if weed diversity could rather be indirectly promoted by diversifying weed management tools . In addition, a diversity of farming practices in time may lead to increase the diversity of resources pool and thus should decrease the crop: weed competition. The CA-SYS platform represents one of the major tools in Europe to experiment these hypotheses since the overarching objective of the CA-SYS platform (https://www6.inra.fr/plateforme-casys_eng/) is to design and test the feasibility and performances of pesticide-free agriculture using (cropped and wild) biodiversity in support of production, i.e. biodiversity-based forms of agriculture.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

PL-3

Recent trends in global weed management research and their relevance to Indian context

A.N. Rao* and Sreenath Dixit
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana 502324
**Email: anraojaya1@gmail.com*

Weeds are the most serious threat to agricultural production and agrobiodiversity in India as they are across the world. The total actual economic loss caused due to weeds, in 10 major crops of India, was recently estimated to be about USD 11 billion. Thus weed management is going to play a key role in future too, to optimize crops productivity and increase food grains production to meet the demands of increasing population. In this paper, the global trends in weed management research were analyzed and relevant lessons from their experiences are pointed out to utilize them in weed management research in India The availability of selective herbicides, non-availability and increased cost of labor in developed countries (*e.g.* U.S.A., Australia, and Japan) has led to use of herbicides in 100% crops area. In developing countries like China, South Korea, Malaysia, Vietnam and Thailand, depending on the crop, 50 to 100% area of the cropped area was reported to be under herbicides use. The continuous use of herbicides has led to increased incidence of infestation of herbicide-resistant (HR) weeds and hence greater research efforts are being made to understand and manage HR weeds. The cost and time to discover, develop and launch new herbicide product has considerably increased. Thus herbicide tolerant crops were developed and used mainly to combat the problem of HR weeds with the use of existing non-selective herbicides. Globally, the weed science research is getting diversified with increased research activities in areas such as allelopathy, biocontrol, weed ecology, weeds utilization, crops cultivars with combined (stacked) herbicide tolerant traits, genome sequencing to understand weed populations; use of unmanned aerial vehicles (UAVs), imaging sensors-based tools and geospatial information technology, harvest weed seed control (HWSC) and integrated weed management (IWM).

Weed management research has progressed in India from herbicide based research to integrated weed management focused research, across the years. However, still the herbicides based research is predominant and several herbicides were identified for managing weed in different crops and cropping systems. Available herbicides were not fully utilized in India as only 20-30% area is covered with herbicides. Availability of herbicide based weed management technology and the selective herbicides to manage weeds in India is leading to increased use of herbicides year after year in most of the states India. In India herbicide resistant weeds reported are relatively few. Herbicides must be used judiciously in India to avoid or delay evolution of herbicide resistant weeds which occurred rapidly in other countries.

The future weed management research in India must be farmer's location specific need based and should focus to develop diverse and durable climate resilient weed management solutions to tackle complex weed problems that prevail in the climate change era. Weed scientists need to work with interdisciplinary teams of scientists having different backgrounds, and such collaborations results in development of novel ideas. The agricultural weed science research must encourage more weed science research involving diverse disciplines such as plant physiology and biochemistry, genomics, agroecology, climatology, paleo biology, community ecology, evolutionary and ecological genetics, sociology, psychology, information and communications technology (ICT) for weeds identification; artificial intelligence and economics. Weed science research must aim at developing integrated weed management systems that give farmers more flexibility and options which use herbicides and supplementary nonchemical practices in order to offer a more robust sustainable weed-management system.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

PL-4

Past, present, and future of weed management for optimum crop production and food security

Megh Singh* and Amit Jhala
Emeritus Professor of Weed Science, University of Florida, USA
Associate Professor of Weed Science, University of Nebraska-Lincoln, USA
**Email: msingh@ufl.edu*

Hand-weeding and mechanical control has been commonly used to achieve acceptable weed control since the beginning of crop production. Since the discovery of 2,4-D for broad-leaf weed control in number of cereal crops and non-crop situation, growers in advance countries have relied on herbicides for weed management in crops. Discovery and widespread adoption of glyphosate-resistant crops resulted in glyphosate-resistant weeds. The world population is swelling, necessitating increased food production to feed 9 billion people by 2050. The emergence of natural product leads in discovery of new herbicides and bio-pesticides suggests that new modes of action can be discovered. Advances in genetic engineering provided additional options for manipulating herbicide selectivity and creating multiple-herbicide-resistant crops. Advances in understanding plant pathogen interactions will contribute in developing new biological control agents, and insights into plant-plant interactions suggest that crops can be improved by manipulating their response to competition. Demand of organic vegetable and fruit production is increasing that requires to address weed management in organic production systems. Revolutions in machine learning and automation have led to use global positioning system (GPS) to distinguish weeds from crops and deliver spot herbicide application. These technologies open multiple possibilities for efficient weed management, whether through chemical or mechanical mechanisms. Information is also needed by growers to make good decisions, and will be delivered with unprecedented efficiency and specificity, potentially revolutionizing aspects of extension work. We consider that meeting the weed management needs of agriculture by 2050 and beyond is a challenge that requires commitment by funding agencies, researchers, and extension educators to translate new technologies into affordable weed management for optimum crop production and food security.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

PL-5

Precision weed management: A means of boosting agricultural productivity

V.S. Rao
Affiliate Faculty Member, University of California, Davis, CA, USA
Email: dr_vs_rao@yahoo.com

Weeds constitute a major constraint to agricultural productivity. Chemical weed management has been the focus in agriculture ever since the discovery of 2, 4-D over 75 years ago. But repeated application of one type of herbicides will sort out resistant strains within the weed population. This became real beginning in 1957 in U.K., Hawaii, USA and Ontario, Canada in the case of 2, 4-D. With continuous use of same group of herbicides since that time, herbicide resistance has become a significant and unabated global problem. Currently, 262 weed species (152 dicots and 110 monocots), infesting 93 crops and non-crop areas in 70 countries, have been identified to develop resistance to different herbicides. In this situation, weed scientists need to look for alternatives to enhance weed management efficiency and thus boost agricultural productivity. One such alternative is precision weed management (PWM). It is inclusive of those methods that will ensure greater farm productivity. These include a combination of need-specific, site-specific and cost-effective chemical, mechanical, manual and cultural methods. Weed scientists need to look for, explore and develop a combination of these methods for the benefit of farming community. They are required to reorient their future research programmes in this direction. This paper discusses these in greater detail.

Lead lectures

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-1

Crop residue management in rice-wheat rotation: Challenges, opportunities and strategies

M.L. Jat* and H.S. Jat[1]

International Maize and Wheat Improvement Center (CIMMYT), New Delhi

[1]ICAR-Central Soil Salinity Research Institute, Karnal, Haryana

**Email: M.Jat@cgiar.org*

Rice-wheat rotation of North-West India has contributed significantly to country's "food basket" and will remain very important for future food security, farmers' income and livelihoods of rural population. However, there are several issues of sustainability of this system. Therefore, sustainable intensification (SI) of rice-wheat system based on the principles of Conservation Agriculture (CA) and backed with precision input management practices not only has potential to sustain the food bowl, but also provide new avenues of growth in farming in the region. Crop residue burning in NW India contributes to air pollution, health hazards, disruption of transportation, school closures and soil degradation. Significant amount (23 million metric tons) of rice residue till recent past are being burnt in rice-wheat cropping system (~4.1 million ha) to clear the field for conventional wheat sowing because of the narrow window (~10 to 20 days) between rice harvesting and wheat sowing. Managing the huge voluminous crop residues of rice in a span of 10-20 days is a very daunting task. However, it provides the opportunities by creating the business for the farmers for managing the crop residues in both the ways of *ex-situ* and *in-situ*. There are number of options available like *ex-situ* and *in-situ* but our major focus was on *in-situ* management of crop residues to sustain the quality of natural resources (land, water and environment). Our long-term (10 years) research jointly by ICAR-CSSRI and CIMMYT and its validation in farmers' participatory mode in Haryana shows that CA based management systems including direct seeding using Happy seeder improved the system productivity by 10-15% and profitability by 25-40%, respectively in rice/maize based systems. These CA based climate resilient practices reduces the environmental footprints by 20-30%, while using 20-30 less irrigation water on cropping system basis. Continuous use of theses practice for 3-5 years improved overall soil health and improve the soil organic carbon by 50-75% and available N and K by ~50 and P by 30% in addition to significant improvement in soil physical and biological properties and proved to be more resilient to climatic risks like temperature stress and water stress compared to conventional system. Happy seeder options in climate smart villages (CSVs) of Karnal improved the system productivity by ~10%, profitability by 25% with less irrigation water and energy compared to farmers' practice (10 yrs mean). Our results showed that happy seeder-based *in-situ* management systems emerge as the most profitable and scalable residue management practice as they are, on average, 10-20% more profitable than burning. The results showed that mulch SMS+ happy seeder is ~10% (INR 5000/ha) more profitable than burning option (burn+zero-till). Switching from the most common burning system to the happy seeder system is ~INR 11000/ha more profitable for the farmers. Happy seeder options reduces the particulate pollution by more than 98% (1 kg/ha/year), GHG by ~80% (933 CO_2 eq kg/ha/year) and ground water withdrawals by ~20% (1412 m^3/ha/year) than the farmers' common practice (burn+disc harrow) in rice-wheat system of NW India. In NW India, burning regulations were in place to reduce agricultural fires, but it continues because of uncertainty regarding policy implementation and regarding access and returns to alternative technologies. But after the launch of *In-situ Crop Residue Management* policy of the Govt. of India in 2018 of worth ` 1150 crore, implementation of a sustainable and scalable *in-situ* crop residue management practices in north-western states of Punjab, Haryana, Western Uttar Pradesh and National Capital region of Delhi has been increased to support farmers for machinery, capacity development, knowledge sharing and awareness creation. This mission created the awareness, capacity building and created the business opportunities for the farmers, custom-hiring centers, co-operatives and also generate the business for alter-native practices. The results of this study not only have scientific relevance but high potential to benefit whole society and contributes to Government of India's farmer's welfare schemes of (i) doubling farmers' income, (ii) improving soil health, (iii) more crop per drop, (iv) minimize climatic risks, (v) reduce chemical load in agriculture, (vi) reduce global warming potential *etc*. Therefore, these results have wider practical applicability and scalability.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-2

Inheritance of resistance against alternate herbicides in various biotypes of *Phalaris minor* from different parts of Haryana: Pot studies 2017-18

S.S Punia*, Paras Kamboj, Manjeet, Dharambir Yadav
Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: puniasatbir@gmail.com*

To evaluate the level of resistance in different biotypes of *Phalaris minor*, experiment was undertaken during rabi 2017 in screen house of Department of Agronomy, CCS Haryana Agricultural University, Hisar. The seeds of 12 canary grass populations were collected from wheat fields of farmers on the basis of problem reported by the farmers. Of these 12 populations; 4 were from Hisar (HAU Hisar, Khedar, Ludas), 3 from Jind (Rasidan, Kalwan, Ujahana), 4 from Kaithal (Kheri Raiwali, Lamba Kheri, Keorak and Teek), two from Hisar (Hindwan and H.A.U Farm), one each from Fatehabad (Nangla) and Sirsa district(Lehrawali Dhani of Haryana. Lehrawali Dhani (Sirsa) and Khedar (Hisar) were taken as susceptible populations. Four herbicides were applied as post-emergence at 2-4 leaf stage of *Phalaris minor* with different doses. These herbicides were clodinafop, sulfosulfuron, mesosulfuron + iodosulfuron and pinoxaden. All the herbicides were applied with doses X/2, X and 2X (where X is the recommended dose of herbicide). After 30 days of the herbicide application, the phytotoxicity to the canary grass populations was recorded with a rating scale of 0-100, where 0 stands for 0 per cent phytotoxicity and 100 for 100% killing of the plants.

Among 12 populations, two populations P2 Khedar (Hisar) and P11 (lehra wali Dhani, Sirsa) showed complete phytotoxicity (100%) to recommended dose of clodinafop, where as 10 populations showed variable response (0-98%) phytotoxicity. P11 found to be most sensitive with complete control with all four herbicides at recommended doses. All populations except P6 (Rasidan, Jind) and P8 (Lambakheri,Kaithal) were inflicted with more than 50% mortality with recommended dose of 14.4 g/ha of meso+iodosulfuron. GR50 values of clodinafop ranged from 12.30 ± 1.09 and 14.12 ± 1.15. Susceptible check populations of P11 and P2 to 812.83 ± 2.91 g/ha from Kalwan (Jind) and Rasidan (Jind) populations. Based on RI index ranging from 102.32 ± 2.01-812.83 ± 2.91 g/ha, all populations except P2 and P11 were highly resistant to clodinafop, 7 populations viz. HAU, Hisar, Kheri (Kaithal), Keorak (Kaithal), Kalwan (Jind), Ludas (Hisar), Lamba Kheri (Kaithal, Dhos (Kaithal), Ujhana (Jind) and Nangla (Fatehabad) were highly resistant to sulfosulfuron with RI index of 11.74-274.57. Only two populations, Rasidan (Jind) with RI of 25.80 and Lambakheri (RI 10.51) were highly resistant to meso+iodosulfuron (RM). Similarlily, only 5 populations, *viz*. Kheri (Kaithal), Keorak (Kaithal), Kalwan (Jind) with RI ranging from 11.76-58.97 were highly resistant to pinoxaden.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-3

Weed management in pulses

Guriqbal Singh*
Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana, Punjab 141 004
**Email: singhguriqbal@pau.edu*

Pulse crops are an integral part of various cropping systems in Indian agriculture. Chickpea, lentil and fieldpea during *Rabi*/winter season, pigeonpea, greengram and blackgram during *Kharif* (rainy) season and greengram and blackgram during spring (summer) season are grown in various parts of the country. India is the major producer and consumer of pulses in the world.

Weeds compete with crop plants for moisture, nutrients and sunlight and thereby reduce yields. During rainy season, in pulse crops weeds like *Cynodon dactylon*, *Cyperus rotundus*, *Trianthema portulacastrum*, *Phylanthus niruri*, *Eleusine indica*, *Digera arvensis*, *Eleusine aegyptiacum*, *Commelina benghalensis* and *Euhorbia hirta* were the prominent weeds. However, the major weed flora present in *Rabi*/winter season pulse crops included *Medicago denticulata*, *Anagalis arvensis*, *Spergula arvensis*,*Lepidium sativum*, *Oenothera drumundii*, *Rumex dentatus*, *Melilotus indica*, *Chenopodium album*, *Phalaris minor* and *Cyperus rotundus*. The un-controlled weeds cause huge losses in the grain yield and the magnitude of yield losses depends upon the duration of crop-weed competition, species and density of weed flora, the pulse crop *etc*. Grain yield losses are low in case of tall growing pulse crops such as pigeonpea whereas the yield losses are more severe in case of slow growing short statured pulse crops such as lentil.

There are various weed control strategies available for controlling weeds in pulse crops. The non-chemical as well as chemical means are being employed by the farmers for controlling weeds, however, the use of herbicide is increasing due to various reasons. In pulses, pre-plant incorporation herbicides such as fluchloralin and trifluralin, and pre-emergence herbicides such as pendimethalin and pendimethalin + imazethapyr (pre-mix) have been found effective to control weeds and safe to many pulse crops. Integrated use of herbicides and hand weeding/hoeing have been found superior over sole use of herbicides in controlling weeds and improving grain yield. Furthermore, pre-mix combination of pendimethalin + imazethapyr has shown promising results than pendimethalin alone.Recently some post-emergence herbicides such as imazethapyr, quizalofop-ethyl, clodinafop-propargyl, propaquizafop, topramezone, clodinafop-propargyl + acifluorfen-sodium and so on have been tested in various pulse crops. However, post-emergence application of imazethapyr and metribuzin has shown severe phytotoxicity in chickpea. Efforts are going on to develop varieties of chickpea and lentil having tolerance/resistance to such herbicides. Some herbicides used for the purpose of controlling weeds may have an adverse effect on non-target microorganisms, which may reduce biological nitrogen fixation, phosphate solubilization *etc*. and thus might affect sustainability of agriculture for which pulses are known for. Furthermore, some of the herbicides, though found very effective to control weeds as well as safe to the pulse crops, may not be recommended to the farmers due to label claim issues.Cultivars of a crop may differ in tolerance to difference herbicides. Therefore, there is a need to screen genotypes of pulse crops having tolerance to herbicides. Furthermore, weed suppressing ability of crop genotypes need to be investigated. For recommending herbicides in various pulse crops, there is need of not only to study their effectiveness against weeds but also their adverse effect, if any, on soil microflora. Label claim issues associated with some of the herbicides, though found effective to control weeds and safe to the pulse crops, need to be sorted out so that these could be recommended to the farmers and they may benefit by using such herbicides.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-4

Environmental impact of glyphosate

C.T. Abraham* and K.M. Durgadevi
Kerala Agricultural University, Thrissur, Kerala 680 656
**Email: ctabraham@yahoo.com*

Glyphosate [N-(phosphonomethyl) glycine, introduced by Monsanto Agricultural Products Company in 1974, is considered as a miracle herbicide as it is a broad spectrum, foliar, systemic herbicide with no soil activity and low mammalian toxicity. It is being used world over for weed control in non-cropped areas, for directed application in row sown crops and plantation crops and for total weed control before land preparation for sowing crops. Use of glyphosate increased with the introduction of genetically modified herbicide tolerant (GMHT) crops (the Roundup ready crops) from 1996. However, the widespread and indiscriminate use of the herbicide has led to concern about its possible adverse impacts on human health and environment, including allegations that it is a possible carcinogen. Many law suits alleging health problems from exposure to glyphosate are pending verdict. A US court has awarded compensation of $289 million to a groundskeeper who claimed roundup caused his cancer (Non-Hodgkin's Lymphoma). This was reduced to $78 million by the superior court. Monsanto (now acquired by Bayer Crop Science) appealed against this decision in the California court claiming that there is an extensive body of research findings to confirm that glyphosate is safe if used as directed. In Sri Lanka, the government banned use of glyphosate in 2015. But in the absence of an alternative herbicide, the tea industry was severely affected resulting in drastic reduction in crop production and finally the government lifted the ban in July 2018. In India, the states like Punjab, Kerala and Andhra Pradesh have restricted the use of Glyphosate.

In Kerala, a series of experiments were conducted on the environmental safety of glyphosate to fishes, earthworms and soil microflora. More than 90% of the glyphosate reaching the soil was tightly adsorbed and not desorbed into water. In water bodies, glyphosate persisted for 15 days if weeds were present and up to 30 days in weed free water. Trials in glass aquarium tanks where fishes were exposed to high concentrations of glyphosate, the herbicide caused histopathological changes in gills, muscle tissue, liver and ovaries. The damage was more with Roundup (glyphosate + the surfactant POEA) than with glyphosate or POEA alone. Earthworms were found to avoid the damage by moving out to unsprayed areas. Glyphosate caused, short term inhibitory effect on soil fungi and bacteria, which got reversed within 60 days. These information suggest that glyphosate is safer than many other herbicides, if used as per directions.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-5

ICT-based decision tool for weed management in rice and wheat

Virender Kumar[1]*, R.K. Malik[3], Ashok Yadav[2], Sushil Kumar[4], Dharmabir Yadav[5], Makhan S. Bhullar[6], Buddhadeb Duary[7], J.S. Mishra[8], Sanjay Saha[9], Malay K. Bhowmick[10], Mainik Ghosh[11], Pardeep K. Sagwal[2], Sushanshu Singh[2]

[1]International Rice Research Institute (IRRI), Los Banos, Philippines
[2]International Rice Research Institute (IRRI)-India office, New Delhi
[3]International Maize and Wheat Improvement Center (CIMMYT)-India office, New Delhi
[4]ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh, India
[5]CCS Haryana Agricultural University Hisar, Haryana, India
[6]Punjab Agricultural University, Ludhiana
[7] Visva-Bharati University, Sriniketan, West Bengal, India
[8]ICAR- Research Complex for Eastern Region (ICAR-RCER), Patna
[9]ICAR-National Rice Research Institute (NRRI), Cuttack, Odisha, India
[10]Directorate of Agriculture, Government of West Bengal, Kolkata, West Bengal, India
11Bihar Agricultural University, Sabor, Bihar
**Email: Virender.kumar@irri.org*

Weed management practices in cereal-based systems in South Asia are changing due not only to labor scarcity but also to changes in cropping practices in the region. Recently, there is increased interest in shifting from resource inefficient and costly conventional tillage and crop establishment (T&CE) methods to new resource-efficient and cost-effective alternate T&CE methods (e.g. puddled transplanting to direct-seeded rice or mechanical transplanted rice in non-puddled conditions in rice; and conventional tillage to zero-tillage in wheat) to cope with the rising scarcity of resource availability (labor, water and energy), the rising cost of cultivation, and climate change in the region. Weed control has been a major obstacle in the wide-scale adoption of these new resource-efficient methods. In the new systems, weed management has become knowledge-intensive. Moreover, large knowledge and information gap exists in farmers current weed management practices and by closing these gaps, weed control can be improved and herbicide usage can be reduced optimized.

One of the approaches to close the knowledge and information gaps are by developing and deploying the ICT-based decision tool for making accurate field-specific integrated weed management recommendations. International Rice Research Institute (IRRI) in close partnership with national agricultural research institutes, International Maize and Wheat Improvement Center (CIMMYT), and private sector is developing an Android-based weed management App for generating safe and accurate integrated weed management options for rice and wheat farmers in India. We will present the progress made so far in developing this App. This App will help extension agents, input dealers, and service providers in generating accurate weed management options for farmers. Farmers having smartphones will also be able to generate recommendations by themselves.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-6

How should students remain involved in weed research

Srikanth Rupavatharam
ICRISAT, Pantancheru, Hyderabad, 502 324
Email: R.Srikanth@cgiar.org

Weed science is at a critical junction with decades of inefficient chemical weed control leading to herbicide-resistance among weeds. With increase in world population by up to 9 billion in 2050 merits need to increase food production. It also necessitates innovation in the discovery of new herbicides and biopesticides and create novel approaches for weed management. There is a stress to alleviate soil and human health crisis through integrated approaches that cut across all the fields of science. Revolution in artificial intelligence has led to using machine vision to identify weeds and deliver precision management systems. Advances in plant-pathogen interactions have contributed to new bio-control agents. We are in a warfare within the ecosystem to feed the needs of our growing population. We cannot afford to be silent witnesses of climate change and this warrants commitment from students who are tomorrow's researchers to translate new technologies into sustainable weed management solutions in the future.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-7

Invasive weeds: An eco-biological challenge for weed management under changing climate

C. Chinnusamy*, P. Murali Arthanari[2] and C. Bharathi[3]

Vanavarayar Institute of Agriculture (Affiliated to Tamil Nadu Agricultural University), Manakkadavu, Pollachi, Tamil Nadu 642 103

[2&3]Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003

**Email: chinnusamyc@gmail.com*

Invasive alien species are species whose introduction or spread threatens the environment, the economy or society, including human health and agriculture. Invasive weeds are also responsible for shrinking of water bodies and becoming a severe environmental problem. Biological invasions by alien species are widely recognized as a significant component of human caused global environmental change, often resulting in a significant loss in the economic value, biological diversity and change in aspects of functioning of invaded ecosystems and in particular agricultural production systems. From an ecological perspective, any plant species introduced to an ecosystem beyond its home range that establishes, naturalizes and spreads is said to be invasive plant. Introduction of these plant species may occur accidentally or through their being imported for a limited purpose and subsequently escaping in to the ecosystems on a large scale. Spread of non-native or alien or exotic plant species has emerged in recent years as one of the most serious threats to biodiversity, undermining the ecological integrity of many native habitats and pushing some rare species to the edge of extinction, second only to habitat loss. The introduction of invasive alien species is considered to be a leading cause of crop and water productivity losses in agriculture. Thus alien invasive weeds not only pose serious threat to Indian agriculture in terms of affecting agricultural production but may also pose serious health problems as evidenced in case of introduction of Parthenium weed seeds along with imported wheat from USA. Hence, it is imperative to understand the ecology and biology of those invasive weeds in crop production systems so as to reduce its impact on the environment, biodiversity and in agricultural production systems.

Invasive weeds, like *Lnatana camera*, *Parthenium hysterophorus* and *Solanum carolinense* in terrestrial ecosystems and *Ipomoea cornea* and *Eichhornia crassipes* in aquatic systems had greatly affected the crop productivity as well as water productivity. Hence, detailed studies have been made in understanding and documenting ecological adaptation, biological expressions and interference in agriculture and allied production systems of the alien invasive weeds in different agro-ecosystems of India. In addition, strategic integrated management of those invasive weeds have been made in cropped and non-cropped situations as well as in inland water bodies. Eco-biology and management techniques for *Lnatana camera*, *Parthenium hysterophorus* and *Solanum carolinense* in cropped and non-cropped areas and *Ipomoea cornea* and *Eichhornia crassipes* in aquatic ecosystems have been made for many years through experimentation and recommended for managing the invasive alien weeds in different ecosystems. Eco-biological characters and integrated management of predominant invasive alien weeds in agro-ecosystems and aquatic ecosystems are presented and discussed in this paper.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-8

Threat of Invasive Weeds: Case study on eradication of *Ambrosia psilostachya*

N. Sathyanarayana, N.V. Kulkarni and S. Latha
Directorate of Plant Protection, Quarantine & Storage, N.H.-IV, Faridabad 121 001
Email: appa.ipm-ppqs@gov.in

Invasive species are criss-crossing across the globe at much faster rate than ever before, facilitated by increased international trade, travel and movement of carriers such as aircraft, ship, containers *etc*. Many invasive weed species have entered into India in the past and have become problematic weeds in agriculture and forestry and environment including human and livestock health. The major pathway for entry of invasive weeds is through bulk grain imports. To minimize the risk of entry and establishment of such invasive weeds, Government of India regulates imports through Plant Quarantine (Regulation of Import into India) Order, 2003 (PQ Order, 2003) issued under Destructive Insects and Pests Act, 1914 (DIP Act, 1914). The Pest Risk Analysis has identified 57 weeds as potential threat to India and are regulated under Schedule-VIII of PQ Order, 2003. Major interceptions made at port of entry are *Bromus secalinus, Echinochloa crus-galli, Galium aparine, Lolium multiflorum, Polygonum lapathifolium, Raphanus raphanistrum, Thlaspi arvense, etc.*

Ambrosia psilostachya, a quarantine weed was reported in Tumkur District in Karnataka. The weed was noticed in an area of 400 acres covering cultivated land, irrigation canal and forest land. Eradication of *Ambrosia psilostachya* was initiated in 2014. Delimiting survey organized, created awareness among the farmers, established association of weed-affected farmers, organized training programmes for all stakeholders and provided herbicides for eradication. Regular survey and management resulted in 80% reduction in weed intensity and prevented further spread of the weed to new areas.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-9

Aquatic weed problems and their sustainable management

R.M. Kathiresan

Department of Agronomy, Faculty of Agriculture Annamalai University, Annamalai Nagar 608 002
Email: rmkathiresan.agron@gmail.com

The aquatic weed water hyacinth is ranked among the top ten weeds worldwide and is one of the most successful colonizers in the plant kingdom. A native of Brazil, the weed has spread to other parts of the world, through initial introductions for its aesthetic values in Africa, southern Asia and USA, Integrated weed management becomes most suitable for managing severe infestations. The use of herbicides affects water quality and associated flora and fauna where as exclusive dependents on bio-control is a relatively slow process. Thus, often integration of a short- term control measure with bio control is inevitable. Allelopathic inhibition of water hyacinth by the dry leaf powder of the Indian medicinal herb *Coleus amboinicus/aromaticus* appears to offer a promising lead in this direction and integrating this allelopathic plant product with bio- control agent *Neochetina eichhorniae/bruchii* was reported successful in controlling the weed within 45 days.

Residues of 60 rice cultivars were screened for their allelopathic inhibition on water hyacinth in laboratory bio-assays as well as in micropond tests. It was observed that cultivar '*BPT*' was highly allelopathic on water hyacinth that was imparting a weed biomass reduction of 47.68%in the laboratory screening and 45.62% in the micropond confirmative study. Rice cultivar '*ADT-36*' was moderately allelopathic that resulted in a weed bio-mass reduction of 33.4%in laboratory screening and 32.2% in micropond confirmative study. Based on the results, a recoverable straw unit has been developed with the rice residues bundled in a perforated polyurethane bag tied to an anchor rope sealed by bamboo pole at required intervals, in the water bodies during the monsoon season. During summer, when the channels dries off, the straw units could removed, to get rid off the decomposing residues from the channel.

Among various modes tried for using this weed in order to affix the tag of utility for speeding up public participation in controlling this weed, mixing dried and powdered water hyacinth in the daily ration for cattle, did not cause any adverse change in the health of animals. Utilizing water hyacinth as a manure, through composting and incorporation 6.25 t/ ha favoured rice yields. Another mode of utility is attempted through TEMPO mediated extraction of nanofibers 5-100 nm thick which were used for making transparent thin film, transparent sheet, paper and transparent biodegradable nanocomposites.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-10

Non-chemical management of weeds through bioherbicides - current status, market and future prospects

K.R. Aneja
Department of Microbiology, Kurukshetra University, Kurukshetra, Haryana136 119
Email: anejakr@yahoo.ca; anejakr@gmail.com

Weeds, unwanted plants, a major kind of pests, constitute about 3% (8000) of the total 250000 species of plants on Earth. As per the ICAR report, weeds cause economic loss of US$100 billion, globally. India loses annually agricultural produce worth over US$11 billion, exclusively in 10 major crops more than the Centers' Budget allocation to agriculture for 2017-18. Herbicides, the dominant tool for weed control in agriculture, are linked to the evolution of herbicide resistant plants, key risk of cancer, birth defect, respiratory and skin problems, in addition to reducing the beneficial soil microflora, especially involved in nutrient cycling and fertility.

Bioherbicides are the bio-based biocontrol agents of weeds, which may be developed from plant pathogens, natural products and extracts of natural materials. Bioherbicides based on fungal biocontrol agents are called mycoherbicides. In the majority of the bioherbicides, fungi have been employed, hence the term mycoherbicide has often been used interchangeably with bioherbicide. Globally, 24 bioherbicides based on fungi, bacteria and viruses, have been registered, and of these 10 are registered in the USA, 5 in Canada, 2 in South Africa and one each in Japan, the Netherlands and China. Some of these registered bioherbicides have shown poor performance in fields due to their low shelf-life, changing weather conditions (such as free moisture/dew and temperature) which play an important role in their germination, penetration and infection of the host target. Mycoherbicides based on *Colletotrichum* spp. and *Gibbago trianthemae*, the hemibiotrophic pathogens, have performed well in nature.

The increasing demand for organic products derives the global bioherbicides market. According to the latest research report by IMARC Group, the overall bioherbicides market is projected to grow from US$1428.1 million in 2018 to US$2895.2 million by 2024, at a CAGR of 12.5% from 2019 to 2024. In spite of all efforts, the development of bioherbicides is slow due to a wide range of constraints.

The need of the hour is to concentrate research on the following lines: Considering the taxonomic diversity among the microbes, search for new bioherbicide candidates which could meet the challenges caused by environment; Development of technology to maintain consistent efficacy of a mycoherbicide in varied field conditions; Evaluation of consortia of biocontrol agents which could target simultaneously various weeds in a crop; Creating awareness among the consumers/farmers.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-11

Expediency of botanical herbicides in organic green farming for sustainable productivity of agricultural crops in alluvial soils of India

R.K. Ghosh*, Anannya Ghosh, Dibyendu Mondal and Pintoo Bandyopadhyay
School of Agriculture, GIET University, Gunupur, Odisha 250 172
**Email: drajr1956@gmail.com*

Global agriculture is now facing four major problems, *viz*. population increase and per capita land decrease, resource management and environment pollution, climate change and crop loss and farmers' livelihood with young farmers' shift. With the help of various agriculture revolutions programmes in India the total food grain production has touched 284 mt and oilseeds 33 mt in the country, but still it needs additional 8-10 mt of food grains/annum. Weed, the major pest causes 11.5% global and 10.9% national production loss.

Sustainable green agriculture practice with agri-skill development may be the solution to raise farmer's livelihood status by increasing productivity of crops and farmers income. Based on the last two decades researches, on farm field experiments were conducted during 2018-19 with two treatments, *viz*. T_1 – Farmers' practice and T_2- bio-herbicides and bio-nutrients – [PE botanical herbicides including APWPM + basal (FYM and PK) with top dressing thrice {Calpushti (N:P:K::20:20:20), micronutrients Calnutrree and bio-fertilizer Calrrhiza Gel} one tablet / 200 m^2] to find out the efficacy of botanical herbicides *Parthenium hysterophorus*, *Bambusa vulgaris* and *Echinochloa colona* applied as sole or in mixture with organic green label pretilachlor on paddy, potato, onion, and rapeseed grown in organic culture. The tablet/gel forms of bio-nutrients and plant extracts of botanical bio-herbicides were used in these experiments with recommended organic cultural practices (no use of any toxic chemicals). The WCE at 45 DAP revealed that in T_2 (70.9%) where bio-nutrients + botanical herbicides in APWPM were used the figures varied from 62-77% in comparison to T_1 (59.0%) where chemical fertilizers and synthetic herbicides were used (47-73%) showing 20.2 % advantages of the organic agriculture. The maximum WCE (77%) was obtained in paddy field and that too in *Kharif* paddy because of lesser infestation of weed flora due to water submergence. The bio-nutrients showed an increase of mean paddy yield by 16% mainly due to increase of number of grains /panicle (mean 4.6%) and number of panicles /plant (mean 4.5%) over three locations, Kalyani, Nadia, Debipur and Arambag, Hooghly. The maximum mean yield of summer paddy (5.41 t/ha) was observed at Kalyani, Nadia, of rapeseed at Chandamari (15.2 t/ha) and the treatment T_2 recorded 5.0% more yield than T_1 . In two high value crops potato and onion the treatment, T_2 could not show better yields than T_1, probably the bio-nutrients doses were lower than their requirements. The maximum mean potato tuber (36.4 t/ha) and onion bulb (26.9 t/ha) yield was recorded in location Polba, Hooghly. It is therefore, concluded that using natural bio-products there is a fabulous scope of increasing the farmers livelihood and rural welfare by reducing the farmers input cost, reducing pest infestation in agricultural crops, increasing the soil and plant health status, diversification of crops, quality produce and using balance nutrition a sustainable increase of crop productivity which ultimately helps to reach the goal of sustainable organic eco-safe green agriculture.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-12

Preventing exotic weeds through plant quarantine

Mool Chand Singh* and S. C. Dubey
Division of Plant Quarantine
ICAR-National Bureau of Plant Genetic Resources, New Delhi 110 012
**Email: moolchand.singh@icar.gov.in*

A risk assessment system was developed to assess the weed potential of new plants. Species eligible for risk assessment are classified into three categories (high risk, further evaluation required, low risk) by rating them according to various biogeographical and ecological aspects. The rating system was validated by testing 47 well-known invasive plant species and 193 exotic plants. The overall accuracy was 65%. Accuracy of correctly predicting invasive species was 77%, while accuracy of correctly predicting non-invasive species was 62%.

The spread of exotic species into natural communities is threatening native biological diversity and the functioning of ecosystems, and is occurring at an alarming rate. The significance of invasive species as a global environmental problem is widely recognized, and article 8(h) of the Biodiversity Convention asks for measures "to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". As more and more exotic (alien, nonnative) plant, species are introduced and become naturalized in most regions of the world, the likelihood of new invasion events with subsequent negative ecological impacts on the native communities increases rapidly. To prevent new plant invasions, there is an urgent need for the development of early warning systems to determine the likelihood of a given species becoming invasive and of methods to conduct rapid assessments of the status of invaders. Preventive measures would ideally consist of the prevention of entry of a species, and the restriction of spread once the species is present. It is possible to avoid damage to native ecosystems by exotic species and the associated costs if such harmful species are not used and planted in the first place. However, this step requires knowledge as to whether a particular species will become invasive where it has been introduced but is not yet widespread, or where it is intended for introduction. It is possible to recognize potential harmful species to at least some extent. In fact, sound models that could be applied to predict invasiveness are needed urgently, including quick and easy-to-perform assessment protocols to screen exotic plant species for their potential invasiveness.Plant species considered suitable for risk assessment include any exotic species that is not yet present, has a restricted distribution in the risk area, and is planned to be introduced and commercially used on a large scale. The rating system allocates scores to the species for biogeographical, ecological, and experience-linked aspects. The scores of the 12 questions are summed up, and species are classified into "high risk", "intermediate risk", and "low risk".We validated the risk assessment scheme by testing a set of well-known invasive plant species. Out of the 47 invasive plant species tested, 36 were recognized as being invasive in the risk assessment, giving an accuracy of 76.6%.

The accuracy of correctly predicting non-invasive species (61.6%) was less than the accuracy of correctly predicting invasive species (76.6%). The overall accuracy was closer to 50% than to 100%. However, the likelihood-ratio was high (14.8), indicating that the risk assessment has some predictive character.

The objective of a risk assessment for invasive weeds is to decide which species should be listed on quarantine weed lists and to decide which new species infestations should be controlled or removed in order to prevent their spread. Predicting plant invasiveness is, however, limited due to three facts: (1) the high ecological and taxonomic diversity of invasive plants, (2) the lack of ecological data for most plant species, and (3) the variation in invasiveness within the range of a species.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

LL-13

Challenges in herbicide detection at trace levels: Applications of isotopic internal standards in enhancing the accuracy of determination of residues by LC-MS-MS analysis

A. Ramesh
International Institute of Biotechnology and Toxicology (IIBAT), Padappai, Chennai, Tamil Nadu 601 301
Email: raamesh_a@yahoo.co.in

The hyphenated technique of the 20th century LC-Mass spectrometry (MS) tends to have inherently worse precision than traditional detectors (LC-UV or GC-FID). Traditional detectors are still widely in use for applications such as determination of crop residues where there is no need for sensitivity and where quantitation is vital. MS, particularly liquid chromatography (LC-)MS, comes into its own when measuring multiple analytes of different chemistries in applications where a high degree of selectivity and sensitivity are required. There is an acceptance that quantitative precision may be sacrificed in these circumstances. It is the industry-standard technique for applications such as trace level detection of residues in food and the environment samples especially the produces meant for exports.Stable isotope internal standards are a valuable resource for minimizing measurement uncertainty. For accurate quantification using electrospray LC-MS, this verges towards an essential resource. Their correct selection and optimization for any given application requires a degree of technical knowledge and scientific assessment. They are used to standardise their own matching analytes, with an individual internal standard needed for each analyte to be quantified.All analytical measurements have an inherent uncertainty. Particularly in the case of chromatographic methods for trace organic analytes, this can be significant. It is not unknown for a reported result to have an associated uncertainty of over 100%. The overall measurement uncertainty is a combination of factors from each individual stage of the method; extraction, clean-up step(s), chromatography and detection. Even if the sample is calibrated against "fortified" matrix standards (a control sample, with a known amount of analyte added, taken through the entire procedure to mimic the losses suffered by the sample), full mitigation is rarely possible. The critical issues involved in the determination of residues of herbicides and its analogues in food and environmental samples, the interference associated in detection using LC-MS-MS at trace levels, impact on the quantification and its accuracy relative to the use of isotopic internal standards are further discussed.

Invited oral presentations

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-1

Conservation agriculture for weed management and reducing costs in the intensified rice-wheat system

V. P. Singh*, Sirazuddin and Abnish Kumar

Department of Agronomy, College of Agriculture, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand 263 145

**Email: vpratapsingh@rediffmail.com*

Rice-wheat rotation occupies about 18 mha in Asia of which 13.5 mha is in Indo-Gangetic plains (IGP) having 10 m ha in India itself. Currently, the productivity of rice-wheat system is under pronounced threat due soil fatigue, declining water availability, shifting in weed flora, escalating costs, *etc*. Thus, for meeting the requirement of increasing population and to effectively reduce cost of cultivation in the intensified rice-wheat system, attention has to be given to conservation agriculture (CA). Conservation agriculture helps to manage weeds and harvest more at less cost and preserve ecological integrity of rice-wheat systems by saving water, eliminating tillage and improving efficiency of external inputs.

A field study was undertaken at N.E. Borlaug Crop Research Center, Pantnagar during *Kharif* 2012 to *Rabi* 2017-18 to assess the impact of conservation agriculture on weed management and economics of rice wheat system. Five establishment method in main plot *viz.*, TPR (CT)-wheat, TPR (CT)-wheat (ZT)-*Sesbania* (ZT), DSR (CT)-wheat (CT)- *Sesbania* (ZT), DSR (ZT)-wheat (ZT)- *Sesbania* (ZT) and DSR (ZT)+residue – wheat (ZT)+residue- *Sesbania* (ZT) and three weed control methods in sub plot *viz.*, recommended herbicides, integrated weed management (herbicide+mechanical weeding) and untreated (control) were laid out in strip plot design with three replication. The average relative weed density of over the years under weedy situation was recorded in rice crop were *E. colona* (17.5%), *L. chinensis* (12.9%), *A. sessilis* (12.9%), *C. iria* (9.3%) and *C. difformis* (11.5%). During *Rabi* season in wheat, major weeds were *P. minor* (42.0%), *M. denticulata* (26.3%)and *C. album* (8.9%). Among the establishment method of rice, TPR (CT)-wheat (CT) recorded the lowest weed density (37.2/m^2) followed by TPR (CT)-wheat (ZT)-*Sesbania* (ZT). The highest grain yield (4885 kg/ha) in rice (average of six years) and B:C ratio (2.16) was obtained in TPR(CT)-wheat(ZT)-*Sesbania*(ZT) establishment method followed by TPR(CT)-wheat(CT) (4486 kg/ha)and DSR(ZT)+R-wheat (ZT)+*Sesbania*(ZT) (3478 kg/ha).IWM (bispyribac-Na 20 g/ha + 1 MW) recorded the lowest weed density (16.5/m^2) and maximum grain yield (4832 kg/ha) and B: C ratio (2.1).

In different establishment system of wheat, lowest weed biomass (21.9 g/m^2) was recorded in DSR (ZT)+R-wheat (ZT) +*Sesbania* (ZT) system followed by TPR (CT)-wheat (ZT)-*Sesbania* (ZT). Among weed management practices, lowest weed biomass (5.9 g/m^2) of weeds was recorded with IWM (clodinafop 15%+MSM 1% at 60+4 g/ha + 1HW).The highest wheat grain yield (3913 kg/ha) was recorded with DSR (CT)+wheat (CT)+*Sesbania* (ZT) followed by DSR (ZT)+R-wheat (ZT)+R-*Sesbania* (ZT) (3847 kg/ha). The highest B: C ratio (2.3) was obtained with TPR (CT)-wheat (ZT)-*Sesbania* (ZT) followed by DSR (ZT) +R-wheat (ZT)+R-*Sesbania* (ZT).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-2

Long-term impacts of green manuring, herbicide rotation and planting methods on weed flora and their management in rice-wheat cropping system

Dharambir Yadav*, Ashok Yadav and S.S. Punia

CCS Haryana Agricultural University, Hisar, Haryana 125 004

**Email: dbyadav9@gmail.com*

Rice-wheat is the most important cropping system in Asia comprising 13.5 mha in Indo Gangetic Plains. In India, rice is being grown over approximately 44 mha producing 106.7 mt grain annually, of which 91.5 mt comprises *Kharif* rice. Whereas, wheat is grown on 30.97 mha area producing 86.53 mt grains with 2.79 t/ha productivity in the country. However, second-generation problems such as declining factor productivity, stagnating crop productivity, declining soil organic matter, receding groundwater table, serious weed complexities, herbicide resistance, diminishing farm profitability, and environment pollution have become now key features of this cropping system. Enhanced use and/or abuse of agrochemicals to enhance agriculture production and to manage pests is further resulting in reduced soil fertility and productivity and also negatively impacting human health besides evolution of pesticide resistances. The use of green manuring is a positive step in avoiding the deleterious effects of agrochemicals besides improving soil health, combating weeds and delaying herbicide resistance by covering ground and enriching diversity. Further, changes in herbicidal efficacy and composition of weed flora are also expected with long-term green manuring (GM) and rotational/ continuous use of herbicides. Long-term experiment continued since 1999 at CCSHAU Regional Research Station, Uchani, Karnal revealed that in general the infestation of weeds (grassy, broadleaf and sedges) in rice was lower or similar under GM as compared to without green manuring (WGM) with some marginal exceptions in few years.

Continuous and rotational use of herbicides being excellent and as good as weed-free checks in rice provided similar reductions in the dry weights of weeds irrespective of GM and WGM over the years. The dry-weight of *Phalaris minor* in wheat was higher or similar while in case of broad-leaf weeds, it was similar or lower under GM compared to WGM. Interestingly, *P. minor* was found to be more aggressive under GM in recent years due to improved soil fertility. There was an improvement in soil health with improved physical and chemical properties and also population of soil microbes. Due to continuous or rotational use of herbicides, there were no envisaged signs of herbicide resistance development in the dominant weed *Echinochloa crus-galli* in rice and *P. minor* in wheat probably due to proper use of recommended herbicides. Grain yields of rice and wheat were better under GM (under weed-free situations) than WGM leading to overall gain of 0.4–1.1 t/ha or even more over the years in the productivity of rice-wheat cropping system (RWCS). Long-term (23 years) zero-tillage in wheat (ZTW) coupled with recommended herbicides also reduced population of *P. minor* significantly, swiftly and more effectively at multi-locations in RWCS. An early sowing and reduced soil disturbances were adjudged two main reasons for reduced weed pressure in ZTW than conventional tillage wheat (CTW). Direct-seeded rice (DSR) *fb* ZTW (6 years' data) in Haryana have also demonstrated the multi-facial benefits (higher system productivity and profitability, reduced production cost and labour requirement, and water saving) of these two prominent conservation technologies besides reflecting their very well visible and quite significant impacts on weed dynamics. Compared to puddled-transplanted rice (PTR), DSR is encountered with heavy infestation of diverse weed flora which warrants for integrated weed management including herbicides (pre- and post-emergence), stale bed, dust mulching, laser levelling, and manual/mechanical weeding besides competitive and herbicide tolerant varieties.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-3

Weed management in sustainable sugarcane production in sub-tropical India

V.P. Singh*, K.K. Singh, Dileep Kumar and S.K. Shukla
ICAR-Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh 226 002
**Email: vpsinghnrcws@gmail.com*

Competition by weeds during the growing season of the crop for soil moisture, mineral constituents, sunlight, and space along with unhealthy nutrient management practices is the major constraint in enhancing the crop productivity. Besides, reducing the crop yield directly, heavy infestation of weeds interfere with crop harvest and elevate farm production costs through energy spent in controlling them. A weed which escapes the control measures and produces seed at maturity, further multiplies weed control problems by acting as a source of seed bank replenishment and re-infestation in the subsequent years. In sugarcane, the reduction in cane yield due to weeds ranged from 40 – 67 %, the highest being in those areas where farmers are not familiar to improved weed management technologies. Weed control is most critical early in the season prior to the sugarcane canopy closure over the row middles. Wide spacing in between sugarcane rows allows wide range of weed flora to grow profusely. The kind of weed species and the duration of its infestation have a major impact on stalk size, number of millable canes and finally the cane and sugar yields. Further, it severely reduces not only the tonnage, but also its quality besides hindering in the various field operations and harbouring insect-pests and disease.

The nature of weed problem in sugarcane cultivation is quite different from other field crops because of inherent capacity of slow initial crop growth and heavy input requirements. The intensity and diversity of weed flora in sugarcane is dependent on the planting season. Owing to heavy nutrient application and frequent irrigation favours emergence of more flush of weed flora in the same growing season. There are several perennial weeds causing immensely losses in plant and ratoon cane crop in the tropical and subtropical regions of the country as well as the world. These weeds are so damaging that the losses can be experienced as high as 90% of the total crop yield in various part of the world. Although weeds are a challenge in the current sugarcane production system in India, there are many opportunities exist for developing sustainable and effective weed management programmes for main and ratoon crop. A huge quantity of trashes ranging from 12-15 tons/ha) can be effectively utilized as a component of IWM practices besides improving the resource use efficiency. In sugarcane, weeds are generally controlled with manual and cultural manipulations. Now-a-days timely availability of labour is a problem. So, the herbicide uses for weed control in sugarcane is considered to be economical and thus becoming increasingly popular. Hence, providing a weed free environment is absolutely essential to realize the full potential of new varieties and to make the best use of key production factors like nutrients, moisture and other natural resources. There are several weed management techniques which may be started much before planting as a preventive measure and may continue in the standing field crop by way of physical, mechanical, and chemical methods of weed management to improve the cane yield and farmer income.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-4

Nano-encapsulated slow release herbicide formulations for season long weed control in rainfed and irrigated ecosystem

C.R. Chinnamuthu

Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003
Email: crchinnamuthu@yahoo.com

The performance of herbicides in tropical environments can sometimes be erratic and inefficient. This is particularly true for soil-applied herbicides where high temperatures, intense rainfall, low soil organic matter and microbial activity results in rapid breakdown and loss through leaching. Further the irrigation process reduces the herbicide concentration lead to reduced weed control efficiency coupled with leaching and potential ground water pollution. Thus the half-life period for many soil applied herbicides remains very short period ranging from few hours to couple of weeks. Once the soil applied herbicide concentration reduces to 50% of its original strength, correspondingly it loses its weed control efficiency. An effective herbicide should control weeds with accurate doses, selectively non-toxic to crops, remain in the area where applied, persist throughout the growing season taking care of frequently germinating weeds and leaving no residue at the end of the season permitting subsequent crops in the sequence. Under rainfed situation lack of moisture restricts the use of herbicides.Conventional formulations are unsafe for handling, suffer from movement of herbicide in surface run-off and leaching in soil, which is undesired in majority applications except where soil erosion results. These aforementioned problems need over application of herbicide in the case of routine formulations that may increase the latent pollution of soil and ground water. Hence, development of economically viable slow release herbicides necessitates for the season-long weed control. In this background the enabling science of nanotechnology could be used as a tool to formulate the slow release herbicide for achieving season-long weed free condition without hampering the environment.

By controlling structure precisely at nanoscale dimensions, one can control and tailor the properties of nanostructures, such as nanocapsules, in a very accurate manner for smart and slow release to achieve season long weed control. Nanoencapsulated pendimethalin herbicide using manganese core-hallow shell technology remain unaffected under high temperature until the receipt of rain and releases the herbicide after receiving the sufficient moisture under rainfed conditions. Among the nano structures fabricated solvent evaporation was found to be longer in releasing the encapsulated pendimethalin herbicide molecules consistently up to the study period of 40 days. Field experiment with pre-emergence herbicide oxadiargyl encapsulated / loaded with zeolite, biochar, starch, water soluble polymer maintained the lowest weed population throughout the crop sequence of rice-bhendi-blackgram and recorded significantly higher crop yield compared to conventional formulations. Oxadiargyl loaded with zeolite recorded higher recovery of 86 and 83% with half-life of 13.5 and 13.0 days in mainland and Island ecosystem, respectively. Thus the encapsulated pre-emergence oxadiargyl was more suitable for prolonged release and season-long weed control in the rice-bhendi-blackgram cropping sequence.

The encapsulated silver modified Fe_3O_4 nanoparticles with carboxymethyl cellulose exhibited better degradation of atrazine herbicides compared to Fe_3O_4 nanoparticles. The silver nanoparticle used as capping agent for iron oxide nanoparticles increases the catalytic activity. The carboxymethyl cellulose used as stabilizing agent increases the activity of iron and silver nanoparticles and degrades the 88 per cent of atrazine within 12 hours of treatment.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-5

Effect of mesosulfuron-methyl against mix weed flora and it's persistence in wheat grain and straw

M.L. Kewat* and Asha Singh

**Department of Agronomy, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004*

**Email: mlkewat1958@rediffmail.com*

A field experiment was conducted during *Rabi* season 2014-2015 and 2015-2016 to judge the bio-efficacy of mesosulfurom-methyl against mixed weed flora and its persistence in wheat plant at Live Stock Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. Data revealed that dicot weeds *i.e. Anagalis arvensis* (37.37 and 25.40%) and *Medicago denticulata* (14.20 and 36.31%) as well as monocot weeds like *Phalaris minor* (21.92 and 17.26%) and *Cynodon dactylon* (14.30 and 5.26%) were predominant weeds in wheat during 2014-2015 and 2015-2016, respectively. However, other dicot weeds, *viz. Alternanthera philoxeroides* (2.61 and 2.18%) and *Chenopodium album* (2.40 and 6.55%) as well as monocot weed *Cyperus rotundus* (7.20 and 6.75%) also marked their presence in lesser numbers.

Post-emergence application of mesosulfuron-methyl at 11.5 and 12.0 g/ha was found more effective for control of associated weeds weeds in wheat and attained the superior value of growth parameters (plant height, chlorophyll content, crop biomass, LAI, CGR, RGR and RGR), yield attributing traits (ear head length, grains/ ear head and test weight) including yield of wheat. The data also showed that the initial concentration of mesosulfuron-methyl in plant was lower when it was applied either morning or noon time in comparison to evening time application, irrespective to dose and year of experimentation. In plant mesosulfuron-methyl degradation was faster in comparison to soil as 84.68-88.82 per cent of initial deposit of mesosulfuron- methyl was degraded within 10 days and on 30th days, only 5.70-7.11 per cent over initial values of mesosulfuron-methyl (0.812-1.416 µg/g) was persisted in wheat plant. Hence, it could be said that mesosulfuron-methyl tend to persist much longer in soils than in plants. However, at harvest, residues of mesosulfuron-methyl applied at different times and different rates in both wheat grain and straw were below the detectable limit. The dissipation of mesosulfuron-methyl in wheat plant also followed first order kinetics and the half-life values during first and second year of of mesosulfuron-methyl were in the range of 11.97 to 14.38 days, and 10.39 to 13.70 days, respectively. The data on half-life of mesosulfuron-methyl show that the during second year half-life of mesosulfuron- methyl slightly shorter than that during first year. Similarly, half-life of mesosulfuron-methyl in plant was shorter when applied during morning and noon times in comparison to evening time application, irrespective of dose and year of experimentation.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-6

Weeds as a bioenergy feedstock for pyrolytic valorization to biofuel and biomaterials

Rupam Kataki

Department of Energy, Tezpur University, Napaam, Tezpur, Assam 784 028

Email: rupam@tezu.ernet.in

Weeds comprises of a variety of plants that are harmful to the society in many ways. Weeds are lignocellulosic in nature, and as such have been utilized as a base material for various uses and services. Weeds inherent chemical and biochemical make-up also favors its candidature as a feedstock for conversion to various forms of energy. In this regard, there is a growing concern regarding identification and utilization of bioenergy feedstocks that can be harvested in a manner without requiring major land-use intensification or use of food crops. Although various weeds have long been regarded as an intriguing potential feedstock because of their high growth rate in natural eco-systems, most contemporary management is based on plant control rather than utilization.Weeds can be an excellent feedstock for biomass to bioenergy conversion processes. Due to differences in physio-chemical and biochemical constituents, various weeds suits different schemes of the above conversion processes, *viz*. chemical, biochemical and thermochemical.

This work presents a review of the utilization of various weeds for energy conversion processes, their life-cycle overview, and prospects of pyrolytic valorization of weeds to biofuels and biomaterials. Pyrolysis is a thermochemical conversion process that has the capacity to utilize a wide range of plant feedstock, and yields energy rich solid, liquid, and gaseous products. The liquid (biooil) can be upgraded to petro-grade fuels, while solid char (charcoal or biochar) can be utilized for a variety of purposes including energy application, soil amendment, C-sequestration, heavy metal absorption to name a few. This work concludes that utilization of weed as a feedstock for energy conversion processes can be an effective strategy for weed management, as well as for production of various useful products.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-7

Integration of band-spray and inter-row weeding provides effective weed control in maize

Naveen Khanna, Makhan Singh Bhullar*, Manpreet Jaidka[1] and Tarundeep Kaur
Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab 141004
[1]Krishi Vigyan Kendra, Langroya (Nawanshahr), Punjab 144516
**Email: bhullarms@pau.edu*

Earlier, in Punjab and in India also, tillage and crop rotation were the major means of weed control in maize. Presently, the herbicides have become the prime method for weed control in this crop, as the herbicides are selective and save labour. Pre-emergence herbicide like atrazine alone and as tank-mix has been recommended for control of annual broad-leaf and grass weeds in this crop. The post-emergence application of 2,4-D has been used for the control of perennial sedge *Cypeurs rotundus* and broad-leaf weeds. Recently, tembotrione has been recommended for broad-spectrum control of weeds. Though herbicides are selective and provide better control of weeds related to other methods, the over reliance could lead to emergence of minor weeds as major, herbicide resistance in weeds and accumulation of chemicals in the soil. Looking into the present scenario of rising labour costs and labour scarcity, the herbicides will continue to play a key role in the maize production systems. However, there is an urgent need to reduce the dependence on herbicides and integrate the use of herbicides with non-chemical methods, so as to reduce the soil load of herbicides. In this context, the effect of integration of band application of herbicide and hand weeding/mechanical inter culture in inter-rows on weed control and maize grain yield was investigated in a field study conducted at two locations in *Kharif* 2018.

Major weed species in the experimental field included *Cyperus rotundus*, *Trianthema portulacastrum* and *Dactyloctenum aegyptium* at both locations*; Commelina benghalensis* was present at Ludhiana and *Echinochloa colona* at Langroya only. The season long weed infestation reduced maize grain yield by 30 to 40%. Integration of band-spray (tembotrione 36.7 g/ha alone/tembotrione 36.7 g + atrazine 208 g/ha) with hand weeding (HW) (in inter-row) gave weed control at par to blanket spray (tembotrione 110 g/ha alone/ tembotrione 110 g + atrazine 625 g/ha). Integration of band spray (tembotrione + atrazine) and HW (inter-row) gave the highest maize grain yield at both locations; at Ludhiana, it was at par with integration of band spray (tembotrione) and HW (inter-row), blanket spray (tembotrione + atrazine), and at Langroya, maize grain yield did not vary statistically among weed control treatments. Averaged over locations, blanket spray (tembotrione + atrazine) or band spray (tembotrione + atrazine) plus HW (inter-row) gave the highest net returns while highest benefit cost ratio was recorded under integration of band spray (tembotrione alone/ tembotrione + atrazine) and HW/paraquat (inter-row). Integration of band spray (tembotrione) and HW (inter-row) gave higher net returns than blanket spray of tembotrione. In conclusion, the integration of band-spray (tembotrione alone or as tank-mix with atrazine) and HW (inter-rows) seems to be the best way for effective control of weeds and in reducing herbicide load in maize.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-8

Dry-direct seeded rice and zero-tillage wheat: Two most potential resource conservation technologies in rice-wheat cropping system for crop residue management, mitigating globalwarming and enabling sustainable intensification in India

Ashok Yadav[1]*, R.K. Malik[2] D.B. Yadav[3] and Virender Kumar[4]

[1]International Rice Research Institute, New Delhi, India; [2]CIMMYT, New Delhi, India; [3]CCSHAU Regional Research Station. Karnal, India; [4]International Rice Research Institute, Las Banos, Laguna, Philippines

**Email: aky444@gmail.com*

In Asia, rice is grown over 143 mha, including 44 mha in India that produced 106.7 mt grain in 2016, of which 91.5 mt was *Kharif* rice. Whereas, the figures for wheat in 2014-15 were 30.97 mha area, 86.53 mt production and 2794 kg/ha productivity. Country produces roughly 628 mt of crop residue annually, 58 % of which comes from cereals and rice-wheat are the two main players. Around 40, 22 and 20% crop residue of rice, wheat and sugarcane, respectively is being burnt. Puddled transplanted rice (PTR) is highly labor, water, and energy-intensive. Alarming groundwater depletion (33-100 cm/ yr) because of PTR also poses a central threat to national food and environmental security besides it being a major contributor to methane emission (~10 20% of total global annual methane emissions) and adversely affecting the yield of succeeding wheat crop in rotation by around 8% putting a serious question mark on overall system sustainability. Drudgery involved in manually transplanting of rice seedlings in paddy soil, a job which is largely done by women farmers, is also a social and health concern. Declining total factor productivity, resource constraints (land, labor, water, and energy), and climatic vulnerability necessitate sustainable intensification of the rice-wheat cropping system, to produce more with less resources while maintaining soil health and environmental quality.

Dry-direct seeded rice (DSR) and zero-tillage wheat (ZTW) through sustainable intensification and viable crop residues management (CRM) may make the existing system more remunerative. Viable and cost effective *in-situ* management of crop residues majorly through ZT/Happy seeder and enforcement of other necessary laws, and policy framework and interventions are the need of the day. Rice residue retention in ZT wheat might also further simplify the complex problem of weeds like herbicide resistant *Phalaris minor* in wheat besides improving system based water and crop productivity, and environmental safety. Long-term (20-23 years) impact studies on ZT continued in different cropping systems, DSR *fb* ZT-wheat (6 years) and green manuring (GM) along with herbicide rotation in rice –wheat system (>20years) in Haryana have demonstrated the multi-facial benefits of DSR, ZTW, residue retention and GM. Timely rice planting preferably using short duration competitive and high yielding varieties/hybrids under DSR/NPMTR sequencing with early wheat sowing of long duration varieties under ZT in fields (200% cropping intensity) with anchored residue retention or hybrid/short duration rice-mustard-mung bean or hybrid/short duration rice-mustard-maize (300% cropping intensity) could prove most productive and profitable preposition in Bihar and EUP. Early wheat sowing facilitated by ZT also mitigates terminal heat besides curtailing *P. minor* infestation and improving crop productivity. Combine harvesters with SMS; reapers, mulchers, bailers, super-seeders *etc*. are other tools for in-situ-CRM. An additional irrigation could enhance rice-wheat productivity very significantly. Co-ordinated, concerted and consistent efforts are required by all stakeholders (Government, policy makers, extension agencies, service providers and farmers) for wider and accelerated adoption of these alternate planting methods in different agro-ecologies of India.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-9

Recent advances in mitigation methods for herbicide residues in the soil

Neelam Sharma*, Siddhartha Singh and Shobha Sondhia[1]

Department of Chemistry and Biochemistry, College of Basic Sciences, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh 176062

[1]ICAR-Directorate of Weed Research, Maharajpur, Jabalpur, Madhya Pradesh 482 004

**Email: sharma_neelam29@rediffmail.com*

In modern agriculture, with more emphasis on high input systems, the widespread application of herbicides has indubitably improved the crop production but has also resulted in inadvertent revelation to the ecosystem. The increased consciousness towards the adverse effects of herbicide residues on human health and environment, a significant focus within weed science has been shifted towards the mitigation strategies of herbicide residues in soil as well as in plants. The astute use of chemical herbicides provide selective and economical weed control, however, recurrent and non-judicial use may lead to soil residues, phytotoxicity and adverse consequence on subsequent crops, non-targets organisms and environment eventually leading to human peril. The continuous use of herbicides leads to the problem of soil persistency which possesses far reaching environmental consequences. The longer persistence of herbicide poses a hazard to subsequent land use and is undesirable. The persistent quantity of herbicide present in soil in its original or closely related phytotoxic form after its operational function is referred as herbicide residue. The different herbicide family possesses different persistence potential in soil and the families having persistent members include the triazines, uracils, phenylureas, sulfonylureas, dinitroanilines, isoxazolidinones, imidazolinones, and certain plant growth regulators belonging to the pyridine family. Several approaches have been utilized for mitigation of herbicide residues in soil. The hazards from herbicide residues in soil can be reduced by using low dosage chemicals. Residue levels exceeding the MRL, due to unnecessary high application rates or short pre-harvest intervals (PHIs) are contrary to the concept of good agricultural practices and necessitating use of mitigation measures.

Tillage operations help in surface exposure of deep present herbicide residues leading to its decontamination by volatilization of carbamates, thiocarbamates and dinitroaniline. Soil decontamination can also be carried out using tolerant crops. For example, when carry-over due to imazethapyr is suspected, crops such as canola and flax should be avoided. Crop rotation is another approach for mitigation of herbicide residues which spreads the planting and herbicide application season, reducing the risk of encountering widespread herbicide runoff during a single runoff event. Herbicide drift can largely be purged by using proper nozzle and spraying technique and by using granular, foam, gel and encapsulated materials. Site specific application using variable rate applicator, enhancement of herbicide degradation through bio-stimulation, use of non-phytotoxic oil, adjuvants, surfactants, adsorbents, protectants, antidotes, safeners, biochars are various other effective ways for mitigation of herbicide residues in soil. Biochar as an amendment to agricultural soils has been found to increase the bioavailable water, builds soil organic matter, enhances nutrient cycling, lowers bulk density, and can provide shelter for beneficial soil microorganisms. Biochar because of its sorption property prevents the mobilization of herbicide residues in soil and hence helps the crop to escape toxicity. Carbon based nano-absorbents such as carbon nanotubes (CNTs) represents a new class of nonmaterial and have been shown to have good potential in removal of various types of herbicide residues in soil. The adsorption capacity of herbicides by CNTs is mainly affected by the pore structure and the existence of a broad spectrum of surface functional groups that can be achieved by chemical or thermal modifications to improve the optimal performance for a particular purpose.Graphene is another carbon nanomaterial that has attracted tremendous attention in water purification and various fields due to its unique physical and chemical properties. Nanocrystalline metal oxides such as ferric oxides, manganese oxides, aluminum oxides, titanium oxides, magnesium oxides and cerium oxides are highly effective adsorbents for a broad range of herbicides. These nanocrystalline metal oxides do not only adsorb but also actually annihilate many chemical hazards by converting them to much safer byproducts. The amalgamation of bio-augmentation and bio-stimulation along with organic matter addition might be a promising technology for biodegradation of herbicides in the soil. Although it requires extensive field evaluation studies, bio-stimulation along with crop rotation and organic matter addition is absolutely a promising technique for managing the herbicide residue in the soil.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

IO-10

Glyphosate herbicide Product Safety and global scenario

Suresh Pennadam Jeyakaran
Bayer CropScience Limited, India
Email: p.suresh@bayer.com

Glyphosate (N-Phosphonomethyl glycine) is a post emergence, non selective, translocated herbicide, used for control of weeds and unwanted plants in agricultural cropping systems well as non-agricultural sectors including industrial and military establishments, airports, power stations, forests, archeological sites, *etc*. The usage of glyphosate has been on the increase across the globe as it serves as an effective weed management tool when compared to other weed management systems. Glyphosate has a favourable environmental safety profile and over the four decades, has undergone repeated reviews by various global regulatory agencies. In India, the 09 different glyphosate formulations have been registered for use in various segments. The paper delves product safety aspects, reviews of regulatory agencies in assessing risk assessment and evolving challenges in the current scenario.

Oral presentations

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-1

Weed management in rice – wheat system: Challenges and opportunities

U.P. Singh*, Nikhil Kumar Singh, Marthala Bhuvaneshwar Reddy, Anurag Upadhyay, Kajal Verma, Sanjeev Kumar Kashyap and Naveen Tiwari

Department of Agronomy, Institute of Agricultural sciences, Banaras Hindu University, Varanasi, UP- 221 005

**Email: udaipratap.singh1@gmail.com*

The rice – wheat (R-W) is the most predominant cropping system covering approximately 10.5 million ha, – mostly in the Indo Gangetic plains of the Indian sub-continent. This system contributes nearly 40% of the rice and wheat production in India and predominant in Uttar Pradesh, Punjab, Haryana, Bihar and West Bengal. R-W system provides staple food grain for more than 400 million people. It played a key role during green revolution era in 1960s. But after 1990s, the productivity of this system was gradually declined due to several constraints like delayed crop establishment, repeated excessive tillage, and heavy weed infestation. Weed is one of the major constraints for reduction of yields in R-W system. The major weeds of the R-W system during *Kharif* are *Echinochloa colonum*, *Echinochloa crusgalli*, wild rice, *Panicum repens*, *Cyperus* spp, *Cynodon dactylon*, *Caesulia auxillaris* while *Phalaris minor, Chenopodium album, Anagalis arvensis*, during *Rabi* season. Excessive tillage, using poor quality seed especially mixed with weed seeds and mogo culture trend of the farming community contributing tremendous challenges towards occurrence of weeds in R-W system. Changing weed flora due to several factors is another concern for predominance of the weeds in rice based system. Using need based minimum tillage, appropriate surface residue retention, sensible crop diversification, along with use of pure quality seed, stale seed bed technique and rational use of herbicides are potential tools for managing weeds in R-W system on sustainable basis. Results have shown that conservation agriculture (CA) practices like residue retention contributed significantly in reducing weeds in R-W system. Integrated crop and resource management practices along with use of herbicides like pendimethalin 1 kg/ha (direct-seeded rice), or pretilachlor 0.75 kg/ha (transplanted rice) as pre-emergence followed by bispyribac-sodium 25 g/ha + metsulfuron 4 g/ha or pyrazosulfuron 20 g/ha for rice and sulfosulfuron 30 g/ha + metsulfuron 2 g/ha or clodinofop 60 g/ha + carfentrazone 20 g/ha / metsulfuron 4 g/ha or sulfosulfuron 25 g/ha + carfentrazone 20 g/ha as post-emergence in wheat are promising herbicides for broad-spectrum weed management. These herbicides may be rationally used based on the type and extent of weed infestation.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-2

System based herbicidal weed management and soil properties of transplanted low land rice-rice cropping system

P. Murali Arthanari* and C. Bharathi
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore- 641003
**Email: agronmurali@tnau.ac.in*

Field experiment were conducted to study the influence of system based herbicidal weed management and their effect on weed shift, productivity and economics in transplanted rice-rice cropping system, assess the persistent and residue (soil, grain and straw) of herbicides and estimate the effect of weed management on microbial population and enzyme activity in rice – rice cropping system during *Rabi* 2018-19 (December, 2018–May, 2019) and *Kharif*, 2019 (June – October, 2019) in Tamil Nadu Agricultural University, Coimbatore, India. The experiment was laid out in a randomized block design without replication. The rice varieties '*ADT 37*' for *Rabi* and CO(R) 51 for *Kharif* season were used for the trial. There are about six treatments, *viz*. PE pyrazosulfuron-ethyl (10% WP) *fb* hand weeding for both the seasons, PE pyrazosulfuron-ethyl (10% WP) *fb* hand weeding + PE bensulfuron-methyl (0.6%) + pretilachlor (6.6%) *fb* hand weeding, PE pyrazosulfuron-ethyl (10% WP) *fb* POE bispyribac-sodium (10% EC), PE pyrazosulfuron-ethyl (10% WP) *fb* POE bispyribac-sodium (10% EC) + PE bensulfuron-methyl (0.6%) + pretilachlor (6.6%) fb POE bispyribac-sodium (10% EC), hand weeding twice and Unweeded check. During *Rabi*, 2018-19, the relative density of grasses was more in PE pyrazosulfuron-ethyl 20 g/ha *fb* hand weeding at 30 DAT and PE pyrazosulfuron-ethyl 20 g/ha PoE bispyribac-sodium 25 g/ha and significantly higher grain yield of 6891 kg/ha was recorded with PE pyrazosulfuron-ethyl 20g/ha *fb* hand weeding at 30 DAT followed by PE pyrazosulfuron-ethyl (10% WP) *fb* POE bispyribac-sodium (10% EC). During *Kharif*, 2019, the relative density of grasses and broad-leaved weeds were dominant in all the treatments at 60 DAT. The relative density of sedges was more in PE pyrazosulfuron-ethyl (10% WP) *fb* POE bispyribac-sodium (10% EC) + PE bensulfuron-methyl (0.6%) + pretilachlor (6.6%) *fb* POE bispyribac-sodium (10% EC) at 25 g/ha significantly higher grain yield of 8143 kg/ha was recorded with hand weeding, which was on par with PE pyrazosulfuron-ethyl (10% WP) *fb* POE bispyribac-sodium (10% EC). Higher grain yield and income was obtained with PE bensulfuron-methyl (0.6%) + pretilachlor (6.6%) *fb* hand weeding during *Rabi* 2018-19 and pre-emergence application of pyrazosulfuron-ethyl (10% WP) *fb* hand weeding during *Kharif* 2019. Residues are below the detection limit of 0.01 mg/kg and soil nutrients status was also unaffected significantly by the herbicidal weed management practices. Hence, it was concluded that pre-emergence application of PE bensulfuron-methyl (0.6%) + pretilachlor (6.6%) *fb* hand weeding during *Rabi* season and pre-emergence application of PE pyrazosulfuron--ethyl (10% WP) *fb* hand weeding during *Kharif* recorded significantly higher grain yield and income in rice – rice cropping system of clay loam soil in Western agro climatic zone of Tamil Nadu.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-3

Evaluation of critical period for weeding and yield loss in direct-seeded *boro* rice by weeds in shallow lowland of Assam

Teekam Singh
Division of Agronomy, ICAR-Division of Agronomy, ICAR-Indian Agricultural Research Institute, New Delhi 110012
Email: teekam@iari.res.in

Field experiment was conducted at research farm of Regional Rainfed Lowland Rice Research Station, ICAR-National Rice Research Institute, Gerua, Asom during two consecutive *Boro* season of 2014–15 and 2015–16 to assess yield losses in direct-seeded rice (DSR) under weeding times. Soil of experiment Cite was clay loam texture, having pH of 6.2, high in organic carbon (1.08%), medium in available nitrogen (290 kg/ha), phosphorous (16.15 kg/ha) and high in potash (320 kg/ha). Weather parameters remained variable especially the maximum and minimum temperature, sun shine hours and rainfall distribution pattern during both the years of experimentation. There were two DSR establishment techniques (dry and sprouted seeding) in main plots and four weeding times (15, 30, 45 and 60 days after sowing (DAS) in sub plots. Dry and germinated seeds of rice variety '*Naveen*' were carefully sown in well puddled soil on 8th January 2015 according to the treatments with spacing of 20 cm × 15 cm. A fertilizer dose of 60-30-30 kg/ha of N-P-K was applied as urea, di-ammonium phosphate (DAP) and muriate of potash (MOP) in the field. It was found that *Scirpus juncoides*, *Echinochloa colona*, *Cyperus difformis*, *Cyperus iria*, *Monochoria vaginalis* and *Ludwigia octovalvis* were the dominant weed species in shallow lowlands. DSR establishment techniques had non-significant effect on weed characteristics as well as growth, yield attributes and productivity of rice. Weed density of individual weed group and dry matter were significantly influenced by weeding times. Weed density of grasses was recorded in increasing trend up to weeding at 45 DAS and thereafter start declining. There was significant increment in grasses density between weeding at 30 and 45 DAS. Grasses and sedges density at 45 and 60 DAS were significantly higher over 15 and 30 DAS. Sedges density went on increasing as long as weeds allowed to grow in the field, which might be due to secondary propagation of sedges from tubers. However, broad-leaf weeds (BLW) were recorded highest at 30 DAS and thereafter drastic reduction in BLW density was observed which might be due to continuous stagnation of water from advancing pre monsoonal rainfall in shallow lowlands of Asom. However, total weed density at 45 and 60 DAS remained non-significant with each other but significantly higher over with 15 and 30 DAS. Weeding at 15 DAS resulted in significantly lowest weed density and biomass as compared to weeding at 45 and 60 DAS. Growth and yield attributes mainly plant height, panicles/m^2, filled grains/panicle and fertility percentage were significantly higher and subsequently resulted significantly higher grain and straw yield with early weeding at 15 DAS (4.41 t/ha) over weeding at 45 and 60 DAS. However, weeding at 15 and 30 DAS sowing remained at statistically at par with each other. Grain yield (4.03 t/ha) with weeding at 30 DAS was significantly higher over weeding at 60 DAS (3.52 t/ha) but remained at par with weeding at 45 DAS (3.72 t/ha). The highest grain yield losses due to weeds were calculated with weeding at 60 DAS (20.4%) followed by 45 DAS (15.8%) in DSR. Thus, early weeding in DSR had the most important role to obtain higher productivity of rice and minimum yield loss due to weeds.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-4

Integrated management of *Sacciolepis interrupta*, a weed menace in rice

K. Sreelakshmi* and Meera V. Menon
AICRP on Weed Management, Kerala Agricultural University, Thrissur, Kerala 680 656
Email: sree.agro1988@gmail.com

Sacciolepis interrupta (Wild) Stapf, locally known as 'Polla' a problem grass weed in semi-dry rice ecosystem of Kerala. Uncertainty in rainfall led to farmer's dependence on this system of rice cultivation, which in due course resulted in the spread of the weed. However, recently this weed has been reported under wet-seeded rice too. The weed has reached such problematic dimensions that farmers have abandoned harvest of rice in several areas due to severe infestation. In this context, a field experiments were conducted in the *Kharif* seasons of 2018 and 2019 at a farmers' field in Chithali in Palakkad district with the objective to develop an effective integrated weed management strategy for *Sacciolepis interrupta*.The treatments included pyrazosulfuron-ethyl 0.03 kg/ha, 5 DAS *fb* one hand weeding 45 DAS, cyhalofop-butyl +penoxsulam 0.15 kg/ha 15 to 20 DAS *fb* one hand weeding 45 DAS, pyrazosulfuron-ethyl 25 g/ha 5 DAS *fb* cyhalofop-butyl + penoxsulam 0.15 kg/ha 15 to 20 DAS *fb* one hand weeding 45 DAS, pretilachlor + bensulfuron-methyl 0.6 + 0.06 kg/ha 5 DAS *fb* one hand weeding 45 DAS, pertilachlor + bensulfuron-methyl 0.6 + 0.06 kg/ha 5 DAS *fb* cyhalofop-butyl + penoxsulam 0.15 kg/ha 15 to 20 DAS *fb* one hand weeding, 45 DAS, hand weeding twice at 20 and 45 DAS and an unweeded control.

The major weeds observed in the first year were *Sacciolepis interrupta*, *Cyperus iria, Paspalum conjugatum* and *Cyanotis axillaris*, whereas second year had *S. interrupta*, *Cyanotis axillaris*along with *Fimbristylis miliacea*, *Echinochloa crus-gulli* and *Ludwigia perennis* as the major weeds. Adoption of integrated weed management practices reduced the competition from all weeds including *Sacciolepis interrupta*. Combinations of pre- and post-emergence were effective in significantly reducing the weed density. While in the first year, all herbicidal combinations followed by hand weeding were superior and on par. In the second year pretilachlor + bensulfuron-methyl *fb* cyhalofop-butyl + penoxsulam *fb* hand weeding was most effective in reducing weed dry matter accumulation at 30 and 60 DAS. Yield was found to be significantly higher for this treatment for both 2018 (4.44 t/ha) and 2019 (3.10 t/ha) cropping season. However, hand weeding was found to be on par in the second year (2.93 t/ha). Considering the economics of cultivation of rice, treatment pretilachlor + bensulfuron--methyl *fb* cyhalofop-butyl + penoxsulam *fb* hand weeding was found to have high B:C ratio for both the years (1.53 and 1.17, respectively), and hence this treatment can be recommended for managing *Sacciolepis interrupta* below economic threshold level.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-5

Effectualness of herbicides in controlling weeds under aerobic summer rice

Satyananda Jena*, Rama Chandra Das, R.K. Paikaray, Jyotiprakash Mishra, Bishnupriya Patra and Shalini Mohanty

Odisha University of Agriculture and Technology, Bhubaneswar, Odisha 751 003

**Email: snjena2008@gmail.com*

Rice is the foremost cereal crop of world and is the primary food crop for about half of the world population. Traditionally rice established by transplanting seedlings in puddle soils, with standing water to give crop a competitive advantage over weeds. But, it is laborious as well as needs more water. So, the best promising option for the future is to adopt direct sowing of rice in place of transplanting, thereby reducing its dependence on labour and water. But, a major impediment in the succesful cultivation on direct-seeded rice in tropical countries is heavy infestation of weed which often ranges from 50-91% due to simultaneous emergence of weeds and crop and less availability of efficient selective herbicides for control of weeds during initial stages of crop weed competition. A field experiment was conducted during summer 2017 at Agronomy Main Research Farm, OUAT, Bhubaneswar taking twelve weed management treatments in randomized block design with three replication. The treatments are, *viz*. pretilachlor 0.5kg/ha (PE) 1 DAS, carfentrazone-ethyl 0.025 kg/ha (PoE) 15 DAS, cyhalofop-butyl 0.1 kg/ha (PoE) 15 DAS, flucetosulfuron-ethy l0.025 kg/ha (PoE) 15 DAS, propanil 80% WG 3 kg/ha (PoE) 15 DAS, triafamone + ethoxysulfuron 0.225 kg/ha (PoE) 15 DAS, cyhalofop –butyl 0.1 kg/ha+2,4-D 0.5 kg/ha (PoE) 15 DAS (Tank mix), pretilachlor0.5 kg/ha (PE) *fb* 2,4-D0.5 kg/ha (PoE) 15 DAS, pretilachlor0.5 kg/ha (PE) *fb* carfentrazone-ethyl 0.025 kg/ha (PoE) 15 DAS, Ffarmers practice (2 hand weedings at 15 and 30 DAS), weed free (4 hand weedings at 15, 30, 45 and 60 DAS), and weedy check. The soil of experimental site was sandy loam in texture with pH 5.68. The available N, P_2O_5 and K_2O of the experimental site was 303.2, 19.70 and 240.6 kg/ha, respectively. The test variety "*Pratibha*" was sown in lines on date. 04.01.17 and harvested on date. 13.05.17. The weed management practices were imposed as per treatments.

Application of triafamone + ethoxysulfuron (PoE), recorded lower weed density, weed dry weight throughout the cropping period, which was at par with pretilachlor (PE) *fb* carfentrazone--ethyl (PoE). Among different chemical weed control treatments, triafamone + ethoxysulfuron (PoE) recorded lowest weed index (WI) of 5.70% and highest weed control efficiency (WCE) of 79.80% at harvest followed by pretilachlor (PE) *fb* carfentrazone-ethyl (PoE). This might be due to reduction of weed density, weed biomass thus resulted in increase in weed control efficiency. Weed free treatment recorded significantly highest grain yield of 4.92 t/ha whereas weedy check recorded lowest grain yield (0.43 t/ha). Among different herbicidal treatments, significantly higher grain yield of 4.64 t/ha was obtained from application of triafamone + ethoxysulfuron (PoE) which was at par with application of pretilachlor (PE) *fb* carfentrazone-ethyl (PoE) with grain yield of 4.53 t/ha, also recorded highest number of yield attributes.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-6

Comparative evaluation of ALS inhibitors and 2,4-D on stress and productivity indices of rice

T. Girija*, C. Linu, C.V. Ramanarayana and N. Nithya
College of Horticulture, Kerala Agricultural University, Thrissur, Kerala 680 656
**Email: girijavijai@gmail.com*

Herbicides application to control weeds in rice has been widely adopted by the farming community. The usage of herbicides is also increasing. Currently, there are large numbers of rice herbicides commonly used by farmers. The ALS and ACC inhibitors do not contribute to any toxic symptoms on the rice crop while older chemicals such as 2,4 D show phytotoxic symptoms. In this context, studies were conducted in the Department of Plant Physiology, College of Horticulture from 2014 to 2019,to evaluate the stress induced on the rice plant by ALS inhibiting herbicides, *viz*. Azimsulfuron, bispyribac-sodium, metsulfuron-methyl and chlorimuron-ethyl and ACC ase inhibiting herbicides, *viz*. cyhalofob-butyl, fenoxaprop-p-ethyl and metamifop-sodium, at recommended doses. The ALS inhibiting chemicals. Azimsulfuron, bispyribac-sodium , metsulfuron-methyl and chlorimuron-ethyl were than compared with 2,4-D.

Results of our study revealed that the stress barometers like proline, catalase enzyme activity was higher in case of ALS –inhibitors and ACCase inhibitors as compared to hand weeded control followed by 2,4-D. The productivity parameters such as auxin content and Nitrate reductase enzyme activity, net photosynthesis and stomatal conductance showed a similar trend. Moreover, reduction in morphological parameters such as plant height, relative growth rate was also evident. However, stress on the plants was higher when observations were taken seven days after application of the herbicide. The plants showed recovery when observations were taken one month after application. However there was a 5 to 17% yield reduction in both the straw and grain yield of rice by use of ALS and ACCase inhibitors. This yield reduction can be negated by the use of boosters with urea, auxin and micronutrients this helped to improve yield by 20-25%.. This is in addition to this the development of resistance in weeds was higher in the case of ALS and ACC ase inhibitors than 2,4-D. A number of common weed species such as *Eclipta alba* , *Sacciolepis interrupta* which were effectively controlled by the ALS inhibitor seem to exhibit resistance to the weed. Similarly cyhalofob-butyl, which was one of the leading grass herbicide in the field is currently not so effective on weeds like *Isachnae miliaceae* . Many broad spectrum herbicides like bispyribac-sodium and penoxsulam both ALS inhibitors are not effective on many of the common weeds of rice such *as Fimbristylis miliaceae* and *Cyperus iria* at normal doses.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-7

Integrated weed management in unpuddled transplanted hybrid rice

Sneha Kumari, Manoj Kumar Singh* and Ram Pratap Singh
Banaras Hindu University, Varanasi, Uttar Pradesh 221 005
**Email: mksingh194.m@gmail.com*

Transplanting rice seedling in puddled soil is prevalent method of rice establishment in rice-wheat cropping system of Gangetic plains of Eastern India. Transplanting of rice seedling in unpuddled soil condition is a new emerging technique to reduce water requirement and excessive tillage prevalent in traditional transplanting. Weed infestation is a deterrent factor in rice production and in unpuddled transplanted conditions too. Therefore, main objectives of the experiment were to evaluate mulching options and weed management practices in unpuddled transplanted rice. A field experiment was conducted during *Kharif* 2017 and 2018 at Institute of Agricultural Sciences, BHU, Varanasi. The experiment was laid out in a split plot design with three mulching treatments,*viz*. no mulching, cover crop of *Sesbania* followed by surface mulch with same green residue and rice straw mulch (5 t/ha) in main plots and five weed management treatments, *viz*. weedy, hand weeding at 20 and 40 DAT, post-emergence application of bispyribac 25 g/ha at 18 DAT, post-emergence application of penoxsulam 30 g/ha at 18 DAT and post-emergence application of bispyribac 25 g/ha + pyrazosulfuron 20 g/ha at 18 DAT in sub plots and replicated thrice. *Sesbania* was sown as a cover crop, 45 days before transplanting and manually cut and left on the soil as green residue at the time of transplanting.

The results revealed cover crop of *Sesbania* followed by surface mulch with same green residue and rice straw mulch recorded significantly less weed density (37.48 and 24.20% in 2017; 40.98 and 13.98% in 2018, respectively) and dry weight (39.45and 21.54% in 2017 and 37.15and 12.90%, in 2018, respectively) as compared to no mulching. Mulching with *Sesbania* recorded higher WCE (77.9% in 2017 and 76.1% in 2018) as compared to no mulching (57.2% in 2017 and 56.6% in 2018) and recorded significantly higher grain yield (5.2t/ha in 2017 and 5.1t/ha in 2018) as compared to no mulching (3.8 t/ha in 2017 and 3.6 t/ha in 2018) and rice straw mulching (4.4 t/ha only in 2018). Among weed management treatments, post-emergence application of penoxsulam 30 g/ha resulted in significantly lower weed density (56.84% in 2017 and 51.10% in 2018), weed biomass (53.18% in 2017 and 52.39% in 2018) and higher WCE (85.2% in 2017 and 88.7% in 2018) as compared weedy check and increased grain yield (5.8 t/ha in 2017 and 5.4 t/ha) followed by spraying of bispyribac 25 g/ha + pyrazosulfuron 20 g/ha (5.4 t/ha in 2017 and 5.5 t/ha in 2018) and post-emergence spraying of bispyribac 25 g/ha (4.3 t/ha in 2017 and 4.0 t/ha in 2018). Interaction of mulching with *Sesbania* and hand weeding at 20 and 40 DAT had significantly higher grain yield of rice (6.6 and 6.5 t/ha in 2017 and 2018, respectively) as compared to all other combinations of mulching and weed management treatments, except mulching with *Sesbania* and penoxsulam 30 g/ha (6.3 and 6.1 t/ha in 2017 and 2018, respectively). Integrated use of cover crop of *Sesbania aculeate* with different post-emergence herbicides recorded higher rice grain yield than all other combinations of mulching and herbicides. Thus, two years of study revealed that cover crop of *Sesbania* in unpuddled transplanted rice may be opted to suppress diverse weed flora and their growth as well as to enhance grain yield of unpuddled transplanted rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-8

Weed dynamics and management options under different rice establishment methods during *Kharif*

Malay K. Bhowmick*, B. Duary, R.K. Ghosh, P.K. Maiti and S.R. Patra

*Directorate of Agriculture (Govt. of W.B.), Jessop Building, 63, N.S. Road (Strand Road Side), Kolkata, West Bengal *Email bhowmick_malay@rediffmail.com*

Rice (*Oryza sativa* L.) is life and the key pillar of food security for a majority of people. Current issues of labour and water scarcity coupled with climate change compel rice farmers to have a shift from conventional transplanting to alternative methods of crop establishment. Floristic composition, population dynamics and growth attributes of weeds differ according to agro-climatic conditions as well as crop establishment methods. Choosing a sound weed management practice compatible to establishment method is, therefore, very much crucial. In this view, a comprehensive study was conducted at Rice Research Station, Chinsurah, Hooghly, West Bengal during *Kharif* season of 2011 and 2012. Three establishment methods, *viz.* System of Rice Intensification (SRI), drum-seeding of sprouted seeds (DSS) and conventional transplanting of rice (CTR) were assigned in main plots, whereas eight weed management practices, *viz.* pyrazosulfuron-ethyl 25 g/ha at 5 days after sowing (DAS) / transplanting (DAT) followed by (*fb*) cono weeding (CW) at 25 DAS/DAT, bispyribac-sodium 25 g/ha (15 DAS/DAT) *fb* CW (25 DAS/DAT), azimsulfuron 35 g/ha (15 DAS/ DAT) *fb* CW (25 DAS/DAT), penoxsulam 25 g/ha (10 DAS/DAT) *fb* CW (25 DAS/DAT), metsulfuron-methyl + chlorimuron-ethyl 4 g/ha (10 DAS/DAT) *fb* CW (25 DAS/DAT), one CW (25 DAS/DAT), two hand weeding (20 and 40 DAS/DAT) and weedy check were in sub-plots, and evaluated in a split-plot design with three replications. Rice variety '*Khitish*' was raised with recommended package of practices. Data were recorded on crop and weed growth at 75 DAS/DAT, and grain yield at harvest. Production economics were worked out for different treatments and their combinations.

The crop was infested with grasses in higher proportion *fb* sedges and broad-leaved weeds, irrespective of establishment methods. Major weeds under SRI were *Cynodon dactylon*, *Echinochloa colona*, *E.crus-galli*, *Eleusine indica, Leptochloa chinensis* (grasses), *Cyperus difformis*, *C. iria*, *C. rotundus, Fimbristylis miliacea* (sedges), *Commelina benghalensis, Eclipta alba* and *Euphorbia hirta* (broad-leaved), whilst predominant weeds found in common under CTR and DSS were *C. difformis*, *E. alba*, *E. crus-galli, F. miliacea, Ludwigia parviflora*, *Marsilea quadrifolia, Monochoria vaginalis* and *Sphenoclea zeylanica.* As of pooled data, SRI significantly registered the highest grain yield (5.06 t/ha), compared with DSS (4.72 t/ha) and CTR (4.66 t/ha), whereas the highest net return was fetched under DSS (INR 21109/ha) *fb* SRI (INR 17553/ha) and CTR (INR 12872/ha). Efficacies of weed management treatments were found better under SRI (61.64 no./m^2 and 49.31 g/m^2) than DSS (68.29 no./ m^2 and 55.15 g/m^2) and CTR (62.57 no./m^2 and 53.20 g/m^2) with regard to suppression of weed density and biomass at 75 DAS/DAT. Post-emergence application of bispyribac-sodium (25 g/ha), azimsulfuron (35 g/ha) or penoxsulam (25 g/ha) supplemented with one CW (25 DAS/DAT) proved to be cost-effective in managing complex weed flora, exhibiting higher grain yield (5.27, 5.23 and 5.14 t/ha, respectively), and fetching more net return (Rs. 22131, 21859 and 21110/ha, respectively) under all establishment methods.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-9

Bio-efficacy of bispyribac-sodium 9.5%+ penoxsulam 7.8% SC w/v against weeds in transplanted rice and their residual effect on garden pea

J.K. Singh* and S.P. Vishwakarma
Department of Agronomy, Banaras Hindu University, Varanasi, Uttar Pradesh 221 005
**Email: jksinghbhu3@gmail.com*

A field experiment entitled bio-efficacy of bispyribac-sodium 9.5%+ penoxsulam 7.8% SC w/v against weeds in transplanted rice (*Oryza sativa* L.) and their residual effect on garden pea (*Pisum sativum* L.) was conducted during 2018-19 at Banaras Hindu University, Varanasi, India. The soil at the location was sandy loam in texture. The soil was deficient in nitrogen and medium in phosphorus and potassium. The treatments comprised of eight treatments *i.e.* bispyribac-sodium 9.5% + penoxsulam 7.8% SC w/v (19 + 15.6 g/ ha), bispyribac-sodium 9.5% + penoxsulam 7.8% SC w/v (23.75 + 19.5g/ha), bispyribac-sodium 9.5% + penoxsulam 7.8% SC w/v (25.65 + 21.06 g/ha), ttandard check 1: bispyribac-sodium 10% SC (25 g/ ha), standard check 2: penoxsulam 21.7% SC (22.5 g/ha), standard check 3: penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (135 g/ha), hand weeding (twice) and untreated control in a randomized block design replicated thrice.

It is evident from data that the density of *Cynodon dactylon, Echinochloa stagnina, Cyperus difformis, Cyperus rotundus* weeds before application of the treatments was uniform in the experimental plots. The relevant data on weed density reveals that application of penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (standard check 3) at 19 DAT reduced density of *Ammannia baccifera* at 15 days after application over the untreated control. The weed dry weight was also lower values with post-emergence application of bispyribac-sodium 9.5% + penoxsulam 7.8% SC w/v either at 23.75 +19.5g or 25.65+21.06 g/ha doses in respect to *Ammannia baccifera, Caesulia axillaris, Echinochloa colonum, Cyperus difformis* weeds. The higher grain yield of transplanted rice cv. *Improved Samba Mahsuri* (4.181 t/ha) was recorded with bispyribac-sodium 9.5% + penoxsulam 7.8% SC w/v at 25.65 g +21.06 g/ha (post-emergence) followed by its lower dose of 23.75 g +19.5 g/ha (4.06 t/ ha). Among herbicidal treatment, per hectare cost of cultivation was lower with penoxsulam 21.7% EC (22.5 g/ha) (standard check 2) followed by bispyribac- sodium 9.5% + penoxsulam 7.8% SC w/v (19 + 15.6 g/ha). Moreover, the application of bispyribac-sodium 9.5% + penoxsulam 7.8% SC w/v at 25.65 g +21.06 g recorded the maximum net return (‘99,106/ha) followed by bispyribac -sodium 9.5% + penoxsulam 7.8% SC w/v at 23.75 g +19.5 g/ha (‘95,514/ha). Perusal of the data also revealed that post-emergence application of bispyribac- sodium 9.5% + penoxsulam 7.8% SC w/v at 25.65 g +21.06 g showed the higher B:C (2.46) followed by bispyribac- sodium 9.5% + penoxsulam 7.8% SC w/v at 23.75g +19.5 g/ha (2.45). The minimum B: C (1.77) was registered under the hand weeding (twice). Data pertaining to the residual effect of the treatments applied for main transplanted rice crop on garden pea (cv. *Kashi Mukti*) revealed that there was no difference in per cent crop germination and plant population/m^2 at 15 and 20 DAS, respectively. Further, yield attributes and yield of garden pea were more under herbicidal treatments as well as hand weeding (twice) applied in preceding transplanted rice crop as compared to the untreated control.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-10

Performance of different pre- and post-emergence herbicides in transplanted rice

R. Poddar* and R.K. Ghosh
Dept. of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741 252
**Email: rpoddar.bckv@rediffmail.com*

A field experiment was conducted at C Block farm of BCKV, Kalyani to find out the effect of different pre and post-emergence herbicides in transplanted rice at NAZ of West Bengal during summer in 2013 and 2014. The experiment consisted of five pre-emergence (PE) herbicides having two botanicals along with five post-emergence (PoE herbicides besides this there were two hands weeding at 20 and 40 DAT and one weedy check treatment. The entire PE herbicides were provided two mechanical weeding at 20 and 40 DAT while all PoE were given one mechanical weeding at 40 DAT. The experiment was conducted in RBD having three replication with the *cv* '*IET-4786*'.

The data related to weed density and biomass revealed that maximum WCE at the initial stage was observed from PE herbicides upto 20 DAT and thereafter it was with HW followed by PoE herbicides. There was a reduction of 76.08% grassy weed, 46.48% sedges and 42.83% BLW in PE herbicides as against weedy check at 20 DAT. At the initial stage PE herbicides were accounted in 40.90% grasses, 39.22% sedges and 37.64% BLW less population than PoE herbicides treatments. Among the different PE herbicides grasses were more effectively controlled by cyhalofop-butyl 10% EC followed by botanical aqueous extract of *Parthenium hysterophorus* + *Calotropis procera* + *Tectona grandis*. Whereas, all weeds were more effectively controlled by oxadiargyl 80% WP followed by pretilachlor 50% EC at the early stage. As expected hand weeding twice was found best in controlling all categories of weed both at 40 DAT and at harvest irrespective of year. Among the different PoE herbicides, the herbicide mixture of metsufuron-methyl + chlorimuron--ethyl was more effective followed by another herbicide mixture of pretilachlor + pyrazosulfuron--ethyl at later stages of observations. Important weed indices like WCE, WEE, WPI also showed higher values at 20 DAT in case of PE herbicides particularly oxadiargyl and pretilachlor EPoE or PoE herbicides. In all other dates of observation the same higher values were obtained against hand weeding. The biological yield results showed that PE herbicides recorded 57.65% and 9.49% more than weedy check and PoE, respectively while it was 10.44% lesser than in PE than HW. PoE treated plots though recorded 43.98% more yield over weedy check but 18.20% lesser grain yield than HW plot. Plant height, dry matter, CGR and RGR was maximum in hand weeding followed by PE oxadiargyl and pretilachlor. In all the herbicide treated plots MW helped to manage the resurged weed flora in PoE stage. Micro flora and urease enzyme activity had positive correlation with nutrient status in soil and the population varied according to the residual toxicity of the herbicides. All the treatments recorded no detrimental effect on soil microflora (total bacteria, actinomycetes and fungi) in the long run though the application of herbicides decreased the microflora population initially up to an average of three weeks. Net return and B, C ratio was higher in PRE application of oxadiargyl (1.82) followed by PRE pretilachlor (1.76) than HW treatment (1.72).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-11

Weed management in transplanted rice with special reference to *Commelina benghalensis* L. in Central India

Pramod Kumar Gupta* and Yogita Gharde[1]
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur - 482004, M.P., India
[1]ICAR-Directorate of Weed Research, Jabalpur - 482004, M.P., India
**Email: pkgtaxo@gmail.com*

Rice (*Oryza sativa*) is the most widely cultivated rainy season's cereal in Madhya Pradesh. Weeds are considered as the more harmful than insects, fungi or other crop pests in many situations as far as economic loss is concerned. Owing to favourable weather and soil moisture regime, *Commelina* spp. infestation is a major biotic constraint to rainy rice production. *Commelina benghalensis* L. have been found infesting rice fields heavily and season-long infestation of this weed alone causes grain yield reduction by 13-40% and removes considerable amount of soil nutrients. Keeping this in view, on-farm research trial was conducted during 2014-17 at five farmer fields in Katni district of Madhya Pradesh to validate, refine and popularize the technology for managing *C. benghalensis*. Replicated on-farm trials were conducted at five farmers' fields in five villages (similar agroclimatic conditions) namely Deori, Umariyapan, Banda, Lakhapateri and Dhundhari of Katni district of Madhya Pradesh during 2014-17. The study aimed to find out the efficacy of bispyribac-sodium 20 g/ha, pyrazosulfuron 20 g/ha and pendimethalin 1.5 kg/ha over farmers practice (hand weeding twice at 30 and 60 DAT) and unweeded control on the management of weeds and profitability of rice sown in transplanted condition.

The weed flora recorded from the unweeded control plots consisted of *Commelina* spp. (71%) and others (29%) as *Echinochloa crus-galli, E. colona, Cyperus iria*, *Eclipta alba*, *Fimbristylis* sp. and *Marsilea quadrifolia*. All herbicidal treatments significantly reduced population of weed compared to farmers' practice. Grain yield of rice had a significant negative correlation (0.51 to 0.99) with weed parameters such as total weed population/m^2, total dry matter production (DMP) of weeds and N removal by the weeds, as well as a positive linear correlation with rice DMP and N uptake (0.97 and 0.39). Data on straw yield also showed same trend.Bispyribac-sodium 20 g/ha at 20-21 DAT reduced the density of *C. benghalensis* upto 9.8 no./m^2 and dry weight upto 6.9 g/m^2 and also reduced the infestation of other weeds to a significant extent. Higher values of yield attributes such as number of panicles (229/m^2), grain yield (3.46 t/ha) and net returns (Rs. 31,820/-), as well as less values of nutrient uptake by weeds (5.8 kg N, 1.1 kg P and 6.9 kg K/ha) were recorded with this herbicide compared to farmers practice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-12

Evaluation of post-emergence herbicides in rice fallow blackgram

K. Srinivasulu*, J. Padmavathi and K. Nagendra Rao
Agricultural Research Station, Ghantasala, ANGRAU, Andhra Pradesh 521 133
**Email: srinivasulukatragadda@yahoo.co.in*

Blackgram is grown in rice fallows of Krishna and Godavari delta during *Rabi* and summer seasons on residual soil moisture and fertility. Certain weed species like *Grangea madaraspatana, Oscimum canum* and *Cardiospermum halicacabum* are not being controlled by post-emergence application of imazethapyr in blackgram grown in rice fallows. Aciflourifen-sodium + clodinofop-ethyl and fomesafen + fluzifop-p-butyl mixtures are known to be effective in controlling the above weeds. A field experiment for evaluation of post-emergence (PoE) herbicides in rice fallow blackgram was conducted at Agricultural Research Station, Ghantasala on clay loam soils during *Rabi* season. No fertilizers were applied to blackgram and it was grown on residual soil fertility after rice crop.

Weed density values recorded with the treatments involving aciflourfen sodium + clodinofop propargyl 140+70 g/ha at 20 DAS and fomesafen + fuzifop p-butyl 220+220 g/ha at 20 DAS as PoE alone or following with pendimethalin were markedly lower than the values observed with the weedy check. Similar trend was observed in case of weed dry weight indicating that they are effective in controlling weeds in rice fallow blackgram. Grain yield obtained in the plots received pendimethalin1.0 kg/ha as PE *fb* aciflourfen sodium + clodinofop propargy l140+70 g/ha at 20 DAS and pendimethalin1.0 kg/ha as PE *fb* fomesafen + fuzifop p-butyl110+110 g/ha at 20 DAS were comparable with each other and with the hand weeding at 20 and 40 DAS. However, the highest grain yield (1151 kg/ha), net returns (Rs 35706) and benefit cost ratio (3.14) were observed with the treatment pendimethalin1.0 kg/ha as PE *fb* aciflourfen sodium + clodinofop propargy l140+70 g/ha at 20 DAS. Plants received imazethapyr 50g/ha as post-emergence at 20 DAS showed stunted growth up to 14 days after treatment and disappeared later and plants recovered well. Whereas, other herbicides studied aciflourfen sodium + clodinofop propargy l140+70 g/ha at 20 DAS and fomesafen + fuzifop-p-butyl 110+110 g/ha at 20 DAS does not showed any symptoms of phytotoxicity at the levels studied. Overall the study indicates that the treatments received pendimethalin1.0 kg/ha as PE *fb* aciflourfen-sodium + clodinofop propargyl 140+70 g/ha at 20 DAS is effective in reducing the dry weight and density of weeds significantly thereby favouring better growth and yield of rice fallow blackgram leading to increased net returns and benefit cost ratio.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-13

Standardization of weed management practices in transplanted scented rice in lower gangetic alluvial zone of West Bengal

***Bikas Mandal, Dhiman Mukherjee, Sunil Mandi, Chandan Baskey, Priya Das**
Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741 252
**Email: mbikas12@gmail.com*

Rice (*Oryza sativa* L.) is one of the predominant cereal food crops of above 70%of the Asian population and a staple food crop for world's economically challenged regions. India is the world's second largest producer (105.3 mt) of rice covering an area of 44.10 m ha, with 2.38 t/ha productivity. India stands second in rice production with an annual production of about 152 million tonnes. West Bengal, Uttar Pradesh, Madhya Pradesh, Punjab, Orissa and Bihar are the major rice producers. A field experiment was conducted on standardization of weed management practices in transplanted scented rice variety *Gobindabhog* at Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India with 12 different weed management practices *i.e.* bispyribac-sodium 40% SC 25.0 g/ha as PoE (20 DAT), bispyribac-sodium 40% SC 40.0 g/ha as PoE (20 DAT), pretilachlor 50% EC1.0 kg/ha as PE(2 DAT), pretilachlor 50% EC 1.5 kg/ha as PE (2 DAT), pretilachlor 50% EC 1.0 kg/ha as PE (2 DAT) followed by bispyribac-sodium 40% SC 25.0 g/ha as POE (20 DAT), pretilachlor 50% EC 1.5 kg/ha as PE (2 DAT) followed by bispyribac-sodium 40.0 g/ha as POE (20 DAT), 2,4-D-ethyl ester 38 EC 850 ml/ha as POE (20DAT), penoxulam 21.7% SC 22.5 g/ha as POE (20 DAT), butachlor 50% EC1.5 kg/ha as PE (2 DAT), two hand weedings at 20 DAT and 40 DAT, butachlor 50% EC1.5 kg/ha as PE (2 DAT) + hand weeding at 30 DAT, and control (weedy check).

The experimental field was dominated with mixed weed flora of grassy, sedge and broad-leaved types. Among grasses *Echinochloa colona, Echinachloa crusgali, Cynodon dactylon,* sedges *Cyperus iria, Cyperus difformis, Fimbristylis miliaceae,* and broad-leaved *Marsilea quadrifolia, Ludwigia parviflora, Ammania baccifera* and *Alternanthera philoxeroides* were found prominently. The results of two years of the experiment revealed that among the treatments, two hand weedings recorded highest yield in both grain and straw yield (3.30 t/ha and 6.65 t/ha, respectively) which was statistically at par with pretilachlor 1.5 kg/ha as PE (2 DAT) followed by bispyribac-sodium 40.0 g/ha as POE (20 DAT). However, from the economic point of view, the highest net return and B:C ratio observed in treatment pretilachlor 1.5 kg/ha as PE 2 DAT followed by bispyribac-sodium 40.0 g/ha as POE (20 DAT) was Rs.41,142/ha and 1.85, respectively. Highest WCE was recorded from two hand weeding at 20 DAT and 40 DAT. Among the chemical treatment pretilachlor 1.5 kg/ha as PE (2 DAT) followed by bispyribac-sodium 40 g/ha as POE (20 DAT) was statistically at par with pretilachlor 50% EC 1.0 kg/ha as PE (2 DAT) followed by bispyribac-sodium 40% SC 25.0 g/ha as POE (20 DAT).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-14

Assessment of performance of maize+ runner bean intercropping under planting pattern and weed management

R.K. Divya, B. Behera*, L.M. Garnayak, M.R. Satapathy, S.D. Behera and S. Prusty
Department of Agronomy, College of Agriculture,Odisha University of Agriculture and Technology, Bhubaneswar-751 003, Odisha, India
**Email: bdbehera1@rediffmail.com*

Runner bean, a trailing vegetable, is intercropped in maize. Maize, being a C_4 - plant, has quick growing habit and acts as biological stake for runnerbean. In intercropping, crops belonging to diverse families, maturity duration, growth habits and herbicide selectivity are grown. Choice of herbicides is often limited. A field experiment was conducted during *Rabi* 2016 at Agronomy Main Research Farm, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha to find out effective weed management strategy for the intercropping system. Six planting patterns, *viz*. psole maize (100% maize + 0% runner bean), sole runner bean (0% maize + 100% runner bean), maize and runner bean in 2:2 row ratio (100% maize + 100% runner bean), maize and runner bean in the same row (100% maize + 100% runner bean), maize and runner bean in 1:1 row ratio (100% maize + 50% runner bean) and maize and runner bean in the same row (100% maize + 50% runner bean) and five weed management practices, *viz*. pendimethalin 1.0 kg/ha (pre-emergence spray), metribuzin 0.02 kg/ha (pre-emergence spray), pendimethalin 1.0 kg/ha (pre-emergence spray) + one manual weeding at 25 days after sowing (DAS), hoeing and weeding at 21 and 40 DAS and weedy check were tried in split plot design with three replications. Six planting patterns were allocated to the main plots and five weed management practices were allocated to the sub plots.

Five grasses, one sedge and six broad-leaved weeds infested the cropping system. Pendimethalin 1.0 kg/ha + manual weeding at 25 DAS resulted in the minimum weed density of 2.2/m^2 and dry weight of 55.2 g/m^2 at harvest. The maximum weed density of 73/m^2 and dry weight of 319 g/m^2 at harvest was recorded in the weedy check plot. The maximum weed control efficiency was recorded in pendimethalin 1.0 kg/ha + one manual weeding at all stages of crop growth and the maximum weed smothering efficiency of 81.3% was recorded in maize 100% + runner bean 100% in same row at harvest. The aggressivity of maize was found to be the maximum in maize 100% + runner bean 50%. Runner bean was found to be more aggressive than maize when 100% population of maize and runner bean were sown in the same row. The competition ratio of maize was the maximum in maize 100% + runner bean 50% in separate rows. Runner bean recorded higher value of competition ratio in maize 100% + runner bean 100% in the same row. The planting of maize 100% + runner bean 100% in same rows gave the maximum LER of 1.41. The maize equivalent yield (MEY) of system was the maximum in maize 100% + runner bean 100% in separate rows with a value of 5.93 t/ha among the planting patterns and the integration pendimethalin 1.0 kg/ha + one manual weeding at 25 DAS resulted in the maximum value of 6.86 t/ha among the weed management practices. The maximum system maize equivalent yield of 9.07 t/ha was obtained with pendimethalin 1.0 kg/ha in maize 100% + runner bean 100% in same row.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-15

Enhancing productivity and profitability through herbicidal weed management in maize-wheat cropping system

D.D. Chaudhari*, B.D. Patel, V.J. Patel and H.K. Patel
AICRP-Weed Management, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat 388 110
**Email: ddcsms@aau.in*

Maize (*Zea mays* L.) is one of the most important cereals in the world agricultural economy both as food and fodder due to its wide adaptability and compatibility under diverse soil and climatic conditions. Maize-wheat is the third most important cropping system contributes about 3% in the national food basket. In general, reduction in maize grain yields due to presence of weeds in India to the tune of 27-60%, depending upon the growth and persistence of weed population in crop. The critical period of crop-weed competition in *Kharif* maize was 15-45 days after sowing. Weed management in this critical period is not possible due to scarcity of labour and continuous rains in monsoon season. Under such circumstances, it is desirable to use different mode of action of new molecules of herbicides like topramezone and tembotrione in combination with other herbicides or mechanical method. Hence, the present experiment was conducted at AICRP on Weed Management Farm, Anand Agricultural University, Anand during *Kharif-Rabi* seasons of the year 2016-17 and 2017-18 on sandy loam soil to enhance the productivity and profitability through herbicides in maize-wheat cropping system.

The experimental field was infested with complex weed flora and the overall dominance of monocot weed (72%) was observed during the experimentation period. Major weed species observed in the experimental field were *Eleusine indica* (39.5%), *Dactyloctenium aegyptium* (11.2%), *Commelina benghalensis* (9.0%), *Eragrostis major* (4.9%) in monocot weeds category and *Digera arvensis* (10.0%), *Oldenlandia umbellata* (8.3%) *Phyllanthus niruri* (3.7%) and *Trianthema monogyna* (2.9%) in dicot weed category. Application of atrazine + pendimethalin (500+250 g/ha) PE *fb* 2,4-D 1000 g/ha LPoE and topramezone + atrazine (25.2 + 500 g/ha) EPoE *fb* IC + HW at 30 DAS was found most effective to manage complex weed flora in maize at harvest followed by topramezone 25.2 g/ha EPoE *fb* IC + HW at 30 DAS, tembotrione + atrazine (105 + 250 g/ha) EPoE *fb* IC + HW at 30 DAS, atrazine 1000 g/ha PE *fb* HW at 40 DAS, IC + HW at 20 and 40 DAS and tembotrione 120 g/ha EPoE *fb* IC + HW at 30 DAS with more than 80% weed control efficiency. These treatments were also recorded significantly higher grain and stover yield of maize without any adverse effect on succeeding wheat crop. Further, system productivity of maize equivalent yield, gross return and net return of maize-wheat cropping system was recorded higher under topramezone + atrazine (25.2 + 500 g/ha) EPoE *fb* IC + HW at 30 DAS, atrazine + pendimethalin (500+250 g/ha) PE *fb* 2,4-D 1000 g/ha LPoE and topramezone 25.2 g/ha EPoE *fb* IC + HW at 30 DAS with higher B:C ratio.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-16

Effect of nutrient and weed management practices on weed growth and crop productivity in sweet corn

Dibakar Ghosh*, R.P. Dubey, Subhash Chander, Chethan C.R., Dibakar Roy and P.K. Singh
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: dghoshagro@gmail.com*

Agro-techniques related with use of proper nutrient as well as weed management are very important for enhancing crop yield and the input use efficiency of the entire system. Keeping these views in background, a field experiments was conducted for developing suitable nutrient and weed management practices for higher crop productivity in sweet corn during *Rabi*, 2017-18 at ICAR-Directorate of Weed Research, Jabalpur. The treatments comprised of different levels of nutrient [75% of recommended fertilizer (RDF), 100% RDF, 125% RDF and 150% RDF] and weed management practices [atrazine 1000 g/ha at 2 days after sowing (DAS), tembotrione + atrazine 120+500 g at 20 DAS, atrazine 1000 g/ha as pre-emergence (PRE) *fb* tembotrione 120 g at 30-40 DAS, atrazine 1000 g/ha PRE *fb* mechanical weeding at 30 DAS and unweeded]. The RDF for sweet corn used as 225-60-60 kg/ha of N-P-K.

The most dominating weed flora was *Medicago polymorpha*, *Chenopodium album* and *Avena ludoviciana*. Different level of nutrients had not any significant effect on weed density, whereas, dry weight of *M. polymorpha* was lowest at lower level of nutrient application (75% RDF) at 60 DAS. The application of nutrients as recommended dose or higher dose gave the higher level of cob yield than the 75% RDF treatment, on the other hand stover yield of maize was not differ significantly with the varying level of fertilizers. In case of weed management practices, application of atrazine at 1000 g/ha as PRE was effectively inhibited the germination of most of the weed spp. Whereas, sequential application of atrazine at 1000 g/ha as PRE followed by post-emergence (POST) application of tembotrione 120 g/ha efficiently suppress the weed growth. The nutrient management practices significantly influences the cob length, cob grith, and cob weight, whereas, number of cobs/plant, number of grains/cob and number of grain rows/cob not differ statistically. But, different techniques of weed management practices significantly influences most of the yield attributing characters except number of grain rows/cob. The sequential application of PRE herbicides followed by POST herbicide and mechanical weeding enhanced the weed control efficiency and provided a better situation for higher crop productivity and the higher cob yield was recorded with these two treatments. As compared to the un-weeded situation, the maize crop of herbicide treated plots had higher nutrient use efficiency.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-17

Influence of brown manuring on weeds and growth attributes of irrigated maize

A. Ramachandran, A Veeramani[1] and R. Ananth[2]
Department of Agronomy, Mother Terasa College of Agriculture Mettusalai, Pudukkottai, Tamil Nadu 622 102
[1]Department of Agronomy, Agricultural college and research institute, Madurai, Tamil Nadu, 625 104
[2]Agrl. Statistics, Mother Terasa College of Agriculture, Mettusalai, Illuppur (Po), Pudukkottai, Tamil Nadu 622 102
**Email: ramagri25@gmail.com*

Field experiment was conducted at the central farm of the Department of Agronomy, Faculty of Agriculture, Agricultural College and research institute at Madurai. The soil of the experimental site was sandy clay loam in texture with a pH of 8.07, electrical conductivity- 0.33 dS/m and available N, P and K were 261.2, 21.4, and 256.5 kg/ha, respectively. The experiment was laid out in at randomised complete design with seven treatments and three replications in a plot size of 4.2 x 3.2 m. The main treatments comprised maize sole crop + mechanical weeding by hand hoe on 20 and 35 DAS, maize sole crop + PE alachlor 1.0 kg/ha *fb* mechanical weeding by hand hoe at 35 DAS, maize + daincha as intercrop with in-situ incorporation on 35 DAS, maize + daincha as intercrop and killing by 2,4–D on 35 DAS (brown manuring), maize + daincha as intercrop with in-situ incorporation on 35 DAS+ PE alachlor 1.0 kg/ha, maize + daincha as intercrop and killing by 2,4–D on 35 DAS (brown manuring) + PE alachlor 1.0 kg/ha, maize sole crop + unweeded check.

Result revealed that density of grasses, sedges, broad-leaved weeds and total weeds was reduced substantially by maize + daincha as intercrop and killing by 2,4 –D on 35 DAS (brown manuring) + PE alachlor 1.0 kg/ha over rest of the treatments. However, it was equally effective as that of maize + daincha as intercrop with in-situ incorporation on 35 DAS+ PE alachlor1.0 kg/ha at 20 and 40 DAS. Growth components of maize such as plant dry matter production, leaf area index and plant height. Among the treatments recorded the highest growth components maize + daincha as intercrop and killing by 2,4–D on 35 DAS (brown manuring) + PE alachlor 1.0 kg/ha. This was followed by maize + daincha as intercrop with in-situ incorporation on 35 DAS+ PE alachlor 1.0 kg/ha as compared to maize sole crop + un weeded check.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-18

An endeavour towards doubling jute farmers' income through mechanical weed management in North 24 Parganas of West Bengal

S.K. Jha*, S. Kumar, A. Shamna, M.l. Roy, R.K. Naik and A.K. Ghorai
ICAR-Central Research Institute for Jute and Allied Fibres, Kolkata, West Bengal 700 120
**Email: sunitikumarjha@gmail.com*

In India, particularly in major jute growing area, farmers still practicing broadcast method of sowing to avail limited soil moisture with less care in land preparation. Weeds are major threat to all crops and removal of weed at early stage of crop growth facilitates better crop yield. Weed infestation in the field increases the cost of production and reduces the quality and quantity of crop. The initial 15 to 60 days after sowing of seed is critical period for weed competition and the subsequent reduction in yield. Afterwards, the intercultural operation is done by manual uprooting of weeds which is labour intensive. Due to shortage of labour in peak seasons, weeding operation cannot be done within short period of 20-35 DAE of plants. Manual weeding in jute field involves 40% of total expenditure for jute cultivation and thereby reduction in fibre yield up to 70% under un-weeded situation and thereby reduction in economic benefits. As mechanization is gradually spreading amongst the farmers and they have become aware of the advantages of line sowing. The popularization and adoption of mechanical weeders have a great potential. Considering the above aspects, ICAR-CRIJAF initiated the research work by keeping the socio-economic status of jute farmers in mind to develop a low cost and light weight manual weeding machine suitable for operation in between line sown jute and other dry land crops for weeding out young composite weed flora. Considering the socio-economic factors of the jute farmers and nature of land holding, there was a challenge to come out with a low cost and light weight manual weeder for mechanical weeding. The technology is very promising as it reduces labour requirement by more than 50 - 55 man-days per ha, besides reduces drudgery and cost requirement in line sown crops. By using the technology the farmers have earned additional monetary benefit of Rs. 15,000- Rs. 17,000/ha by saving in manual labour cost involved in weeding and thinning operation. It further increases fibre yield by 8-10% and thus helping the farmers to substantiate their income in the endeavour towards doubling their income.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-19

Weed management in chickpea

Sheela Barla* and R.R. Upasani
Department of Agronomy, Birsa Agricultural University, Ranchi, Jharkhand 834 006
*Email: sheela.barla123@gmail.com

One of the major constraints for chickpea cultivation is weed problem as it ispoor competitor to weeds because of slow growth, short stature and limited leaf development at early stage of crop growth and establishment. Yield loss incurred due to weed competition in chickpea is estimated to be between 40 to 87% depending on the type of weeds and their density. Among various pests, weeds in general reduce yields by 30-54% in chickpea. No herbicide is available to be applied as post-emergence to control the emerging broad-leaf weeds effectively. Of late, development of high potency effective herbicide molecules as well as their combinations may be useful to control the wide spectrum of weeds. Hence, present experiment was carried out to study the efficacy of different herbicides with different doses on mixed weed flora and their effect on growth and yield of chickpea. A field experiment was conducted during winter seasons of 2017-18 and 2018-19 at the Agronomical research farm of Birsa Agricultural University, Ranchi, Jharkhand, to study the effect of weed management practices on chickpea under medium land condition. The treatments comprised of application of imazathepyr 50 and 70 g/ha; pre- and post-emergence (PE and PoE) respectively, application of ready mix imazethapyr 35% + imazamox 35% (Odyssey) 50 and 70 g/ha, PE and PoE, respectively; application of pendimethalin 1000 g/ha PE, ready mix imazethapyr 2% + pendimethalin 30% (Valor) 1000 g/ha PE, hoeing twice at 20 and 40 days after sowing (DAS) and weedy check. The soil of experimental plot was sandy loamy in texture with pH 5.6 poor in available nitrogen (189 kg/ha), medium in phosphorus (21.0 kg/ha) and potash (155 kg/ha), low in organic carbon (4.30 g/kg). The chick pea crop variety '*KWR-108*' with seed rate 70 kg/ha and fertilizer dose 25: 50: 25: 20 kg NPKS/ha was sown on 25th and 12th October 2017 and 2018 and harvested on 28th February, 2018 and 7th March, 2019, respectively. The experiment was laid out in a randomized block design with three replications. Weed density was counted at 30 and 60 DAS. Yield and yield attributes were recorded at harvest.

Among different herbicides, pre-emergence application of imazethapyr 35% + imazamox 35% (Odyssey) 50 and 70 g/ha similar to pre-emergence application of imazathepyr 50 as well as70 g/ha, pre-emergence application of imazethapyr 2%+ pendimethalin 30% (Valor) 1000 g/ha, hoeing twice at 20 and 40 DAS was most effective in reducing total weeds density as well as total weed dry matter at 30 and 60 DAS. Pre-emergence application of imazethapyr 2%+ pendimethalin 30% (Valor) 1000 g/ ha recorded significantly maximum weed control efficiency (81.12%, at 60 DAS) thereby enhancedseed yield (2.31 tones /ha) and gross return (Rs 1,06,681/ha), net return (Rs 71764/ha).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-20

Bio-efficacy of various herbicides on weeds and yield of Indian mustard under sub-tropical agro-ecosystems of Jammu region

Rajeev Bharat*, Sunil Kumar Rai and Rahul Gupta
AICRP on Rapeseed Mustard, SKUAST- Jammu (J&K) 180 009
**Email: bharat_rajeev@rediffmail.com*

A three year experiment was conducted at research farm, main campus, Chatha of SKUAST-Jammu from 2010-11 to 2012-13. The experiment to study the bio-efficacy of different weed control treatments on weeds and seed yield of Indian mustard was laid out in randomized block design with 3 replications under AICRP (Rapeseed Mustard) programme. In the first year the experiment was laid down with nine treatments which were subsequently increased to 10 and 12 treatments during the second (2011-12) and third year (2012-13) of experimentation. The initial nine treatments of the experiment comprised of Pendimethalin1.0 kg/ha pre-emergence (PE), oxidiargyl0.75 kg/ha PE, oxyfluorfen 0.15 kg/ha PE, post-emergence application (PoE) of quizalofop 0.06 kg/ha, PoE application of Clodinafop 0.06 kg/ha, isoproturon1.0 kg/ha as PE, isoproturon1.0 kg/ha as PoE weedy check and weed free plots. During the second year of experimentation, pre plant incorporation of trifluralin 0.75 kg/ha (PPI) was added to the treatments thus increasing the number treatments to 10 which were again increased to 13 treatments with addition of pendimethalin PE 0.75 kg/ha and pendimethalin (stomp extra 38.7 CS) PE. Periodic weed and crop yield observations were taken using standard methods. All the standard package and practices of SKUAST-Jammu were followed and data was analysed using standard statistical tools.

The major weeds present in the experimental field were *Medicago denticulata, Euphorbia helioscopia, Ranunculus arvensis, Rumex retroflexus, Anagallis arvensis, Cirsium arvensis* and *Cannabis sativa*. Weedy check caused an average reduction in seed yield of Indian mustard (35.43%) which was significantly lower than weed free situation in comparison. All the herbicides increased the seed yield of Indian mustard due to significant reduction in the weed dry weight as well as weed population per unit of land area. Among the various herbicide treatments, application of oxyfluorfen 0.15 kg/ha (PE) and trifluralin 0.75 kg/ha (PPI) besides oxidiargyl 0.09 kg/ha (PE) resulted in significant control of diverse weed flora in mustard which was at par with application of pendimethalin1.0 kg/ha PE and isoproturon1.0 kg/ha (PE and PoE) than other treatments in comparison thereby resulting in significant increase not only in the seed yield of Indian mustard but also the yield attributes due to higher WCE and lower weed Index and hence may be recommended for weed control in rapeseed mustard crops in Zone II and Jammu region. However, application of trifluralin 0.75 kg/ha as pre-plant was found to be the most economical treatment than other treatments in comparison controlling mixed weed flora in rapeseed mustard and hence can be recommended for weed control in rapeseed mustard under sub tropical agro-ecosystems of Jammu region.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-21

Effect of post-emergence herbicides on cuscuta infestation in jute (*Corchorus olitorius*) and mesta (*Hibiscus cannabinus*)

Mukesh Kumar*[1], A.K. Ghorai and Amit Bera
Central Reserch Institute for Jute and Allied Fibres, Barrackpore, Kolkata, West Bengal 700 120
[1]RPCAU, Pusa Samastipur, Bihar 848125
**Email: mukesh.agro@gmail.com*

Dodder (*Cuscuta* spp.), infests almost all crops except crops of *Poacece* family. Jute crop was not reported to host of *Cuscuta* in past, but recently this parasitic weed has been observed to infest jute and mesta in Madhavpur area of North- 24 Parganas and at CRIJAF research farm, Barrackpore. This not only reduced the fibre yield but also hider with harvesting of jute and mesta crop. The *Cuscuta* entangles into jute plant damaged the bark through its twining vines. It also bends the top portion of stem and causes mechanical damage to the plant lead to complete loss of jute fibre if not control on time *i.e.* 10-20 days of crop growth stage. The reduction in fibre yield was up to 50% by damage of bark by vine of *Cuscuta*, even it was controlled manually by hand pulling at 50-60 days of crop growth stage. The yield loss upto 80% has been observed by *Cuscuta* infestation. Pendimethalin as pre-emergence application reported to reduced the *Cusucuta* infestation in many crops but pendimethalin has phytotoxcity to jute crop. There is need to find out suitable herbicides to control *Cuscuta* in jute and Mesta. Hence, a field experiment was carried out in *Cuscuta* infested field of CRIJAF farm during 2017-18. The post-emergence herbicides namely quizalofop-ethyl at 40 and 60 g/ ha, propaquizafop at 40 g/ha, fenoxaprop-ethyl 80 and 100 g/ha and ethoxysulfuron at 20 and 40 g/ha were screened for an effective control of *Cuscuta* at 40 and 60 days after sowing of crop.

Among them ethoxysulfuron was observed to be effective for controlling the *Cuscuta* in jute and mesta/ kenaf. None of the grass killer post-emergence herbicide controlled the *Cuscuta* in jute and mesta. Application of ethoxysulfuron 15 WG 0.075 g/litre of water (*i.e* 75 ppm conc., or 0.5 g/lirte commercial product) at 40 days of crop age and consecutive spray of same dose at 10-12 days after first spray effectively controlled the *Cuscut*a in jute but at 40 DAS yellwing of jute leave were observed as toxicity of ethoxoysulfuron at 60 g/ha doses. At later stage of crop growth (50-60 DAS) of jute crop the higher dose of ethoxysulfuron 15 WG 0.15 g/litre, *i.e.* 150 ppm conc. (1.0 g/lirte commercial product) and second spray of same dose at 10-12 days after spray to control the *Cuscuta*

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-22

Influence of tillage, weed and nutrient management practices on crop-weed competition for nutrients in green manure – maize – pulse based conservation agriculture system

R. Thirumalaikumar*, N.S. Venkataraman, R. Babu, K. Balakrishnan and A. Rathinasamy
Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu-625 104
**Email: thiruhid@gmail.com*

Conservation Agriculture is predominantly practiced in Indo-Gangetic Plains. We don't have, appropriate management practices for conservation agriculture in semi arid conditions. While shifting from conventional tillage/agricultural practices to conservation agriculture, weed management gives a tough challenge for farmers. In maize based cropping system, nutrients uptake by crop mainly depends on the dynamics of biomass accumulation. Decreased uptake of nutrients by the crop was noticed with increase in severity and duration of weed infestation. The field experiments were conducted in Agricultural College and Research Institute Tamil Nadu Agricultural University, Madurai during 2016-2018. The experimental field is located in the Southern zone of Tamil Nadu at 110 29'N latitude and 770 08'E longitude with an altitude of 147 m above MSL. The soil of the experimental field was red sandy clay loam in texture belonging to Madukkur serious. The experiments were laid out in a split-split plot and completely randomized block design under field and pot culture experiments respectively, with replicated thrice.

The experimental results revealed that, under both experiments, minimum tillage with PE herbicide followed by one hand weeding + 75% NPK + vermicompost + bio-fertilizer significantly recorded higher WCE, NUE, productivity and increased economic return than the conventional practices in maize. Similarly in blackgram, zero tillage + crop residue mulch + 75% NPK + vermicompost + bio-fertilizer effectively suppressed the weed growth and achieved the higher WCE and NUE and maximize the economic return compared to farmers practice. From the summary and conclusion of study, it can be recommended that maize sowing in *Rabi* under minimum tillage with 30% daincha residue retention subsequently blackgram sowing in summer under conventional tillage combined with PE application of herbicide application followed by one hand weeding and 75% RDF (NPK) + vermicompost + bio-fertilizer was found to be suitable conservation practices for registering effective weed management, higher grain yield and more economic return besides improving soil physic-chemical and biological properties. However, reducing the use of inorganic nitrogen in crop production by cultivating green manure and pulse crop not only helps to suppress weed population and also reduce the cost of input and limit the emission of NO_2 (greenhouse gas) along with restoring soil health as well as combating climate change.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-23

Weed management practices effect on weed dynamics, growth and yield of different rice varieties under aerobic rice system

Sagar Dhage S* and V.K. Srivastava
Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University,Varanasi, Uttar Pradesh 221 005
**Emai: sagardhage013@gmail.com*

A field experiment was conducted during *Kharif* season of 2017 at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. This region falls in semi-arid to the sub-humid type of climate. Long-term average (over 1941 to 2004) of annual rainfall for this region amounts to 1081.5 mm, out of which 944.5 mm (87.33%) is received during the summer monsoon or rainy season (June to September) and 137.0 mm (12.67%) during the post-monsoon season or post rainy season. The soil type at the experimental site is sandy clay loam in texture with 7.3 pH, 0.44% organic carbon and 189, 26 and 204 kg/ha of available N, P and K, respectively. The experiment was laid out in a split-plot design with three replications and comprises two factors. Four weed management practices, *viz*. weed-free up to 30 DAS (W_1), weed-free up to 45 DAS (W_2), weed-free up to 60 DAS (W_3) and unweeded control (W_4) were assigned to main plot and six rice varieties, *viz*. '*DRR Dhan-44*' (V_1), '*Sahabhagidhan*' (V_2), '*DRR Dhan-41*' (V_3), '*DRR Dhan-42*' (V_4), '*DRR Dhan-46*' (V_5) and '*HUR-3022*' (V_6) were assigned in sub plots. The results indicated that, weed flora of the experiment plot comprised of fourteen weed species belonging to eight families. Sedges and grasses were the most dominant species at early growth stage of rice, but with the advancement of time, sedges and grasses were gradually replaced by broad-leaf weeds. Weed density and weed dry matter was lower in weed-free up to 60 DAS. Weedy check showed the highest weed density and weed dry matter. Among cultivars, significantly lower weed population and weed dry matter was recorded in DRR Dhan-44 and higher weed density and weed dry matter was recorded in DRR Dhan-46. Higher growth and yield attributes, grain and straw yield were observed in weed free up to 60 DAS and it was on par with Weed free up to 45 DAS. Among varieties, DRR Dhan-44 and HUR-3022 obtained higher grain and straw yield. DRR Dhan-46 obtained lower grain and straw yield. Weed free up to 60 DAS and weed free up to 45 DAS were statistically on par and weed free up to 45 DAS is effective in arresting weeds and to prevent yield losses as compared to other weed management treatments and among different varieties, DRR Dhan-44 is found most competitive and effective in minimizing weeds, weed dry weight and obtained higher grain yield, straw yield, net returns and B: C ratio.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-24

Weed management in pulses grown as relay crop in Andhra Pradesh

A.S. Rao
Acharya NG Ranga Agricutural University, Lam, Guntur- 522 034
Email:atlurisrao@gmail.com

In coastal districts of Andhra Pradesh, India cultivation of pulses in rice fallows is a unique system of cultivation, wherein, the sprouted seeds of pulses (blackgram, greengram, horsegram *etc*) are directly broadcasted in the standing rice crop 2-3 days prior to its harvest. Thus, the pulses sown in this system survives entirely on residual moisture and fertility. Among the different constraints, weed menace receives special attention as it can reduce the crop yield ranging from 31-75% depending on the severity of weed infestation. Lack of field preparation, lack of optimum plant population per unit area, excessive moisture in early stage, already established weeds at the time of rice harvest are some of the reasons for severity of weed problem. More than 25 weeds were found to infest rice-fallow pulses and among them *Echinochloa colona, Leptochloa chinensis, (*grasses*), Cyperus rotundus, C. kyllinga (*sedges*), Chrozophora rottleri, Cardiosperma helicacaba, Ocimum canum, Grangea maderaspatena, Vicia satvia* (broad-leaf weeds) and *Cuscuta chinensis* (parasitic weed) are some of the most problematic weeds and critical period of crop weed competition is up to 30 days after sowing. Weed management in rice fallow pulses either by physical or mechanical and chemical methods is very difficult compared to that in upland pulses. Hand weeding is difficult to practice because of presence of rice stubbles in addition to the problem of trampling of pulses seedlings as seeds are broadcasted in the soil surface. Inter cultivation is also not possible as the seeds are broadcasted. Therefore, chemical control of weeds is the only option. Again in chemical control also normal pre-emergence application of herbicides is also not possible as the crop already germinated / established and presence of left over weeds of rice crop by the time of removal of rice sheaves. Keeping all these in view, several experiments were conducted by the weed control unit, Lam, Guntur, Andhra Pradesh during the last two decades and results of research indicated that application of butachlor 2.0 kg/ha or pendimethalin 1.0 kg/ha by mixing with 50 kg sand/ha and apply immediately after removal of rice sheaves and water spray at 500l/ha should be followed immediately in order to create normal pre-emergence situation as the crop already germinated.

For the control of grassy weeds, post-emergence application (at 20-25 DAS) of fenoxaprop-ethyl 56 g/ha, clodinafop-propargyl 53 g/ha, quizalofop-ethyl 50 g/ha, propaquizafop-ethyl 63 g/ha, cyhalofop-butyl 100 g/ha *etc*., were found to be effective. For control of grasses and broad-leaf weeds post-emergence application of imazethapyr 50 g/ha either alone or in sequence with sand mix application of pre-emergence herbicides was found to be effective on *Cuscuta* but not legume weed *Vicia sativa*. For control of *Vicia sativa*, post-emergence application (25-30 DAS) of acifluorfen + clodinafop propargyl 0.3 kg/ha found to be very effective along with grasses and broad-leaf weeds, but was found to be ineffective against *Cuscuta.*

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-25

Comparison of new premix of mesotrione and atrazine with other herbicides for weed control in winter maize

Ramesh K. Singh and Ispita De
Department of Agronomy, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi, Uttar Pradesh 221 005
**Email: rks1660bhu@gmail.com*

In recent decades, winter maize has emerged as a high productivity cash crop due to favorable climatic conditions and relatively longer cropping window. Growing a winter crop provides maize growers an opportunity to increase and diversify their income. The shift from *Kharif* maize to winter maize had an significant impact on agricultural practices, specifically on weed dynamics in winter maize. Most weeds are different in winter maize than traditionally cultivated *Kharif* maize. The critical period do shifts from early to later stages after crop emergence. Exhausted by cultural methods, farmers are moving towards herbicide based weed management system due to labor crisis. Repeated application of same mode of action led to continued selection of herbicide resistant weeds and weed shift within crops and cropping systems poses serious threat to herbicides depend weed management. Weeds have developed resistant to most commonly used maize herbicide triazine compounds. Herbicide rotation with new herbicide mode of actions have proved effective in preventing the selection for resistant biotypes. As, the new chemistries of herbicides are limited by cost, new herbicide formulations consisting mixture of two or more mode of actions are increasingly developed and commercialized to address the challenges from continued application of same mode of action. The present investigation was conducted at the Institute of Agricultural Sciences, Banaras Hindu University in a sandy loam soil, low in organic content with neutral reaction. The objective of the present study was to evaluate and optimize the rates of a newpremix formulation of mesotrion (4-Hydroxyphenylpyruvate dioxygenase (HPPD) inhibitor and atrazine (PS-II) inhibitor herbicide was applied at 87.5+437.5, 100+500 and 112.5+562.5 g/ha as PoE in comparison to alone application of mesotrion at 100 and 125 g/ha, atrazine at 1000 g/ha, 2,4-D at 500 g/ha, topramazoe (HPPD) at 33.6 g/ha and atrazine at 1000 g/ha as PE followed by topramazone 33.6 g/ha as PoE.

The crop was infested with *Solanum nigrum, Rumex dentatus, Chenopodium album, Melilotus* sp. *Anagallis arvensis, Vicia sativa, Pathenium hysterophorus* among broad-leaf and *Cyperus rotundus, Cynodon dactylon* and *Phalaris minor* were major narrow-leaf weeds. The combination of mesotrion (4-Hydroxyphenylpyruvate dioxygenase (HPPD) inhibitor+ atrazine was more effective than individual application of component herbicide in mixture at each rate reaching maximum at 112.5+562.5 g/ha. Sequential application of atrazine (PE) at 1000 g/ha *fb* topramazone 33.3 g/ha (PoE) was most effective in minimizing densities and dry matter accumulation by weeds at 45 DAS and resulted in > 95% weed control efficiency of herbicide. Maximum yield attributes grain and straw yield of maizewas also recorded with sequential application of atrazine (PE) at 1000 g/ha followed topramazone 33.3 g/ha (PoE).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-26

Site specific weed management or precision weed management for sustainable weed management

R.K. Singh* and M. Mruthyunjaya
Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Varanasi, Uttar Pradesh 221 005
**Email: profrksinghagronomybhu@gmail.com*

Increasing economic losses in agricultural production due to abiotic and biotic factors is of utmost importance in modern day input intensive agricultural systems. Among the major biotic constraints, weeds are considered as the most harmful to agricultural production besides aûecting agro biodiversity and natural water bodies. They also affect the crop production indirectly, by competing with the crop for resources, sheltering crop pests, interfering with water management, reducing the yield and quality, and subsequently increasing the cost of cultivation. For obtaining higher yields, weed management is crucial and herbicides are the promising tools in suppressing the deleterious effect of weeds. However, input-intensive agriculture and labour scarcity led to the extensive and indiscriminate use of herbicides by the farming community; resulting in development of resistance to herbicides, increased cost of cultivation, environmental pollution and increased herbicidal residues in food. Hence, judicious use of herbicides is need of the hour. The spatial distribution of weeds within fields has received increased attention in recent years. Though most herbicides are applied uniformly in fields, there is strong evidence that weeds are not distributed uniformly within crop fields. Weeds tend to occur in clumps or patches. The fact that weeds are distributed unevenly within fields is clear to the naked eye. As a logical consequence, it has been recognized widely that there may be financial and environmental benefits from spraying only weed patches, rather than entire fields, or by adjusting application rates according to weed density. Technological advances in location systems, such as differential global positioning systems (DGPS), increase in computing power and spatial analysis techniques, artificial intelligence and machine learning (AI and ML) and the development of precision application equipment have meant that the ability to achieve 'site specific' weed management, which includes more than just patch spraying, is now a reality. Real-time weed detection/ recognition and control in agronomic field crops (*i.e.*, 'green on green') requires seamless integration and high performance of sensors, data processing, and actuation systems. Continuing technological advances in computer vision, robotics, machine learning, *etc*. are advancing this objective despite the many challenges that range from sensing weed vs. crop plants accurately (*e.g.*, grass weeds in a cereal crop) while moving at speeds of up to 25 km/h to efficiently process and analyze large amounts of generated data. The integration of site-specific information on weed distribution, weed species composition and density and the effect on crop yield is decisive for successful site-specific weed management.

The economic and environmental benefits of taking account of within-field spatial variability appear obvious although they have yet to be generally proved in field trials and experiments. Much of the technology is in place but there will be further important developments in the new decade, particularly in the area of sensing and mapping variability. It is essential that complementary research and development in agronomy, crop and soil science are successful in defining, explaining and making recommendations for variable application of herbicides at the very localized level.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-27

Comparative efficacy of herbicides for weed management in soybean

B.D. Patel*, D.D. Chaudhari, V.J. Patel, and H.K. Patel
AICRP-Weed Management, B. A. College of Agriculture Anand Agricultural University, Anand, Gujarat 388 110, India
**Email : bdpatel62@yahoo.com*

Soybean (*Glycine max* L. Merril) is the world's most important seed legume, which contributes about 25% of the global edible oil and two-thirds of the world's protein concentrate for livestock feeding. Being a slow growing crop, due to late development of canopy, weeds compete severely during initial growing stage of the crops. Also heavy infestation of weeds in the crops leads to reduce the efficiency of harvest and also reduced the yield. Hence, untimely and poor weed management adversely affects proper growth and yield of soybean. Yield losses due to weed was to the extent of 43% which indicates the necessity of timely control of weed for exploiting the potential yield of soybean. Most of the herbicides will provide an effective control of grassy or broad-leaved weeds. Application of herbicides alone or in combination with mechanical weeding found quite effective in controlling weeds and increasing the yield of soybean. Further, introduction and availability of newer molecules of post-emergence (PoE) herbicide offered options to the farmers for efficient weed management. Keeping this in view, a field experiment was conducted during two consecutive *Rabi* seasons of 2017 and 2018 at AICRP-Weed Management, B. A. College of Agriculture, Anand Agricultural University, Anand on loamy sand soil.

In general, dominancy of monocot weed (59.8%) was observed during both the years of experimental period. Major weeds observed in the experimental field were *Eleusine indica* (29.4%), *Digitaria sanguinalis* (10.6%), *Commelina benghalensis* (7.94%) and *Dactyloctenium aegyptium* (11.2%) in monocot weeds category whereas, *Odlelandia umbellate* (19.8%), *Digera arvensis* (6.61%), *Phyllanthus niruri* (2.65%) and *Trianthema monogyna* (1.85%) in dicot weed category. Results indicated that IC *fb* HW at 20 and 40 DAS followed by imazethapyr 100 g/ha PoE *fb* IC+HW at 30 DAS, pendimethalin 750 g/ha PE *fb* IC+HW at 30 DAS, quizalofop-ethyl 50 g/ha PoE *fb* IC+HW at 30 DAS, pendimethalin + imazethapyr 960 g/ha PE (PM) *fb* HW at 30 DAS, clomazone 1000 g/ha PE *fb* IC+ HW at 30 DAS and diclosulam 25.2 g/ha PE *fb* IC+HW at 30 DAS recorded significantly lower density and dry weight of weeds and also recorded more than 94% of weed control efficiency at harvest and also found superior in respect of recording significantly higher growth, yield attributes and yield of soybean.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-28

Control of mixed weed flora in rainfed lowland rice with new post-emergence herbicides

G. Gangireddy, D. Subramanyam*, S. Hemalatha, B. Ramana Murthy and G.Karuna Sagar
Department of Agronomy, S.V. Agricultural College, Tirupati-517 502
Acharya N G Ranga Agricultural University, Andhra Pradesh
**Email: subbuagro37@gmail.com*

Rice (*Oryza sativa* L.) is the most important cereal crop of the world, by contributing staple diet of 70% of world's population. Due to increasing scarcity of the water, escalating labour costs and non-availability of labour timely, direct seeding of rice seems to be the only viable alternative to transplanted rice. Uncontrolled weed growth in direct-seeded rice reduced the grain yield by 75.8% compared to best weed management practices (Singh *et al*. 2005). Pre-emergence application of pendimethalin 1 kg/ha not sufficient to obtain broad-spectrum weed control due to diversified and high intensity of weed flora in rainfed lowland rice. Post-emergence application of bispyribac-sodium 25 g/ha is not effective in controlling perennial sedge. There is a need to evaluate new post-emergence herbicides for broad-spectrum weed control including *Cyperus rotundus* in rainfed low land rice. Therefore, the present experiment was conducted during *Kharif* 2018 at S.V. Agricultural College Farm, Acharya N. G. Ranga Agricultural University, Tirupati, Andhra Pradesh, India in randomized block design with twelve weed management practices consisted of sequential application of oxadiargyl, pendimethalin and pretilachlor each at 100, 1000 and 750 g/ha, respectively as pre-emergence followed by new post-emergence herbicides, *viz*. penoxsulam + cyhalofop-p-butyl, florpyrauxifen-benzyl and halosulfuron-methyl each 130, 25 and 67.5 g/ha, respectively along with standard checks. The soil was sandy clay loam with low in organic carbon, slightly alkaline in reaction, low available nitrogen and medium in available phosphorus and available potassium. Rice variety '*MTU-1010*' was sown on 13 August 2018 at 20 x 10 cm. The crop was raised as per the package of practices of Acharya N G Ranga Agricultural University for rainfed lowland rice.

The major weed flora associated with rainfed lowland rice was *Cyperus rotundus* L. (55%), *Digitaria sanguinalis* L. Scop. (12%) and *Commelina benghalensis* L. (7%) and other weeds (26%). All the pre- and post-emergence herbicides did not show any phytotoxicity symptoms on rice crop. Pre-emergence application of pendimethalin 1000 g/ha *fb* florpyrauxifen-benzyl 25 g/ha recorded significantly lower density and dry weight of total weeds, which was comparable with pre-emergence application of pendimethalin 1000 g/ha *fb* halosulfuron-methyl 67.5 g/ha. Post-emergence application of halosulfuron-methyl 67.5 g/ha was effective against predominant sedge, *Cyperus rotundus*. The highest stature of yield components, grain yield and higher benefit-cost ratio were obtained with pre-emergence application of pendimethalin 1000 g/ha *fb* florpyrauxifen-benzyl 25 g/ha or halosulfuron-methyl 67.5 g/ha. The reduction in grain and straw yield due to heavy weed infestation in unweeded check plots was 73.87 and 66.11%, respectively compared to the best weed management practice. All the pre-and post-emergence herbicides applied to rainfed lowland rice did not show any inhibitory effect on growth and development of succeeding greengram. In conclusion, pre-emergence application of pendimethalin 1000 g/ha *fb* florpyrauxifen-benzyl 25 g/ha or halosulfuron-methyl 67.5 g/ha found to be effective for obtaining broad-spectrum weed control, higher grain yield and benefit-cost ratio in sandy lam soils. Post-emergence application of halosulfuron-methyl 67.5 g/ha was more effective in reducing the density and dry weight of *Cyperus rotundus*.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-29

Effect of pre-mixed herbicide RIL-066/F1 (48%EC) in controlling complex weed flora in wheat

Tej Pratap*, V. Pratap Singh, S.P. Singh and Vishal. V. Singh
Department of Agronomy: College of Agriculture, G.B. Pant University of Agriculture and Technology Pantnagar, Uttarakhand 263145
**Email: drtpsingh2010@gmail.com*

Wheat is second most important food grain crop next to rice in India in terms of area and production. In India, during 2017-18 the area, production and productivity of wheat was 30.4 mha, 97.11 mt and 3216 kg/ha respectively . As a result of ever increasing population, India will need 109 m tonnes of wheat during the year 2020 AD, which can be achieved by increasing its productivity 4.29 t/ha and annual growth rate of 4.1%. It has been found that weeds account for about one third of total losses caused by various biotic stresses. Weeds cause yield reduction to the tune of 15 to 50% or sometime more depending upon the weed density and dynamics. .Herbicides are the most accepted control measure to suppress the weeds but need to check the adverse effect on environment not only in the main crop but their effects on follow up crop. Thus, use of new and comparatively safe herbicides is one of the options left with the farmers to eliminate crop weed competition at early growth stages of crop. Among popular selective herbicides, pre-mixture herbicide RIL-066/F1 (48% EC) in wheat field has the potentiality to keep the weed below the economic threshold level. The experiment was conducted at G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand in RBD with thirteen treatments and replicated thrice during *Rabi* season of 2015-2016 and 2016-2017 to evaluate the efficacy of pre-mixed herbicide RIL-066/F1 (48% EC) against major weeds in wheat crop and phytotoxicity on the wheat crop. All the herbicides were applied as pre -emergence using 500 liters of water/ha with the help of knap-sack sprayer fitted with flat fan nozzle.

The most dominant weeds infested the weedy plots were *Phalaris minor* as grass, *Medicago denticulata, Melilotus alba, Malwa neglecta, Polygonum plebejum., Chenopodium album, Coronopus didymus, Fumeria parviflora* and *Gnaphalium polycephalum* among the broad-leaved weeds. Results revealed that pre-mixed herbicide RIL-066/F1 (48% EC) at 1200 g/ha was found to be the superior amongst all the herbicidal treatments with respect to lowest weed density and dry weight. All the grassy and broad-leaf weeds were completely controlled at all the growth stages except *Medicago denticulata* at 30, 45 DAS and at harvest. Pedimethalin (30% EC) applied at 1260 and 1500 g/ha were completely eliminated *Coronopus didymus,* and found most effective against *Chenopodium album, Melilotus indica* and *Fumeria parviflora.* The maximum weed control efficiency was recorded with pre-mixed herbicide RIL-066/F1 (48% EC) at 1200 g/ha and showed best control over both grassy and BLWs followed by its lower dose 960 g/ha and pendimethalin (30% EC) at 1260 and 1500 g/ha in comparison to twice hand weeding. In species wise higher weed control efficiency was also recorded with pre-mixed herbicide RIL-066/F1 (48% EC) at 1200 g/ha. Among the herbicidal treatments, maximum number of effective tillers, grain/tiller, grain and straw yield were also obtained with herbicide RIL-066/F1 (48% EC) applied at 1200 g/ha. This herbicide had not showed any phytotoxicity effect on wheat crop.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-30

Weed management in maize with new herbicide molecules for higher productivity

M.T.Sanjay* , T.K.Prabhakara Setty, Veeresh Hatti[1] and N.Raghavendra[2]
AICRP on IFS,UAS, Bengaluru, UAS, Bengaluru,
[1]SDAU, Sardarkrushinagar, Gujarat, [2]Dept. of Agronomy, UAS, Raichur
**Email: mt.sanjay@gmail.com*

Experiments were conducted at University of Agricultural Sciences, Hebbal, Bengaluru, Karnataka during 2016-17 and 2017-18 to observe the efficacy of new herbicide molecules against sedges, broad-leaf and narrow leaf weeds in maize crop, its phytotoxicity and effect on succeeding crop. The herbicide's application was done as pre-emergence (atrazine 50% WP at 625 g/ha, halosulfuron-methyl 75% WG at 67.5 g/ha and two doses of halosulfuron-methyl 5% + atrazine 48% WG at 43.75+420 g/ha, 56.25+540 g/ha) and post-emergence (halosulfuron-methyl 75% WGat 67.5 g/ha, tembotrione 34.4% SC 120 g ai/ha + adjuvant, topramezone 33.6% SC 33.60 g/ha + MSO adjuvant, atrazine 50% WP at 625 g/ha and two doses of halosulfuron-methyl 5% + atrazine 48% WG at 43.75 + 420 g/ha, 56.25+540 g/ha) in comparison to two hand weedings at 20 and 40 DAS and unweeded check. Other package of practices for cultivation were done as per University of Agricultural Sciences, Bengaluru recommendation.

Major weed flora observed in experimental field were *Cyperus rotundus*, amongst sedge; *Cynodon dactylon*, *Dactyloctanium aegyptium*, *Digitaria marginata*, *Eleusine indica* and *Echinochloa colona* among narrow-leaf weeds and *Borreria articularis, Commelina benghalensis, Alternanthera sessilis, Acanthospermum hispidium, Euphorbia hirta, Amaranthus viridis, Spilanthes acmella*, among broad-leaf weeds, were recorded in experimental field. Halosulfuron 75% WG 67.50 g/ha and halosulfuron-methyl 5% + atrazine 48% WG56.25 + 540 g/ha, applied as pre-emergence and post-emergence recorded significantly less *Cyperus rotundus* (90.58% to 91.88%) after 45 days of sowing in comparison to remaining treatments except two hand weeding (97.38%). Two hand weedings, halosulfuron-methyl 5% + atrazine 48% WG 56.25 + 540 g/ha, atrazine 50% WP 625 g/ha, applied as pre-emergence and post-emergence, recorded significantly less weed population of *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Digitaria marginata*, *Eleusine indica* and *Echinochloa colona* at 45 days after sowing. *Dactyloctanium aegyptium* with 85.09 to 92.98% weed control compared to all other treatments except topramezone 33.6% SC + MSO adjuvant 33.60 g/ha and tembotrione 34.4% SC + adjuvant 120 g/ha as post-emergence. Two hand weedings, halosulfuron-methyl 5% + atrazine 48% WG 56.25 + 540 g/ha, atrazine 50% WP 625 g/ha, both applied as pre-emergence and post-emergence, recorded significantly less weed population of *Borreria articularis, Commelina benghalensis, Alternanthera sessilis, Acanthospermum hispidium, Euphorbia hirta, Amaranthus viridis, Spilanthes acmella* in comparison to remaining treatments, recording 76.04 - 86.46% weed control at 45 days after sowing except tembotrione 34.4% SC + adjuvant 120 g/ha and topramezone 33.6% SC + MSO adjuvant 33.60 g/ha as post-emergence. Among herbicidal treatments, halosulfuron-methyl 5% + atrazine 48% WG 56.25 g + 540 g/ha (1125 g formulation/ha) applied either as pre-emergence or post-emergence recorded significantly less sedges, narrow-leaf and broad-leaf weeds and also significantly more maize kernel yield (5277 and 5182 kg/ha, respectively). Blackgram has been taken as follow up crop after maize and the herbicidal treatments applied in maize crop did not show any phytotoxicity to blackgram.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-31

Effect of herbicides and tillage on weed flora in wheat under alluvial zone of West Bengal

Dhiman Mukherjee and Bikash Mandal

Department of Agronomy, Directorate of Research, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal -741 235

Email: dhiman_mukherjee@yahoo.co.in

The irrigated wheat (*Triticum aestivum* L.) is infested with several broad-leaved weeds which create competitive stress resulting in yield losses varying from 10-70% depending upon their density. Therefore, proper management of weeds is essential to get its higher yield. Several herbicides have been found effective and among them isoproturon is being used for last two decades for controlling weeds especially grasses in wheat, although it has not been found excellent against all broad-leaved weeds. The broad-leaved weeds can; however, be controlled effectively with the application of 2,4-D. Continuous and improper use of these herbicides resulted in shifting of weed flora in terms of herbicide resistant weed biotypes. Alluvial region of West Bengal has a characteristic feature of moderate rainfall and micronutrient deficiency in soil leading to aggressive growth of weeds especially broad-leaved during crop season. High weed pressure of broad-leaved weed during winter season becomes a constraint in crop cultivation. An experiment was conducted with an objective to study the effect of herbicide on weed flora in wheat grown under different tillage systems. The field experiment was conducted at District Seed Farm (AB Block), Kalyani under Bidhan Chandra Krishi Viswavidyalaya during winter season of 2016-17 and 2017-18 in upland situation. The farm is situated at approximately 22° 56´ N latitude and 88° 32´ E longitude with an average altitude of 9.75 m above mean sea level (MSL). The soil of the experimental field was loamy in texture and almost neutral in reaction having pH 7.1, organic carbon 0.47%, available nitrogen 231.6 kg, available phosphorus 21.7 kg and available potassium 256.9 kg/ha. The experiment was carried out in a randomized block design, replicated thrice with ten treatment mainly comprising with zero tillage + weedy, zero tillage + metsulfuron-methyl 4g/ha, zero tillage + metsulfuron-methyl 4 g/ha *fb* 2,4-D 0.75 kg/ha, zero tillage + metsulfuroan-methyl 4 g/ha *fb* carfentrazone 20 g/ha, conventional tillage + weedy, conventional tillage + metsulfuroan-methyl 4 g/ha, conventional tillage + metsulfuron-methyl 4 g/ha *fb* 2,4-D 0.75 kg/ha, conventional tillage + metsulfuroan-methyl 4 g/ha *fb* carfentrazone 20 g/ha, zero tillage + weed free, conventional tillage + weed free were replicated four times in randomized block design. Wheat variety "HD 2967" was used in the experiment. The crop was sown in row of 20 cm apart on 10 November in 1st year and 15 November in 2nd year. The crop was fertilized with 150 kg nitrogen/ha, 60 kg phosphorus/ha and 40 kg potassium/ha. The weedy field was dominated by naturally occurring highly aggressive broad-leaved weeds along with few grasses and sedges mainly, *Chenopodium album*, *Vicia hirsuta*, *Rumex spinosus*, *Melilotus alba*, *Oldenlandia diffusa*, *Spilanthes paniculata*, *Eleusine indica* and *Cyperus difformis*. Among the herbicidal treatments, metsulfuroan-methyl 4 g/ha *fb* carfentrazone 20 g/ha, has recorded highest value of grain yield (39.1), which was statistically at par with complete weed free situation (4.10 t/ha) in conventional tillage. These treatments gave higher growth and yield attributes along with higher yield indicating better resource utilization in good weed control measures. Under zero tillage, herbicidal treatment of metsulfuron 4 g/ha *fb* 2,4-D 0.75 kg/ha was found effective in controlling weeds; however, yield was significantly lower than metsulfuroan-methyl 4 g/ha *fb* carfentrazone 20 g/ha under conventional treated plots.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-32

ParadigmTM- A new post-emergence broad-leaf herbicide for wheat growers in India

Vinod Singh Mehra*, Sunil Kumar, Mayank Yadav
Corteva AgriScience Pvt Ltd, The V IT Park, 12th Floor, The Atria, Plot # 17, Software Units Layout, Madhapur, Hyderabad 500081
**vinod.mehra@corteva.com*

Wheat is one of the most important cereal crops of the world and is a staple among the food crops. India is the second largest wheat-producing country in the world. Weeds in wheat are one of the most limiting factors for realising its full genetic yield potential and account for about one third of total losses caused by all the pests. Labour shortage and increased wages discourage growers to properly hand weed. Herbicides will continue to be the preferred alternative in the foreseeable future. In India, herbicides are used on 10% of the wheat area to control grassy weeds and on 20-25% of the area to control broad-leaf weeds. Excessive use of similar mode of action herbicides have resulted in widespread herbicide resistance in the grassy weed *Phalaris minor*. Resistance in broad-leaved weeds is also emerging and may become a serious issue if the market continues to rely upon similar chemistries. Thus, there is need to have alternate, novel mode of action herbicides both for grassy and broad-leaf weeds (BLW). ParadigmTM herbicide, a new post-emergence, broad-leaf weed (BLW) wheat herbicide is a pre-mix of two active ingredients -ArylexTM active and florasulam. ArylexTM (halauxifen-methyl) is a new class of synthetic auxin chemistry within the HRAC Group O category and has excellent activity on important BLWs in wheat. When compared to synthetic auxins, it has unique binding affinity to different auxin chemotypes. Florasulam is a selective triazolopyrimidine sulfonanilide post-emergent herbicide (ALS inhibitor). ParadigmTM herbicide tank mixed with surfactant was evaluated in 10 field experiments across Punjab, Haryana, UP, Uttarakhand and MP states in India during *Rabi* seasons of 2017-18. Experimental plots were designed randomly with three replications with an objective to evaluate the bio-efficacy of paradigmTM for weed control. The product was compared to the competitive standards metsulfuron-methyl 20% WG, carfentrazone 40% DF, metsulfuron-methyl 10% + carfentrazone 40% DF and untreated (hand weeding). Treatments were applied with a spray volume of 375 L/ha at 2-4 leaf stage of weeds (10-15 days after 1st irrigation) using a knap-sack sprayer fitted with flood jet nozzles.

Evaluated weed species included *Anagallis arvensis, Melilotus* spp., *Medicago* spp., *Solanum nigrum, Chenopodium album, Convolvulus* spp., *Coronopus* spp., *Fumaria* spp., *Lathyrus aphaca, Vicia sativa* and *Malva* spp. ParadigmTM resulted in enhanced weed biomass reduction compared to competitive standards 85-95% for Paradigm vs 60-90% for competitive standards. ParadigmTM provided wider spectrum of BLW control and superior crop safety compared to other herbicide treatments.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-33

Management of broomrape (*Orobanche* sp.) in tobacco through innovative integrated management strategies

T. Kiran Kumar*, S. Kasturi Krishna and D. Damodar Reddy
ICAR-Central Tobacco Research Institute, Rajahmundry 533 105, India
Email: kiranagro1@gmail.com

Broomrape is a root-holo parasitic angiosperm lacking root system and photosynthetic competence and obtains their nutritional resources by feeding on other plants using the haustorium mainly in the families of Asteraceae, Brassicaceae, Apiaceae, Fabaceae, or Solanaceae. Tobacco is one of the most important commercial crops in India which is cultivated in 0.47 million ha with an annual production of 800 million kg. In India, broomrape has emerged as serious biotic stress with devastating effect on tobacco crop and cause the yield loss of more than 75% through reduction in growth, yield and quality. Out of five broomrape species, two species namely *O. ramosa* and *O. cermua* are commonly parasitize tobacco. In the recent past, the *Orobanche* infestation has become wide spread threatening sustainable production of tobacco of all types, particularly flue-cured-Virginia tobacco (FCV) grown on contrasting soils both rainfed and irrigated conditions in India. Tobacco plants infected by this parasite show symptoms of paleness, wilting and necrosis of leaves and thus result in loss of leaf yield and quality to a variable degree depending upon the time and severity of infestation. The fact that *Orobanche* (parasite) infection is a complex process taking place in soil root zone and the damage to tobacco (host) occurs prior to diagnosis of infection makes it difficult to develop effective control measures. Over the decades, a great deal of research on *Orobanche* in many crops including tobacco yielded vast scientific knowledge on myriad aspects of parasite's lifecycle covering seed phase, parasitic phase and emergence and reproductive phase. Based on the understanding of points of weaknesses/vulne*Rabi*lity in parasite's life cycle, several control/management strategies were developed to minimize crop yield and quality. Though control measures are site and crop specific, they commonly include physical (soil tillage, solarisation, irrigation, weeding *etc*.), chemical (use of germination stimulants, herbicides *etc*.) and biological (cropping systems, trap crops, biocontrol agents, resistant/tolerant varieties) methods. Despite the fact that, several strategies for the control of these parasitic weeds have been considered, however none of the single control method could provide fool-proof protection against *Orobanche* under variable environmental conditions. It, therefore, becomes imperative to prefer an integrated approach combining various methods for control of broomrape menace in tobacco with an aim to reducing seed bank, infection to host and reproduction. The following are some of the approaches *viz*.

- Deep ploughing in summer months to expose seed to sun and soil solarisation during off season and cropping time.
- Suicidal germination by application of synthetic compounds to the soil and other germination stimulants.
- In highly infested tobacco fields, suicidal germination of orobanche by growing false hosts or trap crops like sesamum, jowar, blackgram, greengram *etc*.
- Minimizing the spread of *Orobanche* infestation through seed by following clean cultivation practices
- Addition of fully decomposed farm yard manure to the tobacco fields to reduce the infestation.
- Application of 80 to 100 kg of quality neem cake per acre (2-2.5 q/ha) in the main field or during fertilizer application in irrigated conditions.
- Creating anaerobic conditions by applying water before flowering would decompose the *Orobanche*.
- Physical removal of orobanche before flowering is essential even at very low level of infestation and community based approach will give better results.

Future research on the critical elements of long-term integrated strategy for *Orobanche* should focus on: (a) Reducing seed bank in soil while avoiding fresh additions (suicidal germination by use of germination stimulants and false hosts *etc*.) (b) Identification of resistance sources in wild and related species and their introgression into cultivated crops (c) Community approach to implement integrated strategies for effective control of broomrape.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-34

Impact of different weed management practices on growth and fibre yield of mesta

M. Raju*

Agronomy, Tamil Nadu Rice Research Institute, Aduthurai-612 101, Thanjavur , Tamil Nadu

**Email: rajumarimuthu1976@gmail.com*

Mesta (*Hisbiscus cannabinus L.)* is herbaceous annual plant and popularly called kenaf. It is an important commercial fibre crop after cotton and jute. A uniform and optimum plant stand can exhibit its maximum yield potential only if it is properly nourished and managed thereafter. An effective weed management practice is necessary for higher crop production and better economic returns. Conventional manual weeding in raw jute involves around 40% of the total cost of cultivation and fibre yield reduction is up to 70% under unweeded situation. Most effective and economic cultural practices for weed control in mesta crop are not clearly known to our farmers till date. In Tamil Nadu, mesta is grown mostly under intercrop situation and utilized for both fibre as well as vegetables. Severe weed menace is noticed under this situation which is controlled by hoeing (hand weeding) and weeding and thinning operations involve about 50% or more of the labour cost. Field experiment was conducted at Tamil Nadu Rice Research Institute, Aduthurai, Thanjavur during *Kharif* season 2018. The experiment was laid out in RBD with three replications. The treatments comprises of pretilachlor 900 g/ha at 45-48 hrs of sowing with irrigation + hand weeding (15 DAE), quizalofop-ethyl 10%38 g/ha at 15 DAE + hand weeding (30 DAE), quizalofop-ethyl 5 EC 60 g + ethoxysulfuron 100 g/ha at 15 DAE, quizalofop-ethyl 5 EC 60 g + ethoxysulfuron 50 g/ha at 15 DAE + hand weeding (30 DAE), propaquizafop 10 EC 90 g/ha at 15 DAE + hand weeding (30 DAE) (T5), pedimethalin 35% EC 525 g/ha on 3 DAS + hand weeding (15 DAE), Nail weeder at 5 DAE + quizalofop-ethyl 5 EC 60 g at 25 DAE ,unweeded check and two hand weeding at 15-20 DAE and 35-40 DAE. The crop was maintained by adopting the recommended package of practices. Need based plant protection measures were taken up during crop growth period.The data on weed parameters and plant height, basal diameter and fibre yield were recorded periodically and the data was analysed as per the standard statistical procedures.

The results revealed that application of pretilachlor 50% EC 900 ml/ha at 45-48 hours of sowing with irrigation + one hand weeding (15 DAE) controlled the weed menace than other treatments and recorded higher fibre yield of 2.20 t/ha. The major weeds The predominant weeds noticed such as *Trianthema portulancastrum, Cyperus irria, Cynodon dactylon, Amaranthus viridis, Parthenium hysterophorus, Echinochloa colona, Digeria arvensis* and *Corchorus sp*under experimental field.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-35

Evaluation of herbicide application techniques for low-dose-high-potency herbicide molecules in maize crop

C.R. Chethan,* R.P. Dubey, Subhash Chander, Dibakar Ghosh and V.K. Choudhary
ICAR – Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: chethan704@gmail.com*

Chemical weed management is one of the most efficient weed management practice followed in crop cultivation. It has been widely practiced by the farmers' because of its economics and higher efficiency to control the weeds compared to other weed controlling methods. The efficient and effective weed control under chemical weed management is totally dependent on the efficacy of the herbicide application techniques. Further, the usage trend of higher dose herbicide molecules is shifting towards the low-dose-high-potency (LDHP) herbicide molecules. The existing spraying techniques are developed to suit the large spray volume with high dose herbicide molecules, whereas there suitability to LDHP herbicide molecules is unknown. Therefore, it necessitates to evaluate the existing herbicide application techniques and to standardize the operational parameters. A field experiment was conducted during *Kharif* season of 2018 and 2019 maize crop to evaluate the existing herbicide application techniques. The tembotrione + atrazine (120+500 g/ha) was selected for maize crop as post-emergence (PoE) herbicide along with flat fan and floodjet nozzle types, 250 and 500 L/ha of spray volumes and weed management practices as herbicide followed by one hand weeding at 45 DAS, herbicide alone and weedy check to evaluate the herbicide application technique. A solar powered manual knap-sack sprayer was used to apply the herbicide. Very good weed control was observed in herbicide application followed by one hand weeding at 45 DAS treatment plots compared to other treatments. A highest weed control efficiency of 83.1% and highest cob yield of 13.6 t/ha was obtained in tembotrione + atrazine followed by one hand weeding and lowest cob yield of 9.2 t/ha was observed in weedy check. The different weed management practices significantly affected the crop growth, weed control and cob yield. The weed control index was more or less similar and no significant difference was observed among different nozzles and spray volumes. Therefore, based on obtained results from the experiment, the spraying volume can be reduced from 500 L/ha to 250 L/ha and either flat fan or floodjet can be used for effective weed control. Based on the obtained results in maize crop, the same experiment with respective herbicide for the crop may also be conducted in other crops to standardize the herbicide application techniques.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-36

Yield attributes, yield and economics of blackgram under different weed management practices

Kartik Sharma*, S.S. Punia[1] and A.K. Mehta[1]
Department of Agronomy, Punjab Agricultural University, Ludhiana-141004, Punjab
[1]Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004, Haryana
**Email: skartik150@gmail.com*

A field experiment was conducted at Research farm of Department of Agronomy, CCSHAU, Hisar during summer and *Kharif* 2017 to study the weed flora, yield attributes, yield and economics of blackgram crop. The experiment consisted of fourteen weed control treatments, arranged in randomized block design comprising imazethapyr (70 g/ha as PPI, 70 and 80 g/ha as PE and at 3-4 leaf stage), imazethapyr + imazamox (70 and 80 g/ha as PE and at 3-4 leaf stage), PE pendimethalin at 1000 g/ha, PE imazethapyr + pendimethalin at 1000 g/ha including weedy check, two hoeings (employed at 20 and 40 DAS) and weed free plots. Blackgram variety '*UH-1*' was sown in rows 30 cm apart with seed rate of 15 kg/ha.

Major weeds infested the experimental field were comprised of *Dactyloctenium aegyptium, Trianthema portulacastrum, Cyperus rotundus* and *Digera arvensis*. At 30 DAS, *D. aegyptium* and *T. portulacastrum* were the dominated weeds with relative density of 37% and 34% respectively but at 60 DAS, *C. rotundus* and *T. portulacastrum* were the dominated weeds with relative density of 37% and 30% respectively. Results of the experiment revealed that among the herbicidal treatments, PE application of imazethapyr + pendimethalin at 1000 g/ha produced higher dry weight (19.0 g/plant), number of branches per plant (14.7) at harvesting stage and higher number of pods per plant (35.0) and number of seeds per pod (4.41), seed yield (878 kg/ha), straw yield (2797 kg/ha) and biological yield (3675 kg/ha). Regarding economics, PRE application of imazethapyr + pendimethalin at 1000 g/ha provided higher net returns (Rs/ha 31,649) and benefit cost ratio (2.71), followed by PPI imazethapyr at 70 g/ha (Rs. 28655/ha and 2.64). No significant residual effect of different weed control treatments was observed on succeeding pearl millet crop as the yield attributes like number of plants/m.r.l. at 20 DAS, plant height, number of leaves/plant and fodder yield at 45 DAS did not differ between various weed control treatments. Three flood irrigations applied to blackgram crop and occurrence of 341 mm of rainfall between time of application of herbicides and sowing of pearl millet crop may be one of the possible reasons for rapid microbial degradation.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-37

Response of weeds and potato to various weed management tactics

Madhumita Patra, Bishnupriya Patra*, Satyananda Jena and Stuti Debapriya Behera
Odisha University of Agriculture and Technology, Bhubaneswar, Odisha 751 003
**Email: bishnupriya11patra@gmail.com*

Differences in plant community composition and growth rate attributed to abiotic field characteristics, crop type, localized factors, and farm implement traffic. Herbicides and various other controlled methods are known to influence weed community structure ultimately crop growth with their interaction. A field experiment was conducted during *Rabi* 2018-19 at the Agronomy Main Research Farm, OUAT, Bhubaneswar to study the effect of weed management in potato. The experiment was laid out in a randomized block design with a total of nine treatments replicated thrice comprising white plastic mulch, black plastic mulch, straw mulching at 5 DAS, one hand weeding at 20 DAS + Straw mulching at 25 DAS, hand weeding twice at 20 and 40 DAS, metribuzin 0.75 kg/ha as pre-emergence, 50% recommended fertilizer N+50% N organic source + metribuzin 0.75 kg/ha as pre-emergence + one hand weeding at 40 DAS, weed free and weedy check. The test variety "*Kufri Jyoti*" was sown on 23.11.2018 and harvested on 11.02.2019. The soil was slightly acidic in reaction (pH-5.2) and sandy loam in texture with low in organic carbon (0.42%) with low available nitrogen (196.94 kg/ha) and medium in available phosphorus (32.86 kg/ha) and medium in potassium status (138.9 kg/ha). The results revealed that uncontrolled weed growth recorded 68% yield loss in potato. The predominant grass, sedge and broad-leaved weeds found in the experimental field were *Digitaria ciliaris, Cyperus iria* and *Commelina benghalensis* respectively. Maximum dry matter of broad- and narrow-leaf weeds was recorded in weedy check. Among the weed management practices, application of 50% recommended fertilizer N+50% N through organic source + metribuzin 0.75 kg/ha as pre-emergence + one hand weeding at 40 DAS (T7) demonstrated a very effective mortality of broad-leaved weeds resulting in decline in dry matter accumulation of weeds. Application of 50% recommended fertilizer N +50% N organic source + metribuzin 0.75 kg/ha as pre-emergence + one hand weeding at 40 DAP recorded the leaf area index (3.15) at 60 DAP, crop growth rate (9.87 g/m^2/day), dry weight of plant (58.98 g/plant). Interference between crops and weed decreased the dry matter accumulation, CGR and LAI as compared to weed free treatments. The largest tuber yield of 23.57 t/ha was observed in the treatment involving one hand weeding, metribuzin application and N supply from both organic and inorganic sources, which was significantly higher by 17.15% than weed free check too. It is observed that herbicide susceptibility of different weed species was also influenced by N level as well as difference in herbicide efficacy due to herbicide –other methods combinations.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-38

Phalaris minor infestation in wheat crop sown after different rice straw management technologies at farmers field

G.S. Buttar*, Raj Kumar, D.S. Bhatti, Simerjeet Kaur and Dharminder Singh
Additional Director of Extension Education, Punjab Agricultural University, Ludhiana- 141004
**Email: buttargs@pau.edu*

About 70-75% of the total rice straw produced is burned in the fields in a short window of 15-20 days which has serious environmental, human and animal health implications in addition to a substantial loss of plant nutrients (especially N and S) and organic carbon. Punjab Agricultural University, Ludhiana has developed various site- and situation-specific straw management techniques to manage rice straw left in the field after combine harvesting. It can effectively be managed within the same field by sowing wheat with Happy Seeder after harvesting of rice with combine harvester fitted with PAU-SMS. Rice straw can be incorporated with mould board plough after chopping with straw chopper or mulcher or it can be collected and removed either mechanically or manually from the harvested rice fields. *Phalaris minor* Retz. is the most pernicious and competitive weed in wheat in Punjab, causing significant yield losses in rice-wheat cropping system. Covering or mulching the soil surface using crop residues can reduce weed problems by preventing weed seed germination or by suppressing the growth of emerging weed seedlings. An extensive survey was conducted in 21 districts of Punjab during *Rabi* 2018-19 to analyse the performance of different rice straw management technologies at farmers' fields with sample size of 1322. Another sample of 586 farmers following conventional straw burning was also taken for comparison.

A total of 53.4% of respondents recorded nil infestation of *P. minor* in Happy Seeder sown fields while 25.6% and 43.9% respondents observed nil infestation of *P. minor* in fields with rice straw incorporation with harrow and mould board plough, respectively. Further, only 4.3% of respondents recorded severe infestation of *P. minor* in Happy Seeder sown fields while 10.6-15.8% respondents observed severe infestation of *P. minor* in fields with rice straw incorporation. In residue removed fields, 38% and 52.3% respondents observed nil and moderate infestation of *P. minor*. Overall, 91.6% respondents reported nil to moderate infestation of *P. minor* in rice straw managed fields while only 69.5% respondents reported nil to moderate infestation of *P. minor* in wheat fields with conventional straw burning practice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-39

Building collaborative community actions to manage established weeds and prevent the introduction of new weeds

Parmeet Singh*, S.A. Ganie, Bilal A. Pandit, R.H. Kanth, Lal Singh, B.A. Lone and Saleem Mir
Krishi Vigyan Kander Shopian, Sher-e-Kashmir University of Agriculture Sciences and Technology of Kashmir 180 009
**Email: parmeetagron@gmail.com*

Weeds don't respect boundaries. People who keep their land weed free has to spent huge time and resources. Successful long term management requires a multidisciplinary approach and collaborative coordinated action. By developing and maintaining effective partnership between land custodians whose activities impact on or influence the management of weeds. South Kashmir can prevent the introduction of new weeds and reduce the cost and impact of existing weeds. South Kashmir (including districts Shopian, Kulgam, Pulwama and Anantnag) is predominantly known for quality apple production, has vast area under apple orchards. Apple nurseries (both seedling and clonal) is also a budding entrepreneurship. However, still weed competition, not only consumes the resources, but also serves as alternate habitat for disease inoculums. Krishi Vigyan Kanderas has the potential to sensitize the sufferers and facilitate strong convergence to keep this menace at bay. A range of tools including: information, education, engagement, Research and legislation have to be combined to promote weed management responsibilities, share knowledge, build capacity. This will ensure integrated and cooperative approaches to prevent new weeds and manage existing ones. As per survey carried out in different areas of district Shopian, it has been observedthat some invasive weeds have created havoc in apple orchards and nurseries.

Main species identified are *Convolvulance arvences*, *Anthumus cotula*, *Xanthium strumarium*, *Fumaria parviflora*, *Dauscus carota etc*. Some orchardists keep hugience to prevent incidence of diseases, but due to strong proliferation in the adjoining areas, they have to spend huge resources continuously. Further in nurseries, a huge gap is kept to facilitate mechanical weed management which too is not economical. KVK Shopian carried out number of extension activities which includes acquaintance about repercussions of weed infestation, there management strategies and sustainable and cooperative practices to keep weeds under thresh hold level. Integrated weed management interventions were also disseminated to the farming community. About 20 potential weed species were identified which require immediate attention for further proliferation. Among them *Convolvulus arvesnsis*, *Renunculuous* species are prominent one. In high desity plantation where assured irrgation is required, *Anthumus cotula* is laso becoming problamatic one. Orchard grasses were also encroached with weeds having adverse effect on milch animal health and milk production. So there documentation and management also requir holistic approach for extenion site specific technologies.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-40

Assessment of functional form of yield loss models for pulse crops

Yogita Gharde*, PK Singh and Dibakar Ghosh
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: yogitagharde@gmail.com*

Yield loss models are used to estimate the parameters representing effect of weeds on yield at an early growth stage of crop development. The choice of correct model and understanding of the biological interpretation of the parameters are necessary before its inclusion for integration of the models for any other purpose e.g in decision support systems. These estimates may help policy makers and researchers to pay more attention to those weeds which cause greatest losses in the crop. Various linear, hyperbolic, and sigmoidal regression models have been proposed to predict yield loss from early infestation of weeds and these models have been validated for single and multiple weed species in many experiments. However, there is need to reassess these model for different climatic conditions and for different crops as per weed flora present. Keeping this in view, functional form of yield loss estimation models have been proposed for pulse crops such as blackgram, greengram and chickpea using data on dry weight of weeds at early stages of crops. Hyperbolic models (2 and 3 parameters) proposed by Dew (1972) and Cousens (1985) along with exponential models (2 and 3 parameters) were used for the present data along with quadratic models. Analysis was performed using Sigma Plot 14.0 software.

Quadratic model:$y=a+bx+cx2$…(1)

Exponential model (2 parameter)$y=b*(1-e-cx)$…(2)

Exponential model (3 parameter)$y=a + b*(1-e-cx)$…(3)

Hyperbola model (2 parameter)$y=b*x/(c+x)$…(4)

Hyperbola model (3 parameter)$y=a + [b*x/(c+x)]$…(5)

Data on weed density and dry weight were fitted to the data, however, it was found that data on weed dry weight defined the yield losses more accurately. In case of blackgram, maximum yield loss of about 42% was observed in the crop with different treatments. All five models were fitted to the data on weed dry weight in blackgram. Among which, Hyperbola (single rectangular, 3 parameter) model was found to be best fit to the data. In case of greengram, a positive and significant correlation was found between yield loss and weed dry weight data. Among five models, quadratic model was found best fit for the data on weed dry weight with corresponding yield loss. Two parameters of the model were found significant at 5% level of significance. Best fit models were selected based on maximum R square and adjusted R square criterion. Before fitting the model, steps for data pre-processing and model diagnostics were followed to avoid any bias or unsuitability of data for the fitting. At the same time, outliers were also detected and removed before the model fitting for better results.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-41

Quantification of yield losses due to dominant weed species in direct-seeded rice in chhattisgarh plains

Banashri Lodh* and Laxmi Yadav[1]

Institute of Agricultural Sciences, Siksha 'O' Anusandhan, University, Bhubaneswar, Odisha 751 030

[1]College of Agriculture, Indira Gandhi Krishi Vishwavidyalay, Raipur, Chhattishgarh 492 012

**Email: banashrilodh29@gmail.com*

An investigation entitled quantification of yield losses due to dominant weed species in direct-seeded rice (*Oryza sativa* L.) in Chhattisgarh plains was carried out at Instructional-cum-research farm, Indira Gandhi Krishi Vishwavidyaly. Raipur during *Kharif* 2015 (July-November). The experiment was laid in randomised block design with three replications and eleven treatments. The treatments consisted of six dominant weed species *i.e. Echinochloa colona* , *Ischaemum rugosum*, *Cyperus iria*, *Alternanthera triandra*, *Spillanthus acmella*, *Cynotis axilaris* and four groups of weed species *i.e.* only grasses, only sedges, only broad-leaved weeds, mixed weed flora and weed free treatment. Rice variety '*Rajeshwari*' was grown as test crop with row to row spacing of 20 cm. The results revealed that the growth character of direct-seeded rice, *viz*. plant height, number of tillers per meter row length, dry matter accumulation, yield attributes, *viz*. number of effective tillers per meter row length, panicle length, panicle weight, number of filled grains per panicle,test weight, seed yield (4.17 t/ha), straw yield and harvest index were the highest under the weed free treatment and this was at par with the treatment of *Ischaemum rugosum*. The lowest was recorded under the treatment of mixed weed flora. However, the highest net monetary return and lowest weed index was recorded under thetreatment of *Ischaemum rugosum*. Biology of various dominant weeds also includes the maturity time, seed production capacity per plant and test weight of 1000 weed seeds. *E. Colona* matured at 60-70 DAS produced 4044 seeds/plant and test weight was 0.78 g. *I. rugosum* matured after the crop harvest, produced 1610 seeds/plant and test weight was 4.99 g. *C. iria* matured at 80-90 DAS, produced 6553 seeds/plant and test weight was 0.13 g. similarly *A. triandra* and *S. acmella* matured after the crop harvest, produced 1790 and 5922 seeds/plant and test weight was 0.31 g and 0.11g, respectively. *C. axillaris* matured at 100-110 DAS, produced 492 seeds/ plant and test weight was 2.90 g. Among all treatments under weed free treatment obtained the higher gross return (` 66177/ha). However, higher net return (` 47,439/ha) and B: C ratio (4.17) were obtained under the treatmentof *Ischaemum rugosum* .

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-42

Weed management in agriculture using IoT frameworks

G. Surendra*, D. Subramanyam[1], K. Kannan and K. Raja[2]

Department of Computer Science Engineering, Audi Sankara College of Engineering and Technology,Gudur, Andhra Pradesh 524 101

[1]Department of Agronomy, S.V. Agricultural College, Tirupati, Andhra Pradesh 517 502

[2]Department of Computer Science Engineering. Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu 601 301

**Email: dsurendra02@gmail.com*

In India, the privation caused by weeds overshoot the losses from any other genre of agricultural pests like insects, nematodes, rodents, diseases, *etc*. The productivity of agro products cannot be increased by simply doubling the inputs like land, water, labours, seeds, chemicals *etc*. because many of them are limited and over stretched. Control of weeds is critical in agriculture. Starting late, confidants have begun to investigate various roads with respect to self-administering structures for pruning, cutting, sprinkling, harvesting and weed removal. Motorization in horticulture is still under research orchestrate as a result of the stunning idea of unstructured and functional conditions. The robot demands an independent course, condition adaption and a tremendous proportion of data getting ready. To improve the gainfulness, viability and decrease the time, cost and human intervention, there is a requirement for a new development called as Internet of Things (IoT). To modernize the agrarian activities like water the officials, soil checking, crop the board, creatures watching, weed detection *etc.* different sorts of sensors are used. The onion is a moderate developing, shallow-established harvest that can experience the ill effects of weed rivalry. This can be overwhelmed by, the framework PC vision-based mechanical weed control framework (WCF) for continuous control of weeds in onion fields. It will have the option to recognize weeds and specifically shower the perfect measure of the herbicide. The WCF is a cheap and versatile remote arrangement of handheld gear, which can be controlled remotely through an easy to use web interface. It is intended to computerize the control of weeds and along these lines decrease the troubles of ranchers in keeping up the field. This framework depends on a blend of picture handling, agricultural intelligence (AI) and web of things. A modern grouping procedure to section the leaves of carrots from the weeds. In the beginning periods of the plants' improvement, the shade of both the plants and the weeds are comparative, making it hard to separate. The framework has a refined mean for weed distinguishing proof. The significant segments of this framework are made out of three processes, picture division, include extraction and basic leadership. In the picture division process, the information pictures are handled into lower units where the important highlights are separated. In the basic leadership process, the framework utilizes the Support Vector Machine to dissect and isolate the weeds from the plants. A short time later, the discoveries are utilized to direct which plants get herbicides and which don't. Weeds contend with crops like wheat and corn for daylight, water, and supplements. This prompts lower yields. To battle these undesired plants as successfully as could reasonably be expected, herbicides are commonly applied over enormous surface territories, covering harvests and fields all the while. Bosch and BASF are along these lines cooperating to additionally create Smart Spraying innovation that utilizations camera sensor to recognize harvests and weeds. This will empower crop assurance operators to focus on the weeds and secure the earth.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-43

Threshold density of certain weeds in transplanted rice

I.C. Barua and J. Deka
Department of Agronomy, Assam Agricultural University, Jorhat, Assam 785 013
**Email: iswarbarua0101@ymail.com*

Threshold density is highly needed for effective management of weeds as well as for protection of crops from yield loss caused by weeds. It is also helpful in organic management of crops. Amongst all the possible factors, the kind of weeds associating the crops is one of the most important factors concerned to the farmers; as many of these plants possess tremendous ability of overcoming human interventions through their tricky means and grow luxuriantly within a very short period of time offering good competition for acquiring resources damaging the crop. Observing the transplanted rice of Assam for a decade or so, four weed species have been selected to determine their threshold density (TD) with an aim to use this knowledge for better weed management program. Weed density was maintained from 0 to 100/m^2 removing other associated weeds for the entire cropping period. Recommended package of practices for organic cultivation was strictly followed, and crop yield was carefully recorded. Separate experiment was conducted for each of the weed species in between 2014 to 2018 in the ICR Farm of AAU, Jorhat and results were drawn from the study for at least two consecutive years. Results recorded significant yield loss from 5% to 75% in different experiments due to competition with weeds. However, the yield loss was 7.32% to 32.51% beyond the threshold density of certain most common rice associated weed species. When these weeds were allowed to compete with rice isolately, the bushy species *Ludwigia decurrence* and *L. hyssopifolia*, their TD was found to be only two plants per square meter area. *Cyperus iria*, another obligate weed of rice has shown its TD as 70/m^2 with rice variety '*Gitesh*' and 90/m^2 with var. '*Ranjit*'. Similarly, the TD of *Echichloa crusgalli* was found to be 7 plants/m^2, which is equivalent to 65 numbers of culm/m^2 of this grassy weed. From this study, it can be recommended to the farmers that *Ludwigia decurrens* and *L. hyssopifolia* should be managed very carefully and no plant should be in the field to compete with rice. *Cyperus iria* and *Echichloa crusgalli* population should be managed to keep below 70 and 7, respectively. As the critical period of crop with competition of transplanted rice of Assam is 30-60 days after transplanting, the careful management of these weeds should be done at the early part of crop growth to keep their population below the threshold level.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-44

Endozoochory dissemination of weed and its impact on wheat productivity

Pijush Kanti Mukherjee
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
Email: pkm_agronomy@yahoo.co.in

Appraisal has been made from the year 2015 to 2019 with the objectives to assess the dissemination potential of the weeds associated with different fodder crops at the fodder farm of ICAR-IVRI, Izatnagar by following standard procedure adopted by AICRP on weed control (ICAR). The results revealed that *Trianthema* was widely distributed during summer and rainy seasons. The weed *Celosia argentea* preferred the growing condition of fodder sorghum, whereas *Coccinia grandis* was associated with fodder maize and sorghum. Among the other weeds the grasses were widely distributed, whereas the sedges were appeared in patches. Three major broad-leaved weeds *Coronopus didymus, Rumex dentatus* and *Cichorium intybus* appeared during 1st, 2nd, 3rd and 4th cutting of berseem, respectively. The grasses: *Paspalum disticum, Echinochloa colona,* broad-leaved *Trianthema* sp., *Commelina diffusa, Rumex dentatus, Amaranthus viridis, Physalis minima, Coccinia grandis, Cleome viscosa, Phylanthus niruri, Celosia argentea* had shown the character of endozoochory dissemination and were distributed widely through the use of FYM and cattle shed water for irrigation. The effectiveness of endozoochory and germination success of these weeds after passage through the animal gut was the important traits for dissemination and invasion. The experiments were conducted during the *Rabi* season of 2017 and 2018 with the objective to assess endozoochory dissemination of weeds while using cattle shed water for irrigation in late sown wheat crop (*HD 3059*). The results revealed that late harvesting of the berseem led to the development of *Rumes dentatus* up to the seeding stage. Berseem along with *Rumex* was harvested and provided to the cattle as green fodder. On an average *Rumex dentatus* produced 1,364 seeds/plant. Application of carfentrazone at 25 days after sowing (DAS) reduced the population (no./m^2) of *Rumex dentatus, Amaranthus viridis* and *Solanum nigrum* up to 63%, 70% and 64%, respectively at 35 DAS from 20 DAS. Use of cattle shed water for irrigation increased the population of *Rumex* from 35 DAS up to 17% at 50 DAS, 134% at 65 DAS and 186% at 80 DAS. Whereas, the adjacent plot irrigated with normal water recorded the declining trend of *Rumex* population from 35 DAS *i.e.* up to 15%, 32%, 50% and 59% reduction at 50 DAS, 65 DAS, 80 DAS and 100 DAS, respectively. Large infestation of *Rumex dentatus* due to use of cattle shed water containing seeds of *Rumex* reduced the wheat productivity up to 44% (2.14 t/ha), whereas the plot irrigated with normal water registered the grain yield of 3.82 t/ha. As the wheat (*HD 3059)* was grown for seed production at KVK farm of ICAR-IVRI and also curtailed seed bank contribution of *Rumex*, 45 man days with the total cost of ` 14,500 for the area of 1.5 acre was invested for uprooting *Rumex dentatus* during 80 to 90 DAS. During the 2nd year the entire field was irrigated with normal water and similarly carfentrazone was used at 25 DAS. This measure reduced the population of *Rumex* up to 73% at 35 DAS from 20 DAS. Population of *Rumex* showed declining trend up to 30%, 71%, 79% reduction at 50 DAS, 65 DAS and at 80 DAS from 30 DAS. It can be concluded that *Rumex dentatus* has the potential to disseminate through endozoochory mechanism and use of cattle shed water for irrigation may not be recommended if the berseem fodder is infested with seeds of *Rumex dentatus.*

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-45

Climate resilience weed management in *Kharif* rice in Konkan region

P.S. Bodake, S.S. Pinjari, V.A. Rajemahadik and P.S. Pol
Dr.Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Dapoli, Maharashtra 415 712
**Email: prameghash@gmail.com*

Konkan region of Maharashtra is blessed with a high rainfall during June to September. Due to heavy rains ecological conditions for shifting of weed is more dominant. Therefore, it is necessary to study the environmental information, weed biology and ecology of weeds in relation to rice and rice base cropping system and by using all available technologies to control weeds by the most economical means, while posing the least possible risk to people and environment. Mulches are used to manage weeds in crop production systems because it provides a physical barrier on the soil surface and must block nearly all light reaching the surface so that the weeds which emerge beneath the mulch do not have sufficient light to survive. Keeping this in view A field experiment was carried out during two successive years during *Kharif* seasons of 2016-17 and 2017-18 on lateritic soil at agronomy Farm, College of agriculture, Dr. BSKKV Dapoli to study of integrated weed management in *Kharif* rice under the lateritic soli of the Konkan. The experiment was laid out in spilt plot design with two main factors *i.e* green manuring green manuring *Sesbania rostrate*, without green manuring and six sub plot factors for *Kharif* rice (mulching with *G. maculata* (5 t/ha) 20 DAT, mulching with *G. maculata* (5 t/ha) 20 DAT *fb* 1 HW 40 DAT, mulching with *G. maculata* (5 t/ha) 20 DAT *fb* 1 hoeing with cono weeder 40 DAT, weed free check (2 HW at 20 and 40 DAS), oxadiargyl PE 0.1 kg/ha *fb* 2-4 D PoE 1.0 kg/ha 25 DAT weedy check) with 3 replication.

The results revealed that the effect of green manuring did not significantly influenced the weed density and weed dry matter at all growth stages except monocots weeds at 60 DAT (1.92 gm) during 2016 -17. However, yield and yield attributing characters of rice were found significantly higher with the application of green manuring with *Sesbania rostrata* during both the years. The different weed control measures treatment weed free check (2 HW at 20 and 40 DAS) recorded least weed density, weed growth, maximum number of tillers (9.03, 9.50), height (67.33, 68.30), grain (2.86 t/ha, 4.50 t/ha) and straw yield (3.56 t/ha, 5.55 t/ha) than rest of the treatments except in respect to height treatment mulching with *G. maculata* (5 t/ha) 20 DAT *fb* 1 HW 40 DAT) during both the years. The interaction effect between green manuring and weed control measures was found to be non significant during the experimentation. amongst various treatments the weed free check recorded the least weed density, weed dry matter, significantly higher growth attributes and yield than rest of the treatments. However, all the weed control measures tried reduced significantly the weed density, weed dry matter, and higher yield over weedy check and remained at par with each other.While application of green manuring did not influence weed density, weed growth, yield attributes and yield.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-46

Dambu (*Phragmites australis*): A serious ecological threat for Ladakh region in a changing climate

M.S. Raghuvanshi*, Anurag Saxena[1], Dipanker Saha[1], Enoch Spalbar[1], Ngawang Dorjay[1]
ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur, Maharastra 440 033
[1]Regional Research Station, ICAR-Central Arid Zone Research Institute, Leh-Ladakh 194 101
**Email: omsai.msr@gmail.com*

Weeds are commonly considered a threat to biodiversity, yet interactions between native and exotic species in grasslands are poorly understood. On the other hand, expansion and intensification of land use in recent decades is resulting in major changes in biodiversity, especially when invasive weedy species dominate the landforms and summarizing into the cultivated aras in a changing climate. In addition, if invasive weedy species possesses climatic resilience and pose a major threat to native biodiversity. In cold arid region, major invasive weed *Phragnmites australis* of poaceae family comprises of the most common perennial, rhizomatous, stoloniferous and tall (2.0–3.0 m) grass, recorded distributed in whole Ladakh region along the Indus belt, lakes, extending from cold temperate regions to wetlands in Ladakh region. It is locally known as Dambu has profusely seed production potential and spreads vegetatively by a vigorous system of rhizomes and stolons. During survey carried out, it was recorded that it thrives well in soils having higher pH, salinity, fertility and textures, and attains high productivity even around seabuck thorn community. It is a transitional species of two closely attached ecosystems such as aquatic and terrestrial, and commonly occurs in marshy wetlands adjoining to Indus belt. It is well-known environmentally resilient species in a changing climate. In short season like in Ladakh, it sprouts efficiently from last week of June and attains adjustments to the variations in temperature, soil nutrients and available oxygen (wetlands). It has high transpiration rate with rhizomes buried deep in the soil upto 2-5 feet; help provide protection against frost and fire. High transpiration rate growing under flood like conditions display an adaptive feature, protecting it from waterlogging. In a changing climatic conditions, it has intermediate plant growth habit of C_3–C_4 photosynthetic intermediate ecotypes evolve in dry land and C_3–C_4 intermediate ecotype in saline environment have also been reported as it also can be seen in a Spituk wetland of Leh where it is surviving under a high salinity conditions, not allowing any of the crops. Farmers are worried but used-to for utilizing it as fodder for winter security. In addition, removal of toxic heavy metals from the aquatic environment is one of the priorities of the environmentalist all over the world. It has high metal removal potential and fast growth, accumulating metal in above and below ground biomass. Dambu has recently being utilised for mitigating water pollution. It has been the most preferred research plant for pollution mitigation. Efforts have been made to carry out the study on land use and land cover by this invasive species of Leh district, showing an area of 1883.58 ha, which covers very potential and prime agricultural land of Leh region. This study revealed that in recent decades, land use continues to intensify in formerly occupied areas and expand into what were formerly natural habitats and this weed would intensify the utilizable lands of villages like Chushot, Palam, Choglamsar, Stakna, Phey, Spituk *etc*. and affect its biodiversity to a significant extent in a place where water scarcity is a major issue for cultivated lands of resource poor farming community of subsistence agriculture of Ladakh region.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-47

Effect of elevated CO_2 and temperature on soybean and associated weed species

Subhash Chander*, Deepak Pawar, C.R. Chethan, Dibakar Ghosh, Bhumesh Kumar[1] and P.K. Singh
ICAR- Directorate of Weed Research, Jabalpur, Madhya Pradesh 482004
[1]ICAR-Indian Institute of Wheat and Barley Research, Karnal, Haryana 132001
**Email: singhariya43@gmail.com*

Agriculture signifies the major share of the Indian economy and provides food and occupation to the large part of the Indian population. The degree of impact of climate change is expected more on agricultural productivity. Among the different factors of climate change increase in CO_2 and temperature may have a significant impact on plant metabolism. Changes in climate, drivers (CO_2, temperature and non-availability of water) influence not only the performance of individual organism but also can impact interactions with other species at different growth stages; hence, inter-species competition may vary. There is broad agreement that higher atmospheric CO_2 concentration stimulates photosynthesis more in C_3 than C_4 plants. However, it is not clear that how elevated CO_2 in combination with other climate change factors would affect the crop-weeds interaction/competition and what is (are) the mechanism(s) involved. Hence, the study of behavior of soybean and its two weeds *i.e. Echinochloa colona* and *Ischaemum rugosum* under climate change scenario has been studied. Soybean and two weed species were grown in Open Top Chamber (OTC) in *Kharif* 2018. The location of experimental site was 23°23'29.21" N latitude and 79°96'80.95" E longitude. The treatment effect was as of ambient CO_2 and temperature, elevated CO_2 alone (EC: 550±50), elevated temperature alone (ET: ambient + 2ºC) and combination of elevated CO_2 + elevated temperature (EC+ET). Different morphological characteristics and yield attributes were studied. Elevated CO_2 and temperature had positive effect on plant height, dry matter accumulation and seed yield of soybean. Similarly, elevated CO_2 and temperature had encouraging effect on growth of *E.colona* and *I. rugosum* as compared to the ambient condition. At ET, plant height of soybean was higher compared to the ambient but at par with EC. However, its dry weight was 29% higher in EC+ET than that of ambient condition. The growth of *E. colona* plant was comparable in EC and EC+ET, at 90 DAS. Whereas, higher growth of *I. rugosum* was noticed with EC in comparison to EC+ET. As compared to ambient condition, the seed yield of soybean was 21, 18 and 15% higher in EC+ET, EC and ET conditions, respectively. Results indicate that elevated CO_2 and temperature has positive effect on the growth of soybean and two weed species.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-48

Integrated weed management in elephant foot yam at various agro-climatic conditions of India

J. Suresh Kumar[1]*, S. Sunitha[1], M. Nedunchezhiyan[2], K. Mamatha[3], Biswajith Das[4], S. Sengupta[5], P.R Kamalkumaran[6], Surajit Mitra[7], Jayanta Tarafdar[7], K. Desai[8]

[1]ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, 695 017, Kerala, India
[2]ICAR-CTCRI, Regional Centre, Bhubaneswar, Odisha, 751 019, India
[3]Dr YSR Horticultural University, HRS, Kovvur, 534 350, West Godavai, Andhra Pradesh, India
[4]ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra, 799 210, Tripura, India
[5]Birsa Agricultural University, Kanke, Ranchi, 834 006, Jharkand, India
[6]Horticultural College and Research Institute, Tamil Nadu Agril. University,Coimbatore, 641 003, Tamil Nadu, India
[7]Bidhan Chandra KrishiViswavidyalaya, Nadia,Kalyani, 741 235, West Bengal, India
[8]Aspee College of Horticulture and Forestry, NAU, Navsari, 396 450, Gujarat, India.
**Corresponding author Email: suresh.j@icar.gov.in*

An experiment was conducted in elephant foot yam to find out an effective method of weed management. The experiment was laid out in RBD with 8 treatments and 3 replications, during 2017 and 2018 at 6 different agro climatic conditions of India including plains, hills and islands, *etc.* Among the different treatments, hand weeding three times at 30, 60, 90 days after planting recorded taller plants with more pseudo stem girth, canopy spread, leaf area, highest corm yield, gross return and net returns and which was at par with weed control ground cover mulch and glyphosate three sprays at 30, 60 and 90 DAP (days after planting). In most of the locations the predominant weed species identified in this crop were *Cyperus rotundus, Cynodon dactylon* and *Commelina benghalensis.* Lower weed population and dry biomass were recorded in treatment with weed control ground cover, which was at par with application of glyphosate at 30, 60 and 90 DAP. The weed control efficiency of different weed management methods ranged 68.95 to 86.06%.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-49

Chemical weed management in vegetable pea

B.R. Bazaya, R. Puniya, B.C Sharma, Anil Kumar, Meenakshi Gupta, Ashiyana Javed and Supneet kaur

AICRP-Weed Management, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu-180009, J&K

Email: bazaya_br@rediffmail.com

Pea is mainly grown for green pods as a fresh vegetable and is a rich source of protein, calcium, phosphorous, iron and vitamins. Being nitrogen fixing legume, this crop is useful for improving soil fertility and soil conservation. Weeds are major factor in vegetable pea for reducing the yield and quality. Wider spacing in peas provides ample opportunities for weed infestation resulting in 18-76% yield losses. Crop is mainly infested with both grassy as well as broad-leaved weeds. Hence effective weed management is pre-requisite to reduce losses caused by weeds and thereby improving productivity and profitability. Hand weeding is generally adopted by farmers in field pea for weed control but it is time consuming, cumbersome and costly. Various pre-emergence and post-emergence herbicides for controlling weeds in vegetable pea is meager especially under sub-tropical conditions of Jammu and Kashmir. Therefore, the present investigation was undertaken during the *Rabi* season of 2016-17 and 2017-18 to evaluate the effect of different herbicidal treatments on vegetable pea. The experiment was laid out in randomized block design with three replications. The herbicidal treatments consisting clodinafop-propargyl 60 g/ha and pinoxaden 50 g/ha as post-emergence, pendimethalin 1000 g/ha as pre-emergence, pendimethalin + imazethapyr 800, 1000 and 1200 g/ha as pre-emergence, imazethapyr 70 g/ha as pre-emergence, imazethapyr 60, 70 and 80 g/ha as post-emergence, imazethapyr + imazamox 60, 70 and 80 g/ha as post-emergence were compared with weedy check and weed free treatments. The pre-emergence herbicides were applied on next day of sowing and post-emergent herbicides were applied at 18-20 days after sowing.

The results revealed that the most dominant weed specie were *Vicia sativa*, *Anagallis arvensis*, *Melilotus indica* and *medicago denticulata* and *Cynodon dactylon*. Two years study showed that all the herbicidal treatments had significant effect on weed density, weed biomass and yield of vegetable pea. It was observed that imazethapyr + imazamox at 60, 70 and 80 g/ha as post-emergence showed slightly phytotoxicity effects on crop *i.e* yellowing in leaves of pea but these recover at later stages. Among the herbicidal treatments, pendimethalin + imazethapyr 1250 g/ha as pre-emergence significantly reduced the density of grassy, broad-leaved, sedges, total weed density and weed biomass resulted gave higher plant height, plant dry matter, number of pods per plant and green pod yield followed by pendimethalin + imazethapyr 1000 g/ha as pre-emergence. However, highest net returns and B:C ratio were recorded in pendimethalin + imazethapyr 1000 g/ha as pre-emergence.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-50

Integrated weed management in autumn potato

Mohammad Shafiq, Simerjeet Kaur* and M.S. Bhullar
Punjab Agricultural University, Ludhiana, Punjab 141 001
**Email: simer@pau.edu*

A field experiment on integrated weed management in autumn potato was conducted in randomized complete block design with three replications during 2016 and 2017. The major weed flora included *Cyperus rotundus* (sedges), *Coronopus didymus, Rumex dentatus, Medicago denticulata, Spergula arvensis, Anagallis arvensis* (broad-leaf weeds) and *Eleusine indica*, *Digitaria sanguinalis, Poa annua* (grasses). Weeds caused yield reduction of 49.7% and 52.6-58.0% as compared to weed free and integrated weed control treatments, respectively. Metribuzin 350 g/ha when applied as pre-emergence resulted in >99% weed control efficiency of broad-leaf weeds at 30 DAS but this control was reduced to 8.85-20.75% at harvest. On the contrary, metribuzin 350 g/ha applied as post-emergence controlled broad-leaf weeds and grasses very effectively. Clodinafop 60 g/ha as post-emergence resulted in control of grasses only. The pre-mix combination of clodinafop plus metribuzin 260 g and 325 g/ha as post-emergence resulted in significant control of weeds and more tuber yield. Post-emergence application of clodinafop plus metribuzin 260 g and 325 g/ha resulted in statistically similar tuber yield to integrated weed control treatments of PSM 6 t/ha with herbicides and weedfree. The integrated weed control treatment of PSM 6 t/ha with clodinafop plus metribuzin 195 g/ha resulted in the maximum tuber yield and the highest benefit: cost ratio with weed control efficiency of >90% at harvest.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-51

Efficacy of herbicides on weed flora, yield and weed index in ginger

K.N. Geetha*, G.N. Dhanapal, S. Kamala Bai, Prathiba and K.K. Sindhu
AICRP on Weed Management, University of Agricultural Sciences(B.), Bangalore, Karnataka 560 032
**Email: geethagowda@hotmail.com*

Ginger (*Zingiber officinale* Roscoe) is grown in tropical and subtropical regions of the world for its spice and medicinal values. The emergence and early growth of ginger is inherently slow and weed growth can impact on yield. It has slow initial growth rate and shallow root system results in emergence of a variety of weeds. An experiment was carried out to study the efficacy of some herbicides on major weed flora, yield and Weed Index in ginger. The experiment was conducted during *Kharif* 2016-17 and 2017-18 at AICRP on Weed Management, UAS, Bengaluru The experiment was laid out in a randomized complete block design having 11 treatments replicated thrice. In this experiment, the herbicide treatments, *viz.* PE herbicides (metribuzin at 0.7 kg/ha, pendimethalin at 1.0 kg/ha, oxyfluorfen at 0.20 kg/ha) were applied at 3 days after planting (DAP). Further, to get an integrated effect, PE herbicides was followed by different POE (fenoxaprop at 67 g/ha + metsulfuron at 4 g/ha, quizalofop-p-ethyl at 37.5 g/ha + metsulfuron at 4 g/ha) and also by HW twice at 45 and 75 DAP. Passing cycle weeder at 25 DAP and hand weeding at 45 and 75 DAP and one unweeded control treatment was included to have a clear picture of mechanical method of weed controland to compare with chemical treatment with integrated methods.The predominant weed flora in the experimental field were *Cyanodon dactylon, Eleusine indica, Dactyloctenium aegyptium* and the major broad-leaf weeds like *Acanthospermum hispidum, Borreria hispida, Commelina benghalensis, Alternentera sessilis, Mimosa pudica, Tridax procumbens, Spillanthus acmella, Ageratum conyzoides, Euphorbia hirta, Euphorbia geniculata, Emilia sanchifolia* and *Amaranthus viridis*.

Among various weed management treatments, effective control of weeds was noticed at 60 DAP with application of metribuzin at 0.7 kg/ha as pre-em. *fb* hand weeding at 45 and 75 DAP. It was at par with application of pendimethalin at 1.0 kg/ha *fb* hand weeding at 45 and 75 DAP, as evident from the reduced weed density and dry weight. Application of pre-emergence herbicides followed by hand weeding showed better results compared to combination of pre- and post-emergence herbicides. However, all the herbicide treatments reduced the weed density and dry weight as compared to weedy check. PE metribuzin at 0.7 kg/ha *fb* two HW at 45 and 75 DAP recorded significantly higher rhizome yield (23.3 t/ha) with B:C ratio (4.0) followed by PE pendimethalin at 1.0 kg/ha *fb* two HW at 45 and 75 DAP (22.4 t/ha) and realised higher B:C ratio (3.8) and PE oxyfluorfen at 0.20 kg/ha *fb* two HW at 45 and 75 DAP (21.9 t/ha) and these were at par with the passing cycle weeder and hand weeding at 25, 45 and 75 DAP (24.6 t/ha) B:C ratio (3.8). Unweeded control gave the lowest rhizome yield (5.7 t/ha) and B:C ratio (1.3).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-52

Herbicidal control of purple nutsedge

B.S. Gohil, R.K. Mathukia, S.K. Chhodavadia and B.K. Sagarka
Junagadh Agricultural University, Junagadh, Gujarat 362 001
**Email: bsgohil@jau.in*

Purple nutsedge (*Cyperus rotundus* L.) is one of the most worrying invasive weeds in tropical and subtropical climates and has been labelled as the world's worst perennial weed. It reproduces predominately by basal bulbs, rhizomes, and tubers, which allow it to flourish under a wide range of growing conditions. Purple nutsedge forms tuber chains where several tubers (2-6 or more) are connected together by means of a slender rhizome-like thread of vascular tissue. This enables one tuber to branch off and form another tuber. This process continues until a colony is formed. Because purple nutsedge is perennial, tubers may sprout shoots up to seven times before carbohydrate reserves of the tuber are depleted. As a result, primary tillage before planting does not destroy the plants but may actually spread the weed. Shoots can emerge from tubers buried 20 cm deep. When purple nutsedge is cultured in field without interference, it can produce 10-30 million tubers per hectare in a season. It is a troublesome C_4 weed, characterized by high photosynthetic efficiency, compared to C_3 plants. Decline in crop yield is one of the major impacts of purple nutsedge. Among management approaches, solarization, repeated mowing or harrowing, mulching, shading and biological agents reduce the vegetative growth and tuber production. However, due to its aggressiveness, reproduction capacity, high dispersion and rusticity, its control is difficult and costly. Purple nutsedge is difficult to control with herbicides too. To be effective, herbicide must be translocated throughout the rhizome and tuber network of the plant. Traditional herbicides used to control weeds are ineffective since purple nutsedge is sedge and not a broad-leaf or grass. Most herbicides may kill the plant's leaves and shoots, but have no effect on root system and tubers.

A field experiment was conducted during summer season of 2015-16 at Junagadh (Gujarat) to evaluate efficacy of herbicides (halosulfuron-methyl, ethoxysulfuron, glyphosate) and their combinations (glyphosate + halosulfuron, glyphosate + ethoxysulfuron) in managing purple nutsedge (*Cyperus rotundus* L.) under non-crop situation comprising of 10 treatments was laid out in a randomized block design with three replications. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction as well as low in available nitrogen, available phosphorus and medium in available potash. The post-emergence spray was done at 30 days after emergence (DAE) using knap-sack sprayer with flood-jet nozzle. The spray volume of herbicide application was 500 L/ha. Various treatments have significant influence on dead nutsedge density at 30 DAS and regenerated nutsedge density at 60 DAS. Post-emergence spray of halosulfuron-methyl 67.5 g/ha at 30 DAE recorded significantly the highest dead nutsedge density (32.67/m^2), which remained statistically at par with tank-mix spray of glyphosate 1230 g/ha + halosulfuron-methyl 33.75 g/ha at 30 DAE. Maximum purple nutsedge control (92.20%) at 30 days after spraying (DAS) and the lowest regeneration (5.76%) at 60 DAS was recorded with tank-mix glyphosate 1230 g/ha + halosulfuron-methyl 33.75 g/ha at 30 DAE, which was at par with halosulfuron-methyl 80 g/ha at 30 DAE (91.50% and 7.76%, respectively) and halosulfuron-methyl 67.5 g/ha at 30 DAE (89.53% 8.48%, respectively). Ethoxysulfuron 15 g/ha at 30 DAE resulted in significantly the lowest nutsedge control (12.84%) at 30 DAS and the highest regeneration (62.22%) at 60 DAS. The herbicides and their mixtures applied for control of nutsedge during summer season have non-significant effect on plant height and dry matter/plant of succeeding crops, *viz*. groundnut, pearlmillet, cotton and sesame.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-53

Application of sensor technologies for precision weed management

Puspa Parameswari*and S.S. Walia

Department of Agronomy and School of Organic Farming, Punjab Agricultural University, Ludhiana, Punjab 141 004

**Email:pushpaagro95@gmail.com*

The management of weeds in agriculture is a time consuming and expensive activity. Precision weed management is an application of right amount of inputs on the right target (weeds) on the right time.PWM is based on bringing in information technology for decision making about site specific weed control. Discrimination of different plant species can be performed based on the spectral reflectance of the leaves. Research and development into new technology for agriculture can support IWM by providing new weed control techniques and improved data collection and management. Detailed information about the variability of soil conditions, crop health and weed density allows site-specific crop management to be undertaken. This modern return to localised decision making combines the benefits of traditional small-scale agriculture with the productivity of modern agriculture. The maximum benefit from reduction of herbicide use requires reliable information on weed abundance and distribution. Weed mapping is one approach which involves the production of a detailed weed map, combined with other data to determine a variable rate treatment map. Mapping relies on human observation, which is time consuming, expensive and inefficient, or remote sensing. Remote sensing can produce weed maps where patches of weeds are of sufficient size, but provides limited spatial resolution while requiring considerable time and expense for image acquisition and processing. Proximate sensing can use either imaging or non-imaging sensors, and provides resolution below the size of individual leaves. It is an alternative to remote sensing which offers the potential for real-time detection and spot spraying of weeds. Several advantages over remote sensing include high spatial resolution and the ability to use artificial lighting to illuminate the ground. Such a sensor may operate on a similar principle to the Weed Seeker to determine spectral properties of the crop and weeds, or use an imaging sensor and apply machine vision techniques to classify crop and weeds based on leaf size and shape, colour, and/or texture. The potential of these technologies to target spray weeds is promising and would reduce the cost and volume of herbicide used, the associated labour costs, environmental impacts and provide greater opportunity to implement site specific weed management. Measuring the varying density of weeds within a field is required to manage weeds on subfield level. Depending on weed infestation, decision models aid in selection and adjustment of treatments. Weeds are often distributed in farm fields as many irregular patches that are relatively stable from one season to the next. Consequently, some growers have been motivated to consider site-specific weed management (SSWM) to apply herbicides only to sites within fields that are weed infested. Site-specific weed management has been shown to offer economic and environmental benefits. Before growers can benefit from SSWM, they must know where weeds are located within their fields. Today, modern spray delivery systems can be controlled either (i) indirectly from a weed map derived from remotely sensed information that had been acquired at an earlier time, or (ii) directly in response to the outputs from a sensing system mounted on the treatment vehicle. These technologies rely upon machine vision systems capable of detecting green plants and discriminating weeds from the crop.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-54

Major weeds and pesticide use in vegetable crops in Jammu

Stanzin Yangsdon*, Rakesh Kumar, P.S. Slathia and Rajinder Peshin
Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu 180 009
**Email: syangsdon@gmail.com*

In Jammu and Kashmir during the past two decades, there has been a substantial increase in the use of pesticides in terms of both volume and value. The demand for agrochemicals depends upon the type of crops grown, farmers' knowledge about technologies, their profitability and also upon the availability, affordability and ease in accessing the input and output markets. Use of pesticides has definitely increased the production of vegetable crops but simultaneously has resulted into various ill-effects. Rapid increase in the application of pesticides has posed threats to the environment and adverse health effects on farmers (Snelder et al. 2008). Vegetable growers heavily rely on chemical pesticides for controlling weeds, insects and diseases. The average pesticide use in vegetable crops is 1.27 kg/ha (Peshin *et al.* 2014), which is approximately 150% more than the world average of 500 g/ha (Betne 2011). A study was conducted in Jammu district with the objective of assessing the knowledge and perception of farmers about existing weeds in their locality, pesticide use and handling in vegetable crops. Data was collected from 120 vegetable growers. The results depicted that farmers had good awareness knowledge about insecticides but lack in case of fungicides and weedicides. Weeds constituted greater population than that of insect pest and diseases and are commonly found in vegetable crops like that of *Melilotus indica* (maina), *Cynodon dactylon* (dhoop grass), *Trianthema portulacastrum* (it-sit), *Cyprus rotundus* (dhila), *Amaranthas* sp. (charali) and *Chenopodium album* (bathua) as and when found from them in their local language. But, the knowledge of farmers regarding weeds was low as compared to insect pest and diseases and it ranged from overall 6-30% of which highest is 30% of *Melilotus indica* and *Cynodon dactylon* and least with 6% of *Cyprus rotendus*. In case of herbicide, the knowledge of farmers was also low with overall 0-6% with highest 6% knowledge about herbicide round-up. On the basis of findings, indigenous pest management practices/ techniques being adopted by the farmers are attributed to their indigenous technological knowledge. These techniques are not only compatible with the environmental, socio cultural norms of the farmers but are also sustainable and amenable to continued use. It is suggested that appropriate awareness and training programmes should be conducted by the concerned stakeholders regarding the rational use of pesticides.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-55

Aquatic weed control for water resources project management in Maharashtra

K.S. Rathod* and P.S. Bodake
College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapith, Dapoli, Ratnagiri, Maharashtra 415 712
Email: munnainagro@gmail.com

Since formation of Maharashtra, large number of irrigation projects has been constructed in the state and irrigation potential of 5.1 million hectare is created by harnessing rivers. Still, there is a wide gap lies between irrigation potential created and irrigation potential utilized. Many farmers of the tail reach end of canal do not receive water at right time and in right quantity. One of the reasons for such a situation is many canal irrigation projects are suffering from massive growth of aquatic plants along the canal sides known as aquatic weeds and siltation along canal bed. Aquatic weeds are unwanted plants playing a very important role in different ecosystems and many of them cause enormous direct and indirect losses. The losses include reducing water storage capacity in reservoirs, tanks and ponds, impeding flow and amount of water in canals and drainage systems, disrupt hydropower generation, reducing fish production, interfering with navigation and aesthetic value, promoting habitat for mosquitoes and serve as alternate host for many pests and diseases of economically important crops. Weeds enhances rate of evapotranspiration many fold than that of open surface evaporation, thus cause great loss of water. Also, it has been found the vegetation on bottom and sides of the canal increases the roughness resulted into a decrease in velocity which further leads to silt deposition on canal bed which affects the canal functions thereby reducing the availability of water to the farmers. In Pune, water hyacinth and in Kolhapur, water hyacinth and recently *Salvinia molesta* have become problematic in Panchganga river and its tributaries. The Mutha river in Pune is one of the most polluted rivers in Maharashtra and has been infested by water hyacinth, the weed which drains oxygen from the water. It is supposed to be one of the reasons, which increased the severity of flood hits the region during August, 2019, in which many lives affected, killed thousands of cattle, besides causing colossal loss of property, agricultural land and crops. Though there are various methods of aquatic weed control that have been developed so far while much research is being done worldwide to find further more effective and economic tools and techniques to combat weed problems and maintain the efficiency of irrigation canals. But presently, there are certain limitations on adoption of some of the methods due to complexity of situations. There is now a great need to address the problems associated with the non adoption of methods and apply known facts to achieve a measure of control by the means available tools and techniques. It is the purpose of this paper to provide a scientifically documented treatise of the known facts as they may be applied to the control of aquatic weeds in water resources projects and their irrigation distribution networks.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-56

Weed dynamics and productivity of rainfed organic maize + vegetables intercropping and impact on soil quality

Manas Ranjan Panda, Stuti Debapriya Behera*, Basudev Behera and D.K. Bastia
Department of Agronomy, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar-751 003, Odisha
**Email: stuteedebapriya12@gmail.com*

Field experiments were conducted at Research Farm of All India Coordinated Research Project for Dryland Agriculture, Odisha University of Agriculture and Technology, Phulbani, Odisha during *Kharif* 2016 and 2017 to assess the impact of maize + vegetables intercropping and organic nutrient management practices on weed dynamics, crop productivity and soil quality. The experiment was tried in split plot design with three replications. The four cropping systems *i.e.* sole maize, maize + runner bean (2:2), maize + cowpea (2:2) and maize + bitter gourd (2:1) were allocated to the main-plots and the three organic nutrient management *i.e.* FYM 10 t/ha, FYM 10 t/ha + vermicompost 2 t/ha, FYM 10 t/ha + vermicompost 2 t/ha + pot manure (sprayed 4 times at 15 days interval from the day of sowing) were allocated to sub-plots. Maize hybrid *'P-3501'*, cowpea cv. *'Gomti'*, runner bean cv. *'Raikia local'* and bitter gourd hybrid *'Bipasa 2'* were taken as the test crops. Both the main and inter crops were sown simultaneously on 26 and 30 June, respectively, during 2016 and 2017 after the onset of the south-west monsoon. Between two factors, only cropping systems exerted significant influence on weed density and dry matter production at 30 and 60 days after planting. Among cropping systems, maize + cowpea (2:2) proved to be the best with the equal weed smothering efficiency (WSE) of 27.4% at 30 and 60 days after planting and harvest closely followed by maize + runner bean (2:2) intercropping with WSE of 25, 27 and 27%, at the respective stages. Maize + bitter gourd (2:1) proved to be the least efficient with respect to WSE. Pooled over years, all cropping systems recorded higher maize equivalent yield (MEY) than sole maize and maize + cowpea (2:2) recorded the maximum MEY of 6.56 t/ha. Among organic nutrient management, FYM 10 t/ha + vermicompost 2 t/ha as basal + pot manure in maize + cowpea (2:2) recorded the maximum MEY of 6.78 t/ha. All cropping systems enhanced soil pH and organic carbon content of soil over initial value and maize + cowpea (2:2) and maize + bitter gourd (2:1) recorded significantly higher values of these two parameters than maize + runner bean (2:2). All organic nutrient management practices recorded higher soil pH and organic carbon than initial value and application of FYM 10 t/ha + vermicompost 2 t/ha as basal + pot manure proved to be the best with the maximum values. During two years of experimentation, available N and K in soil decreased and available phosphorus increased over initial values by 33.5, 31.4 and 22.5%, respectively. Cowpea and runner bean increased available soil P by 19 and 7 kg/ha, respectively, while maize + bitter gourd the least of 0.1 kg/ha than initial value. All the three cropping systems recorded the mean maximum gross return of ` 110 x 103/ha and net return of ` 57.73x103/ha. Among organic nutrient management practices, application of FYM 10 t/ha + vermicompost2 t/ha as basal + pot manure recorded the maximum gross return of `104x103/ ha, net return of ` 49.41x103/ha and B:C of 2.15.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-57

Utilization of weeds in Jharkhand

R.R. Upasani* and Sheela Barla
Department of Agronomy, Birsa Agricultural University, Ranchi, Jharkhand 834 006
**Email: upasani.ravikant@gmail.com*

The recognition of plants as weeds is perhaps as old as agriculture itself. Man tries to grow only the sort of plants that he wants and the original inhabitants of the soil become useless to him are called as weeds. When land is cultivated to raise crops, weeds grow up naturally along with the crop plants. They are considered to be enemy of crops as thwart man's effort of raising good crop yield. Many works and researches are centered to keep weed below threshold to produce higher crop yield. In this effort, various weed control or weed management practices are applied.When we see the weeds with different angle, their beneficial properties are masked by the menace they cause while their utilization in different ways compels one to rethink about weeds. The weeds of different types are utilized for different purposes. The weeds can be utilized for checking soil erosion as many of the grass species like *Agropyren repens*, *Cynodon dectilon* and *Panicum dichotomiflorum* have capacity to anchor soil with binding action thus prevent soil erosion. In spite of the invasive and allelopathic effects, *L. camara* provides a good covering to the ground with fine leaf mulch that improves the fertility of rocky, grave, or hard laterite soils, and serves to retain humus in deforested areas and checks soil erosion. Some of the available wild and free weeds can be used as mulch. Weed biomass is one of the easily available sources of organic matter and plant nutrients, which hitherto, have not received required attention. In Jharkhand, tribal people as well as rural people still depend on local medicinal plants for the treatment of different diseases using the knowledge of folk medicine which they gain from their forefathers and their own experience for leafy vegetables, cottage industry and other home stead vocation. Often the utility of weeds have not been recognized by many farmers as well as scientists of associated disciplines of agricultural subjects. Weeds are utilized at many places for manure purpose besides; they are useful for improving soil quality, biopesticides and allelochemicals *etc*. In Jharkhand, not only tribal people like Kharia, Munda, Santhali, Ho, Oraon and other primitive tribes as well as majorities of village population in general and living in forest area in particular have their own social, cultural and food practices. During winter and summer seasons, people collect edible weeds from their agricultural and non-agricultural land to supplement their food. These foods vary from place to place. Some of the examples of these are *Chenppodium album, Amaranthus viridis, Alternanthera amoena, Cassia tora, Celosia argentea etc*. Thus considering importance of weeds and their uses by tribal and rural people of Jharkhand, a brief account of utilization of weeds has been described.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-58

Non-chemical weed management in rice-wheat cropping system

S.P. Singh*, V.P. Singh, Tej Pratap, Abnish Kumar and Soniya Saini
College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar U.S. Nagar, Uttarakhand- 263145
**Email: spdrsingh@gmail.com*

It is extremely difficult to put a price on the research and development costs of the herbicides used in agriculture today. Use of herbicides in agriculture sector put forth a concern about ecological health. The said as well human health are of great importance to which every stakeholders, whether agricultural growers or consumers have to think of and still the growers do not have the methodologies or the alternatives of chemicals being used. Non-chemical weed control is an inevitable part of integrated weed control and is needed due to factors such as herbicide resistant weeds, environmental and health challenges, and organic crop production. Weeds are unwanted plants that enhance the production cost of crops, which causes economic loss to growers. Non-chemical means to control weed include preventive, cultural, physical, or mechanical measures, exploiting allelopathic means, and bio-measures. Integrated weed management offers usage of all available tools to effectively minimize weeds in a short- and long-term approach because farming community always preferred to choice an inexpensive, informal, and eco-friendly measure to manage weeds. Thus, a field experiment was conducted to evaluate the performance of non-chemical (organic) weed management practices against the complex weed flora in rice-wheat cropping system over herbicidal treatments during *Rabi* 2017-18 and *Kharif* 2018 of conventional and zero till wheat at N.E. Borlaug Crop Research Centre, GBPUA&T, Pantnagar. The major weed flora in the experimental field were found, *viz*. *Phalaris minor*, *Melilotus indica*, *Fumaria parviflora*, *Chenopodium album, Coronopus didymus, Malugo stricta* and *Cyperus rotundus* during *Rabi* 2017-18. However, *Ammenia baccifera, Echinochloa colona, Eleusine indica, Panicum maximum, Dactylctenium aegyptium, Malugo stricta, Cyperus iria* and *Cyperus rotundus* were observed during *Kharif* 2018. During *Rabi* 2017-18 the lowest total density of all grassy and non grassy weeds was recorded under direct-seeded rice with soil solarization *fb* one HW; zero-till wheat with rice straw *fb* one HW. However, the lowest total dry matter accumulation was obtained with transplanted rice on stale bed technique *fb* one MW then one HW; conventional wheat with stale bed technique *fb* one HW. During *Kharif* 2018 the lowest total density and dry matter accumulation of all grassy and non grassy weeds were recorded with direct-seeded rice incorporated with *Sesbania fb* one mechanical and one hand weeding; conventional wheat stale bed *fb* one HW. Under organic mode, during *Rabi* 2017-18 and *Kharif* 2018, the highest grain yield (6.2 and 3.5 t/ha) was achieved with rice (FIRB DSR) on stale bed technique *fb* one hoeing then one HW; wheat (FIRB) with mentha in furrows *fb* one HW, because rice equivalent yield of soybean was computed and added to sole rice yield in this treatment. Whereas, highest straw yield (6.5 and 6.5 t/ha) was achieved in control measures of direct-seeded rice; zero till wheat during *Rabi* 2017-18 and with direct seeding with FIRB with stale seed bed and soybean bed along with one hoeing *fb* one hand weeding; wheat with FIRB along with mentha *fb* one HW during *Kharif* 2018, respectively.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-59

Parthenium weed biocontrol in India: *Smicronyx lutulentus* to complement *Zygogramma bicolorata*

Prakya Sreerama Kumar*, M. Sampathkumar, A.N. Shylesha and Chandish R. Ballal
ICAR–National Bureau of Agricultural Insect Resources, P.O. Box 2491, H.A. Farm Post, Hebbal, Bengaluru 560 024, India
**Email: psreeramakumar@yahoo.co.in*

The ubiquitous asteraceous plant *Parthenium hysterophorus*, well known as parthenium weed, has been one of the prime targets in India due to its notorious impact on agriculture, animal husbandry and human health. The leaf-feeding insect *Zygogramma bicolorata*, often called the Mexican beetle, is the only exotic agent established for biological control of this weed throughout India. However, due to its inherent limitations, such as hibernation during winter and feeding preference only to leaves, *Z. bicolorata* has been found wanting, especially in the absence of additional agents to complement its damage potential. Out of the three other potential exotic insects, a seed-feeding weevil (*Smicronyx lutulentus*) was prioritised over a root-feeding moth (*Carmenta ithacae*) and a stem-galling weevil (*Conotrachelus albocinereus*) for importation, and an application was submitted in 2017 to the Plant Protection Adviser to the Government of India to obtain a permit. On an earlier occasion in the 1980s, *S. lutulentus* could not be established in the laboratory as it had not survived during shipment. Because of its capability to attack the floral structures of parthenium weed, it was reconsidered for importation. Adults of *S. lutulentus*, which are greyish black and 1.5–2.0 mm long, live for up to 3 months feeding on flower buds and young leaves of parthenium weed. Each female can lay around 230 eggs, which are deposited in flower buds and newly opened capitula. Larvae within the capitula consume the plant reproductive structures leading to fewer seeds. Once mature, they exit seeds and fall to the ground. Pupation occurs in the soil at a depth of 2–6 cm after a prolonged prepupal stage of 7–8 weeks. The weevil, first introduced into Australia in 1981, has established at the release sites and is now widespread and found in high densities in parthenium weed-infested Central and North Queensland. It is reported to have two generations per year, causing up to 30% seed destruction. The insect was later imported by South Africa, where it was approved for field release after extensive host-specificity tests. Taking a cue from the Australian and South African experiences, shipments of this weevil were received from Dr K. Dhileepan of Biosecurity Queensland, Australia, during 2018/19. The weevil has undergone quarantine screening at the ICAR–National Bureau of Agricultural Insect Resources, Bengaluru. This paper discusses the protocols and procedures followed for its import. Besides explaining the challenges confronted in colony establishment, standardisation and refinement of rearing techniques, particulars of the proposed host-specificity studies within the quarantine are clarified. Field releases of the weevil can be taken up only after confirming its non-target safety.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-60

Newspaper mulch for weed management in cotton

D. Blaise*, G. Majumdar, A. Manikandan, P. Nalayini
ICAR-Central Institute for Cotton Research, Nagpur, Maharashtra 441 108
**Email: blaise_123@rediffmail.com*

Approximately, one-third of the total cost of cultivation is incurred on weed management in cotton grown in the country. Present weed management practices are labour intensive with frequent inter-row cultivations. Such practices are not only environmentally degradative, but also costly. Therefore, alternative methods of weed control are needed by the small and poor farmers. Mulching is an option to limit weed growth. Several mulching materials were compared in the past such as polythene and crop residues. The possibility of using newspaper as mulch was explored for cotton grown under the rainfed conditions of central India and was compared with the control, farmers practice and the polythene mulch besides organic crop residue grown in between cotton rows and mulched later. Field experiments were conducted with the BGII hybrid (*Ajeet155*) over six seasons. We also conducted large plot trials to compare these treatments and the benefit-to-cost ratio was worked out. In this presentation, we restrict our discussion to the polythene mulch *vs*. the newspaper mulch. In general, the polythene mulch treatment offered near total weed control resulting in the least population density of both monocot and dicot weeds. On the other hand, weed density was the highest in the control treatment. As a consequence, substantial weed dry matter accumulated in the control treatment, ranging from 249.9 to 783.3 g/m^2. Compared to the polythene mulched plots, weed density was greater in the newspaper mulch treatment; however, it was within acceptable limits and was also easily controlled and required less human labour than the farmers' practice. The newspaper mulched plots had 72.2% less weed emergence and 55.4% less weed biomass than the control treatment. The polythene mulched plots had the lowest biomass ranging from 0 to 1.3 g/m^2 followed by the newspaper mulch (5.9 to 18.7 g/m^2). Furthermore, newspaper as mulch had reduced cost of weeding and investment cost was lower; nearly 5.4 fold cheaper than the polythene. But making them into rolls and sticking, it involves labour and increases the added cost. Seed cotton yields were greater with the polythene than the newspaper mulch treatments; however, the treatment differences were not significant. Both these mulch treatments had positive net benefits and a high benefit to cost ratio. Considering that polythene is a by-product of the petroleum based non-renewable natural resource, mulching with newspaper maybe an effective and an eco-friendly tool to manage weeds in the rainfed cotton.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-61

Status of invasive weeds management by mycoherbicide: Indian perspective

Ajay Kumar Singh* and Praharaju Laxminarayana
A.G. Bio Systems Private Limited, Hyderabad, Telangana 500 015
**Email: ajayagbio@gmail.com*

Invasive weeds pose a serious threat to the biodiversity of natural ecosystems and a significant constraint to agricultural production worldwide. Due to the recent trends in environmental awareness concerning the side effects of herbicides, public pressure is mounting to force industry to develop safer, more environmentally friendly approaches for controlling weeds. Fungus or their metabolites-based pesticides, referred to as mycoherbicide, for the management of weeds offer such an approach. The use of mycoherbicide has proven to be a potentially efficacious, cost-effective, and safe option for the management of weeds. Considerable progress has been made during the past four decades in the use of fungi as biocontrol agent of weeds. There has been a great number of naturally occurring fungal strains researched for possible use as mycoherbicides, but only a small proportion have been developed to commercial products. Currently, a total of 17 mycoherbicides (8 in the USA, 4 in Canada, 2 in South Africa, and 1 each in the Netherlands, Japan, and China) have been registered around the globe. The advancement of formulation techniques is of paramount importance to the continued development of mycoherbicides. It is also essential to continue intensive screening programs for the selection of fungal pathogens, especially hemibiotrophs, if mycoherbicides are to become a viable component of integrated weed management in the future. Recent trend is the application of several host-speciûc fungal pathogens in a bioherbicide mixture as a multicomponent bioherbicide system for simultaneous, broad-spectrum weed biocontrol. Weed pathogens are also able to produce a wide array of toxins, bioactive metabolites with different biological activities, chemical structures, mechanism of action, and specificity with respect to plants, environmental impact and stability. Some of the advantages of mycoherbicide over traditional chemical herbicides are their specificity for the target weed; absence of adverse effects on humans, wildlife or domestic animals; rapid degradation and absence of residues in surface or ground water, crops, soil or food chains. We have made significant progress in the development and application of isolated and patented fungal pathogens for some invasive weeds of India.This paper will discuss the progress on those mycoherbicide for the management of invasive weeds. The possibility and perspectives for obtaining new herbicides from these fungi are investigated in this paper.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-62

Evaluation of manipur rice germplasm for higher weed competitiveness under upland rice ecosystem

K.S. Shashidhar*, B. Bhuvaneswari, Marjit Chandam. Amit Kumar Singh and Samuel Jeberson
Central Agricultural University, Imphal, Imphal, Manipur 795 004
**Email: shashiuas@gmail.com*

Weeds are one the major yield constraint factors in upland rice ecosystem. The losses due to weeds are up to 60-80% under upland condition due to severe weed competition. Most of the weed management regimes with chemicals cause pollution and mechanical methods are labour intensive which increases cost of cultivation. Under almost herbicide free cultivation, identification of weed competitive genotypes is most important tool to improve yield. Identifying the weed competitive or weed suppressive genotypes in addition to other weed management regimes through genetic approach will minimize the effect of weeds and improve yield. In this context, the present investigation was taken up to estimate genetic variability for weed competitiveness in 33 rice land races including high yielding varieties are grown under upland conditions of Manipur and identify weed competitive genotypes for further utilization in breeding programmes. The genotypes were evaluated in adjacent partial weed free and weedy trials in upland condition during the wet season 2017 and 2018 at CAU research farm, Andro, Imphal East in RCBD design with three replications. The recommended practices for rising the crop was followed in weed free plots. The seeds were drilled directly to 2 sq. m. plots. One hundred seeds were sown in each plot and urea, SSP and MOP was broadcasted to each plot at the recommended N, P_2O_5, K_2O of 60, 40 and 30 kg/ha rates. Two additional split doses of urea were done as per the standard practice. The important agronomic traits such as plant height, LAI and tiller number, contributing to higher weed suppression were estimated in weedy and weed-free trials at 20, 40, 60 DAS and at grain maturity stage. There was diverse variation in the genotypes evaluated under weed and weed free conditions in terms of growth and yield attributes. Significantly higher seedling vigour, plant height, no. of leaves per hill, LAI and yield were recorded in land races *Changlei, Moirang-phok, Chakhao, Chakao-Angouba, Langphou-Chakao, Taothabi*, *Kumbi-phou*as compared to high yielding varieties *Sana phou, Leima phou, gim phou* Under weedy condition. The significantly higher yield and yield attributing traits were recorded with the land races *Moirangphou-Yenthik, Langphou, Chakao-Angouba,* Langphou-Chakao and in partial weed free conditions, CAU R1 recorded significantly superior yield and yield attributing traits. However the next best genotypes under partially weed free conditions are *Phouoibi*, *Langphou*, *Chakao-Angouba* and *Sabita*. Consistent performance in terms of significantly increase in yield is recorded with land races *Langphou*, *Chakao-Angouba* in both weedy and partial weed free conditions. Based on magnitude of variation in traits, few important Manipur landraces namely, *Langphou, Chakao-Angouba, Moirangphou-Yenthik,* and improved varieties like Sabita and CAU R1 identified as promising lines for higher weed competitiveness under upland conditionsand can be further utilized in breeding programmes.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-63

Production and profitability of rice-sweet corn cropping system as influenced by organic weed management practices

Manukonda Srinivas*, B. Anusha, C. Venkata Reddy and P.V. Satyanarayana
Acharya N.G. Ranga Agricultural University, Regional Agricultural Research Station, MARUTERU, West Godavari, Andhra Pradesh 534 122
**Email: srinu.manu@gmail.com*

Rice (*Oryza Sativa* L.) is the predominant and staple food crop of Andhra Pradesh which is cultivated over 2.4 million hectares in the state under diversified ecosystems. Source of organic material influences the performance of crop weed competition through its effect on growth and development. In Godavari delta, deltaic alluvial soils under canal irrigated conditions rice-rice or rice-based cropping systems are the most predominant cropping systems. The present field experiment was conducted during *Kharif* and *Rabi* seasons of 2018-19 in deltaic alluvial soils at Regional Agricultural Research Station, Maruteru, west Godavari district of Andhra Pradesh to find out the economically viable and practically applicable organic weed management practices in rice-sweet corn cropping system. Experiment was laid out in randomized block design and replicated thrice with eight treatments. Medium duration rice variety MTU 1075 during *Kharif* season, Sweet corn hybrid S-75 was grown during *Rabi* season were tested under organic weed management practices. During *Kharif* season, highest rice grain yield of 5.22 t/ha was recorded with application of mulching with locally available weed mulch + One hand weeding which is on par with manual hand weeding twice (5.08 t/ha). Similarly, during *Rabi* season highest sweet corn green cob yield of 88.33 t/ha was registered with locally available weed mulch + one hand weeding but which is on par with incorporation of neem cake 15 days before planting5 t/ha + one hand weeding treatment (83.67 t/ha). Rice grain equivalent of 35.33 t/ha and total system productivity of 40.55 t/ha was also realized with the same treatment *i.e.*, application of mulching with locally available weed mulch + one hand weeding. In case of total system net returns, highest was recorded with locally available weed mulch + one hand weeding (` 2.37 lakhs/ha) followed by location specific green leaf manure incorporation (` 2.17 lakhs/ha). Similarly, benefit: cost ratio of 12.28 and 11.43 followed the same trend with locally available weed mulch + one hand weeding and next with location specific green leaf manure incorporation respectively. The incidence of pests particularly leaf folder and incidence of brown plant hopper in case of *Kharif* rice and shoot borer and fall army worm in case of *Rabi* sweet corn was below the economic thresh hold level. Weed index showed that, application of mulching with locally available weed mulch + one hand weeding controlled the weed population more effectively (28.5%) in both the seasons compared to other organic weed control treatments. This clearly indicates that, application of mulching with locally available weed mulch along with timely single hand weeding is the better option for rice-sweet corn cropping system under organic production system with good returns as compared to manual weeding alone or in combination of manual weeding with other organic weed management practices.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-64

Non-chemical weed management in aerobic rice

Sourabh Munnoli*. D. Rajakumar, C. Chinnusamy and N. Thavaprakaash
Department of Agronomy, TNAU, Coimbatore, Tamil Nadu 641 003
**Email: sourabh.ssm@gmail.com*

Aerobic rice is a production system where rice is grown in well-drained, non-puddled, and non-saturated soils. Aerobic rice systems can substitute the conventional rice cultivation system in the wake of water shortage and energy crises. The major constraint in the success of aerobic rice is high weed infestation. Present modern agriculture is very much intensive with respect to use of agro chemical like herbicides. Non-chemical weed management tools gives the advantage of excluding the use of herbicides and ensures environmental stability and crop yield quality.Field experiment was conducted at the Wetland farms of Tamil Nadu Agricultural University, Coimbatore during *Kharif* season (2017) to evaluate non-chemical weed management practices on aerobic rice. The treatments included were, *Dhaincha* intercropping (1:1) + spreading on 30 DAS, cowpea intercropping (1:1) + spreading on 30 DAS, coirpith mulching 5 tons/ha, shredded coconut waste mulching 5 tons/ha, two mechanical weedings on 20 and 40 days after sowing (DAS), two hand weedings on 20 and 40 DAS, mechanical weeding on 20 DAS *fb* Hand weeding on 40 DAS and unweeded control. The results revealed that two hand weedings on 20 and 40 DAS recorded higher grain yield (4298 kg/ha) followed by mechanical weeding on 20 DAS *fb* hand weeding on 40 DAS (3286 kg/ha). *Dhaincha* intercropping (1:1) + spreading on 30 DAS and cowpea intercropping (1:1) + spreading on 30 DAS recorded 2576 kg/ha and 2426 kg/ha grain yield, respectively. Coirpith mulching 5 tons/ha recorded lower grain yield (1840 kg/ha).At 20 DAS weed control efficiency (WCE) was found to be higher in the treatments *Dhaincha* intercropping (1:1) + spreading on 30 DAS (80.1%) and cowpea intercropping (1:1) + spreading on 30 DAS to the tune of 79.4% followed by shredded coconut waste mulching 5 t/ha (73.6%). On 40 DAS two hand weeding on 20 and 40 DAS was better performing treatment with 93.9% WCE. Two mechanical weedings on 20 and 40 days after sowing (DAS) and mechanical weeding on 20 DAS *fb* hand weeding on 40 DAS recorded 47.1 and 46.3% WCE, respectively.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-65

Method optimization for trace-level analysis of 147 crop protectants in Black pepper by LC-MS/MS

Tirthankar Banerjee*, Suman Gupta, Neethu Narayanan and Bijendra Singh
Division of Agricultural Chemicals,ICAR-Indian Agricultural Research Institute, New Delhi 110 012
**Email: banerjeetirthankar@rediffmail.com*

India, known as the home of spices, boasts a long history of trading with the ancient civilizations of Rome and China. Today, Indian spices are the most sought-after globally, given their exquisite aroma, texture, taste and medicinal value. India has the largest domestic market for spices in the world. India is the world's largest producer, consumer and exporter of spices; the country produces about 75 of the 109 varieties listed by the International Organization for Standardization (ISO) and accounts for half of the global trading in spices. Black pepper is one of the most commonly used spices worldwide. It's made by grinding pepper corns, which are dried berries from the vine Piper nigrum. It has a sharp and mildly spicy flavor that goes well with many dishes. Since time immemorial it has been used in ancient ayurvedic medicine for thousands of years due to its high concentration of potent antioxidant called piperine, which prevent free radical damage to cells, decrease inflammation, improve symptoms of degenerative brain diseases and has demonstrated cholesterol-lowering effects in rodents. It also slowed the replication of cancer cells and induced cancer cell death in test-tube studies.In export of black pepper India's position is second in the world (https://www.tridge.com/intelligences/black-pepper/export). To avoid export rejection due to pesticide residues in spices, it is imperative to develop multi-residue method for detection and quantification of trace levels of pesticide residues in black pepper. A method involving sample processing using modified QuEChERS technique and analysis using LC-MS/MS for simultaneous identification and quantification of 147 pesticides [insecticide/acaricide/nematicide (74), fungicide (30), herbicide (42), plant growth regulator (1)], in 20 minutes run was developed using shimadzu LCMS/MS-8030 instrument equipped with zorbax eclipse Plus C-18 column and electrospray ionization source (ESI) operating in both positive and negative mode. Seven-point linear calibration curves for each pesticide were obtained in the range 0.01 µg/g to 2 µg/g with correlation coefficient (r) of e"0.98.The LOD for all the pesticides were achieved in the range of0.01-0.05 µg/g where as LOQ were found in the range of 0.03-0.15 µg/g, respectively. Effect of different proportions of Primary Secondary Amine, C-18 and Graphitized Carbon Black bulk sorbents on recovery percentage was evaluated and the best proportion was optimised. The developed method gave acceptable recoveries of 70-120% with requisite repeatability for 129 pesticides and can be used routinely for the monitoring of black pepper meant for export as well as domestic consumption.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-66

Bioassay guided extraction of potential bioactive compounds from *Rhynchosia minima* and utilization in plant disease management

Neeraj Patanjali, Supradip Saha, Aditi Kundu, Anirban Dutta, Suman Manna, Abhishek Mandal, V. Shanmugam[1] and Anupama Singh*

Division of Agricultural Chemicals, ICAR-Indian Agricultural Research Institute, Pusa Campus, New Delhi-110 012

[1]Division of Plant Pathology, ICAR-Indian Agricultural Research Institute, Pusa Campus, New Delhi-110 012

**Email: anupama.chikara@gmail.com*

Rhynchosia minima, a weed which grows commonly in the plain and open areas throughout India especially under tropical and sub-tropical climatic conditions. Being a legume, roots have bacterial nodules that enrich the soil. According to ITK, aerial parts of *Rhynchosia minima* envisaged to contain many bioactive compounds, which can be successfully utilized for the management of pest. As per the literature reports, the plant is having anti-helminthic properties against few worms. The literature about chemical composition of this weed is really scarce or unavailable. The naturally occurring plant based compounds are promising natural resources which can be successfully used in the management of agricultural pests as an alternative of chemical pesticides due to their advantages *i.e.* multiple mode of action, relative safety towards environment and non-target pests and less chances of resistance development. Plant materials were collected from three different locations (Munak Canal, Haryana, 28.8458 oN, 77.0196 oE; Harewali village, Delhi, 28.8317 oN, 77.0078 oE; IARI, Pusa Campus, New Delhi. 28.6342 oN, 77.1525 oE) and processed for further extraction. Collected aerial parts of *Rhynchosia minima* were air-dried and it was extracted for bioassay guided fractionation using four different polarity of solvents. Hexane, dichloromethane, methanol and water with increasing order of solvent polarity was chosen for extraction and it was done sequentially. Solvents were evaporated under reduced pressure (< 40 0C) using rotary evaporator to obtain respective solvent extracts. Yield of extracts from the leaf material were 2.26, 2.93, 10.15, 5.02% in hexane, dichloromethane, methanol and water, respectively. Additionally, the essential oil was also extracted from the aerial parts by Clevenger apparatus and the constitutive compounds were characterised by gas chromatography/mass spectrometry (GC-MS). Four solvent extracts were evaluated for its antifungal activity against *Fusarium oxysporum* TOFU-IHBT by poisoned food assay. The test fungi is causing soil borne diseases in number of crops. Bioassay study revealed that water extract provided significant antimicrobial activity and per cent inhibition ranged between 40.4 to 67.4% in the concentration range between 100-1000 µg/ml. Non-significant results were shown by other three extracts. This investigation aims for biomass utilization for its use in crop protection. Further studies including *in-vivo* experiments needs to be done in order to confirm the results obtained in the present study. As green solvent based extraction technology is used in the present investigation, it will prove to be eco-friendly option of pest management.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-67

Effect of diuron 80 wp upon bio-efficacy against weeds and phytotoxicity on maize-wheat crops in crop sequence

R.R. Hasure*, N.J. Danawale and S.N. Bhalerao

Regional Sugarcane and Jaggery Research Station, Kolhapur, MPKV, Rahuri, Maharastra

**Email: rajaramhasure63@gmail.com*

The experiment conducted at Research Farm of Pulses Improvement Project, MPKV, Rahuri during *Kharif* 2017 on maize (variety DEKALB 9141) and *Rabi* 2017-18 on wheat (Trimbak) as sequence crop to test pre-emergence herbicide diuron 80 WP for bio-efficacy and phytotoxicity against weeds at different rates of diuron 80 WP in preceding maize and succeeding wheat crop, in RBD replicated four times with six treatments viz, diuron 80 WP 0.40 kg or 0.50 kg/ha, diuron 80 WP 0.80 kg or 1.00 kg/ha, diuron 80 WP 1.60 kg or 2.00 kg/ha, atrazine 50 WP 2.00 kg or 4.00 kg/ha (Check), untreated (weedy check) and weed free treatment plots. The herbicides were sprayed after sowing of maize with a spray volume 600 L/ha. It was revealed that weed free treatment recorded 100% weed control efficiency (WCE) and weeds dry matter in maize at 30, 45 and 60 DAS. Atrazine 50 WP 2 kg/ha recorded significantly lowest weed population and weed dry matter but it was at par with diuron 80 WP 1.60 kg/ha and diuron 80 WP 0.80 kg/ha. Amongst herbicides, atrazine 50 WP 2 kg/ha recorded higher WCE while it was closely followed by diuron 80 WP 1.60 kg/ha and 0.80 kg/ha at 30, 45 and 60 DAS, respectively. Weed free treatment recorded significantly higher yield attributes. Atrazine 50 WP 2 kg/ha recorded significantly higher maize yield attributes as well as grain and fodder yield but it was at par with diuron 80 WP 1.60 kg/ha and 0.80 kg/ha. Diuron 80 WP had no adverse effect on germination and population of succeeding wheat crop at 30 DAS. Wheat crop sown on preceded weed free treatment to maize recorded numerically higher yield attributes and grain yield but it was not differed significantly with all other weed management treatments to preceded maize crop with atrazine 50 WP and diuron 80 WP as well as untreated *i.e.* weedy check. The diuron 80WP in different doses did not show any adverse phytotoxicity symptoms on previous *Kharif* maize at 1, 3, 5, 7 and 10 DAA of treatments and on succeeding *Rabi* 2017-18 wheat crop. It can be concluded that, the higher doses of diuron 80 WP (0.80 kg or 1.60 kg/ha) recorded lower weed population, weed dry matter and better WCE next to weed free and atrazine 50 WP 2.00 kg/ha as compared to its lower dose. Weed free treatment found better than other treatments followed by use of diuron 80 WP 0.80 kg/ha as safe for the control of weeds in maize during *Kharif* followed by succeeding *Rabi* wheat crop as there was no any adverse effect.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-68

Residue concentration, persistence and dissipation of fomesafen in soybean crop and soil

Jitendra Patidar*, Mewa Lal Kewat and Shobha Sondhia[1]
Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
[1]Directorate of Weed Research, Maharajpur, Jabalpur, Madhya Pradesh 482 004
**Email: jitendrapatidar90-coaagr@pau.edu*

Fomesafen is a new post-emergence herbicide of diphenyl ether group, It is highly selective and has excellent herbicidal activity at low application rates against broad-leaf weeds in soybean. There is increasing concern about persistence of herbicide residue in soil and subsequent contamination of ground water leading to environment pollution. Thus, the persistence of fomesafen was evaluated under field condition. The experiment was laid out in randomised complete block design with three replications at agronomy farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP) during 2017 and 2018. Fomesafen was applied at the rate of 0, 90, 110, 130 and 220 g/ha after 10 days of sowing as an early post-emergence in soybean. Soil and plant samples treated with fomesafen were collected at 0, 5, 10, 20, 30, 60 days after herbicide application and at harvest, and analyzed for residues using the standard method. At zero day after herbicide application, concentration of fomesafen ranged from 0.165 to 0.363 µg/g in the soil and 1.513 to 3.350 µg/g in the plant when applied at the rate of 90 to 220 g/ha. There was rapid decline in the residue of fomesafen with time and degraded to below detectable level (0.001 µg/g) in the soil as well as in plants at 90, 110 and 130 g/ha rates of application with 100% dissipation except the highest rate of application (220 g/ha) in which same residue of fomesafen (0.016 µg/g) was found in the soil, which was above the detection limit. Hence, it can be said that fomesafen applied at 90, 110 and 130 g/ha can be applied safely to soybean without any ill effect on soil and human being.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-69

Inheritance of resistance against alternate herbicides in various biotypes of *Phalaris minor* from different parts of Haryana during 2018-19

Paras Kamboj*, SS Punia, Dharambir Yadav
Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: paras.thind@yahoo.com*

There are reports of reduced efficacy of recommended herbicides against *P.minor* in wheat at farmers' fields in Haryana. The reason might be the wrong method of application, dose or development of cross-resistance in *P. minor*. Thus to check the efficacy of different herbicides pot experiment was conducted during 2018-19 at screen houses of Department of Agronomy, CCS Haryana Agricultural University, Hisar. For this experiment different bioypes of *P. minor* were collected from farmers' fields of different parts of Haryana. The seeds of 15 canarygrass populations were tested on the basis of problem reported by the farmers. Of these 15 populations; 4 were from Karnal (P1- kachhwa, P5- Ramba, P11- Sitamai, P13- Uchana), 4 from Jind (P7- Rasidan, P10- Kalwan, P12- Danoda, P14- Ujahana), 2 from Kaithal (P4- Kheri raiwali and P8- Teek), 2 from Hisar (P2- Hindwan and P6- H.A.U Farm), 1 from Yamunanagar (P3 – Khirabad Raiyawala), 1 from Fatehabad (P9 – Laloda) and 1 from Kurukshetra (P15- Chanrathal) district of Haryana. Hindwan, Hisar was taken as susceptible population from clodinafop. All the herbicides were applied as post-emergence on canarygrass. Clodinafop at 30 g/ha (1/2x), 60 g/ha (x), 120 g/ha (2x), 240 g/ha (4x); sulfosulfuron at 12.5g/ ha (1/2x), 25g/ha (x), 50 g/ha (2x), 100 g/ha (4x); mesosulfuron + iodosulfuron (RM) at 7.2 g/ha (1/2x), 14.4 g/ ha (x), 28.8 g/ha (2x), 57.6 g/ha (4x); pinoxaden 25 g/ha (1/2x), 50 g/ha (x), 100 g/ha (2x), 200 g/ha (4x) were applied at 2-4 leaf stage of canarygrass.Almost all the populations showed resistance to clodinafop. GR50 value of the most susceptible check population, Hindwan, Hisar, was 6.02 ± 0.78 g/ha. GR50 value of highly resistant populations -P10, P6, P5 and P1 were 1148 ± 3.06, 933.2 ± 2.97, 707 ± 2.85, 251.1 ± 2.40 with resistance index of 190.69, 155.01, 117.44 and 104.62 respectively. Some populations which were resistant to clodinafop also showed resistance against sulfosulfuron also. At recommended dose of this herbicide only 4 populations (P2, P12, P13, P14) showed more than 80% control. Mesosulfuron + iodosulfuron (RM) showed better efficacy as compared to the clodinafop and sulfosulfuron. GR50 value of the most susceptible check population, Hindwan, Hisar, was 1.02 ± 0.01 g/ha. Three populations (P10, P11 and P15) showed highly resistant against this ready mix with resistant index of 13.21, 18.25, 15.17, respectively. Very poor control of P10 was observed at recommended dose (50 g/ha) of pinoxaden with only 15% mortality but with the increase in dose upto 4x there was control over this resistant population and we got 62.5% control with 4x dose of this herbicide. Expect check only one populations found suspectible to pinoxaden, whereas P3, P9, P11, P15 were resistant and rest populations were highly resistant against pinoxaden. P10 which was highly resistant to clodinafop also found highly resistant to pinxaden with highest resistant index of 64.80 among all the populations.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-70

Effect of different herbicides and their dosage on control level of resistance biotypes of *P. minor*

Jeetendra Kumar Soni*, Amarjeet and S. S. Punia
CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: jeetendra.soni@icar.gov.in*

The resistance of weeds towards herbicide is increasing day by day and in 2019 nearly 510 numbers of unique herbicide resistance cases have been registered worldwide. In India, the problem of herbicide resistance in weeds is increasing drastically. This is primarily owed to the indiscriminate use of herbicides to kill these weeds that develop the selection pressure and ultimately resulting resistant weed population. Little seed canary grass (*Phalaris minor* Retz.) is a mimic weed of wheat and if left uncontrolled, may lead to 15-40% or more yield loss. To control this weed, application of herbicide is most appropriate tool. However, unceasing application of same herbicide consequences the development of herbicide resistance in *P. minor*. Therefore, to evaluate the level of resistance and convey suitable herbicide dose for the management of resistance in *P. minor*, a pot culture study was undertaken at CCS HAU, Hisar in *Rabi*, 2016-17 in CRD design with four replications. Sixteen biotypes of *P. minor, viz*. P1 Nangla (Fatehabad), P2 Pipaltha (Jind), P3 Nangla-2 (Fatehabad), P4 Laloda-2 (Fatehabad), P5 Pipaltha-1(Jind), P6 Barwala (Hisar), P7 Pipaltha (Jind), P8Khedi (Karnal), P9 Ludas (Hisar), P10 Danora (Ambala), P11 Ujhana (Jind), P12 Dhos (Kaithal), P13 Danoda (Jind), P14 Samain (Fatehabad), P15 Rasidan (Jind), P16 Kalvan (Jind) were collected from different parts of Haryana state, India and evaluated with application of 0.5x, 1.0x and 2x time of recommended dose (RD) of post-emergence herbicides, *viz*. clodinafop (60 g/ha), sulfosulfuron (25 g/ha), mesosulfuron + iodosulfuron (14.4 g/ha) and pinoxaden (50 g/ha). From the experiment, it was observed that out of 16 biotypes of *P. minor*, 7 biotypes (P1, P2, P7, P9, P11, P12 and P16) provided deprived control (33.3 to 65%) with 2x dose of clodinafop. Whereas, 10 biotypes showed very poor control (19.7 to 65%) at RD. Similarly, from RD of sulfosulfuron, four biotypes (P1, P8, P9 and P15) shows meagre control (25 to 65%); at 2x dose, two biotypes (P9 and P15) recorded mere 35 to 41.7% control. Under the RD of mesosulfuron + iodosulfuron biotypes (P15 and P16) were observed with 39.3 to 31.7% control only and 2x dose show 53.3% control in biotype P15. Whereas, at 0.5x dose of mesosulfuron + iodosulfuron, 5 biotypes show 0.0 to 68.3% control. Similarly, pinoxaden with RD and 2x dose recorded poor control of 31.7% and 78.8% respectively, in only one biotype (P14). Whereas, other 15 biotypes were controlled effectively even at RD of pinoxaden. All the biotypes treated with herbicide were compared with untreated control of respective resistance biotypes.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India) 5-7 February, 2020.

O-71

Herbicide resistance in broad-leaf weeds in India and its management

Sachin Dhanda* and Simerjeet Kaur
Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab 141 004
**Email: sachin-agr@pau.edu*

Weeds are the major biotic constraint in the sustainable crop production that reduces the crop yield and deteriorate the quality. Weeds compete with crops for nutrients, soil moisture, space and sunlight; thus reduces the crop yield up to 45%. However, losses caused by the weeds depend on their types, density, period of infestation and climatic conditions. Herbicides are the major tool for weed management in India with a share of nearly 20% of total pesticides used. Over-reliance on herbicides with similar mode of action and concurrent selection pressure led to the increased cases of herbicide resistance. Globally, 262 species have evolved resistance to date and out of which, 152 are dicots. Among broad-leaf weeds, *Rumex dentatus* and *Chenopodium album* have shown resistance against acetolactate synthase (ALS) inhibitor herbicides in India. Infestation of *Rumex dentatus* is a serious problem in irrigated wheat particularly in rice-wheat cropping system. Because of continuous use of metsulfuron from last 20 years for its control, *Rumex dentatus* evolved a very high level of resistance against this herbicide. Globally, it is the first case of resistance in *Rumex dentatus* and first amongst broad-leaf weeds in India. Resistant biotypes also showed cross resistance to iodosulfuron, triasulfuron, florasulam, mesosulfuron-methyl, halauxifen+florasulam and pyroxsulam. However, resistant biotypes showed susceptibility to 2,4-D, carfentrazone, metribuzin, pendimethalin and isoproturon. *Chenopodium album* is amongst the top ten resistant weeds with its resistant biotypes in 20 countries against ALS inhibitors, synthetic auxins, photosystem II inhibitor, ureas and amide herbicides. In India, *Chenopodium album* also showed resistance against ALS inhibitor herbicides (sulfosulfuron, metsulfuron, iodosulfuron, trisulfuron) and cross resistance to penoxsulam but is susceptible to 2,4-D, carfentrazone, flumioxazin and pendimethalin. However, exact mechanism of resistance against ALS inhibitor herbicides (non-target-site resistance or target-site resistance) is still unknown. Gradually, the resistant biotypes are evolving multiple resistance which pose a greater threat to crop production. Knowledge of the type of mechanism of herbicide resistance in weeds is vital for designing sustainable weed management practices to discourage the further evolution of herbicide resistance in weeds. Weed preventive methods such as use of clean seed, clean farm machinery and well decomposed manure or compost can contribute significantly in reducing the dissemination of weed seeds from one region to another. Cultural weed control measures include crop and herbicide rotation, stale seed bed, growing competitive crop cultivars and mulching. Use of herbicide combinations and mixtures and herbicide rotation may help in delaying the evolution of resistance. Therefore, this problem needs to be addressed with integrated weed management approaches including weed preventive, physical, cultural and chemical control measures.

Theme 1

Weed management in rice-based cropping system

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-1

Weed flora and weed dynamics in transplanted rice under different weed and nutrient management practices

J.K. Nayak*, B. Behera, R. Dash and B. Lodh

Department of Agronomy, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha 751 003

**Email: jitendrakumarn86@gmail.com*

Rice is the staple food crop of Odisha whose potential yield is not being realized due to poor weed and nutrient management. The traditional way of manual weeding is costly, time consuming and cumbersome. The productivity is declining due to continuous use of chemical fertilizers. There is necessity of integrating organic sources of nutrient with chemical fertilizers for improving soil heath and sustain crop productivity. Considering these facts, a field experiment was conducted at Agronomic Main Research Farm, OUAT, Bhubaneswar, during *Kharif* 2019 to find out the best weed and nutrient management practice to maximize the productivity and profitability. The experiment comprised five weed management treatments, *viz.* W_1 - bensulfuron-methyl (0.6%)+ pretilachlor (6%) 0.66 kg/ha as pre-emergence application, W_2- W_1 + manual weeding at 25 days after planting (DAP), W_3- pyrazosulfuron-ethyl (10%WP) 0.2 kg/ha as pre-emergence spray + manual weeding at 25 DAP, W_4- mechanical weeding at 25 and 40 DAP, W_5- weedy check] and three nutrient management practices, *viz.* N_1- Soil test based dose of NPK, N_2- N_1 + FYM5 t/ha, N_3- N_1+ in situ green manuring of dhanicha. The experiment was laid out in strip plot design with three replications. The rice cv. 'Maudamani (140 days)' was taken as the text crop. The pre-dominant weeds of the experimental site as recorded in weedy check included grasses like *Leptochloa chinensis* (L.) Nees, *Echinochloa crusgalli* (L.) Beauv. and *Digitaria ciliaris* (Retz.) Koel; sedges, *viz. Cyperus iria* L. and broadleaved weeds like *Ammania baccifera* L., *Alternanthera philoxeroides* (Mart.) Griseb, *Monochoria hastate, Ludwigia octovalvis* (Jacq.) Raven, *Commelina diffusa* burm f., *Marsilea quadrifolia* L., *Hygrophylla* spp. and *Spilanthes acmella*. The treatment W_2 controlled almost all the weeds observed in weedy check except a negligible count of *Commelina diffusa* burm f and *Spilanthes acmella*. Treatment W_3 could not suppress the weed species like *Ludwigia octovalvis, Ammania baccifera* L., *Alternanthera philoxeroides* (Mart.) Griseb and *Spilanthes acmella*. W4 recorded later flushes of weeds like *Commelina diffusa, Alternanthera philoxeroides, Hygrophylla* spp. The application of W_2 proved to be most efficient in suppressing the weed flora in transplanted rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-2

Performance of herbicides for controlling weeds in direct-seeded rice in Shahdol district of MP

P.N. Tripathi, Mrigendra Singh, Alpana Sharma, Deepak Chouhan and Rishiraj Negi
JNKVV Krishi Vigyan Kendra Shahdol, Madhya Pradesh 484 001
Email: tripathikvk19@gmail.com

Rice is an important crop for food security. Weed completion is typically major bio-physical constraint in upland rice it frequently leads to significant yield losses. Sahdol district lies under Northern hill zone of Chhattishgarh. The major cropping system of the district is rice- wheat in irrigated condition. However, *Rabi* is fallow in areas where irrigation water is limited. Rice crop occupied about 1.0 lakh ha area in different conditions including low land and upland rice. As par record the productivity of rice in the district is about 38 quintal par ha which is very low. Among the several factors responsible for low production, untimely weed management is major problem in the district. Rice cultivation is high input responsive most of the farmers are not using recommended doses of inputs. Also, there was lack of proper weed management practice in upland rice. Direct-seeded rice is mostly cultivated in upland area where weed management is great challenge for increasing productivity. On farm trial was conducted at village Khetauli JNKVV, KVK Shahdol (MP) with objective to find out the efficacy of herbicides for controlling weeds in direct-seeded rice under medium land saturation. The treatment comprised of application of pyrazosulfuron 25 g/ha 3-7 days after sowing (DAS), fenoxaprop 9.3% 60 g/ha + chlorimuron + metsulfuron 4 g/ha at 25-30 DAS, bispyaribac-sodium 10% 25 g/ha at 25 DAS, 2 hand weeding at 20 to 40 DAS and weed check. Application of pyrazosulfuron 25 g/ha 3-7 DAS being at par with fenaxaprop 9.3% 60 g/ha at 30 DAS, fenaxaprop 60 g + chlorimuron + metsulfuron 4 g/ha at 25-30 DAS, hand weeding at 20 and 40 DAS recorded 15.7, 19.02 and 93.17% significantly higher grain yield as compared to fenoxaprop 9.3% 60 g/ha + chlorimuron + metsulfuron 4 g/ha at 25-30 DAS, bisparibac-sodium 10% 25 g/ha 25 DAS and weed check respectively. Application of pyrazosulfuron 25 g/ha 3-7 DAS was recorded maximum net return (` 31,115) with B:C ratio (3.6) compared to rest of the treatments. The major weed flora observed in upland rice in district Sahdol is *Echinchola colona, Echinochoa crus-galli, Cammelina benghalensis, Cyprus rotudus, Cyprus iria, Phylanthus niruri, Cynotis* spp. and *Cynodon dactylon.* It has been observed that weed problem is serious in upland rice because of no standing water prevalence in upland condition. Timely weed management in upland rice not only increases grain yield as well as significant increase in net return per unit area. Application of herbicide for timely weed management include pre- and post-emergence herbicides along with hand weeding was found most effective in controlling weeds and producing higher rice yield.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-3

Effect of different mulches on density and growth of weeds in direct-seeded hybrid rice

S.H. Lohale, V.N. Shetye, R.S. Shinde* and U.V. Mahadkar
College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth.
Dapoli, Maharashtra 415 712
**Email: rajkumarshinde51@gmail.com*

A field experiment was carried out on the Agronomy farm of College of Agriculture, Dapoli to find out the effect of different mulches on density and growth of weeds and yield of direct-seeded hybrid rice during *Kharif* 2017. The experiment was carried out in Randomized block design with three replications and was comprised ten treatments *i.e.*, M_1-no mulch and no weed management, M_2-no mulch with weed management, M_3-paddy straw mulch 5 t/ha at 20 DAS + one hand weeding at 40 DAS, M_4-*Glyricidia maculata* leaves mulch 5 t/ha at 20 DAS + one hand weeding at 40 DAS, M_5-black polythene mulch (7 micron), M_6-silver polythene mulch (7 micron), M_7-transparent polythene mulch (7 micron), M_8-black polythene mulch (25 micron), M_9-silver polythene mulch (25 micron) and M_{10}-transparent polythene mulch (25 micron). Results revealed that, treatment M_2 recorded significantly lower number of grasses, sedges, broad-leaf weeds and total weed flora than rest of the treatments except treatment M_9 for sedges at 30, 90 DAS and at harvest, treatments M_3 and M_4 for grasses and treatments M_3, M_4, M_5, M_6, M_8 and M_9 for sedges at 60 DAS. Among different mulches, treatment M_9 significantly reduced density of grasses, sedges, BLWs and total weed flora than rest of the treatments, except treatments M_8, M_6 and M_5 for grasses at 30 DAS, treatments M_8 and M_6 for sedges at 30 and 90 DAS, treatments M_8 for BLW's at 30 DAS and for total weeds at 90 DAS and at harvest, for grasses at 90 DAS and treatments M_8, M_6, and M_5 for BLW's at 90 DAS and at harvest. At 60 DAS treatment, M_3 significantly reduced the density grasses, BLWs and total weed flora than rest of the mulch treatments, except treatment M_4 for grasses and total weeds, and treatments M_4, M_8 and M_9 for BLW's. M_2 significantly reduced the dry weight of grasses, sedges, BLWs and total weeds compared to rest of the treatments except treatments M_3 and M_4 for grasses and treatments M_4 for sedges at 60 DAS. At 60 DAS among different types of mulches, M_3 and M_4 remained statistically at par with each other and found significantly superior over rest of the mulch treatments for dry matter weight of grasses, BLWs and total weed flora. In case of sedges, M_3 found significantly superior over rest of the mulch treatments. At harvest among different mulches, treatment M_9 recorded significantly less dry weight of grasses, sedges, BLWs and total weed dry weight than rest of the mulch treatments, except treatments M_8, M_6 and M_5 for grassesand treatment M_8 and M_6 for sedges and BLWs. M_9 recorded significantly higher grain, straw and total biological yield over rest of the treatments except treatments M_8, M_6 and M_5 for grain and straw yield and treatments M_8 and M_6 for total biological yield, which were statistically at par with treatment M_9.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-4

Floristic analysis and its impact on crop-weed interaction in paddy fields of Meghalaya

N. Premaradhya*, Vishram Ram[1] Tosh Korav[1] and K.S. Shashidhar
Central Agricultural University, Imphal, Manipur 795 004
[1]CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: premaradhya@gmail.com*

The present investigation was undertaken during two consecutive years (2016 and 2017) of *Kharif* season at agronomy farm, ICAR-RC NEH region, Umiam to determine the critical period for crop-weed competition and resource acquisition pattern with changing diversity and also to study the weed diversity pattern in rice fields of Ri-Bhoi district of Meghalaya using RS and GIS. The field experiment was laid out in RBD with 3 replications comprising 10 treatments *viz.,* weeds until 14, 28, 42, 56 days after sowing (DAS) and harvest; weed free until 14, 28, 42, 56 DAS and harvest. The second objective includes a random field survey, diversity indices analysis, development of spatial and attribute database of rice fields using high resolution satellite imagery and thematic weed diversity maps. The results revealed that the weed dynamics such as weed density, weed biomass, nutrient NPK removal by weeds was tended to decrease with increasing weeds free condition up to harvest. The growth attributes *viz.,* plant height, LAI and plant dry matter, chlorophyll content and yield attributes*, viz.* number of panicles/plant, number of filled grains/panicle, panicle weight, grain and straw yield and NPK content were realized highest with season long weed free treatment followed by weedy for the first 14 DAS later on weed free until harvest and weed free until 56 DAS. Based on the 5% RYL, the CPWC was between 9 to 56 DAS in 2016 and 14 to 57 DAS in 2017, whereas, the estimated critical period for upland rice at 10% RYL was between 17 to 43 and 24 to 44 DAS in 2016 and 2017, respectively. The significant but negative correlation was obtained between the RYL, spikelet sterility, weed biomass and NPK removal of from weed plants of respective treatment for grain yield. In objective II, among the weed species encountered in the survey under lowland and upland rice, the species, *Cyperus iria, Commelina diffusa* and *Echinochloa colona* were commonly distributed in both type of cultivation. The weed flora on number wise doesn't differ with each other counting around 21 (± 4) but by family wise the weeds are found vary in nature. Out of 21 wetland weeds recorded, the Cyperaceae and Poaceae had more than 5 species each whereas, in upland the weeds belong to 10 different families in which the family, Asteraceae with 10 species, followed by Poaceae was with four species. Results from weed diversity indices revealed that wide range (medium to high) of weed density was observed in Umling and upper Umsning block in both the years of study. Weed species were more evenly distributed in lowland than the upland rice sites. Though Umling block had high to moderate levels of diversity, no new weed species were present compare to other blocks of the district. The diversity values ranged from 3 to 10 species per sq. m in Species richness, Margleaf index (0.48 to 2.28), the Shannon (H') index (0.69 to 2.08), Simpson's index (0.01 to 0.9), Pielou's evenness (0.43 to 0.9) and parker index (0.21 to 0.81). Further, among the treatments, season long weed free treatment (T_{10}) was differed significantly and recorded higher gross return of ` 57,432; net return of ` 27,238 and B: C ratio of 0.90, higher REY, system productivity, monetary net returns and production efficiency but land use efficiency was recorded higher with weed free until 56 DAS during the study period.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-5

Evaluation of dual cropping and herbicide use for weed management in direct-seeded rice and its residual effect on succeeding lentil

Suryendra Singh*, S. Elamathi[1], Gautam Ghosh and Joy Dawson
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh 211007
[1]Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641003
Email: suryendraicar@gmail.com

A field experiment was conducted at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) farm during 2009 - 10 and 2010 - 11 to find out the most suitable weed-management practice and crop establishment method for realizing higher yield of direct-seeded rice (*Oryza sativa* L.) and its residual effect on succeeding lentil (*Lens culinaris*) crop. Treatments included four crop establishment methods, *viz*. transplanted rice, direct-seeded rice [DSR (Sole)], DSR + *Sesbania* and DSR + *Azolla* with two nitrogen levels, *viz*. 100 and 75% recommended dose of nitrogen (RDN); and three weed management practices, *viz*. pretilachlor plus 0.3 kg/ha at 2 days after sowing (DAS) followed by (*fb*) hand weeding (HW) at 45 DAS, HW twice at 20 and 45 DAS and no weeding. DSR + *Sesbania* and DSR + *Azolla* were comparable in terms of weeds density and dry weight, growth and productivity of rice. Conjoint cropping either of DSR + *Sesbania* or DSR + *Azolla* and manual incorporation of the latter at 37 DAS proved better in reducing the weeds population, increasing crop growth and productivity (4.05 and 3.94 t/ha) with 100% RDN, whilst, weed smothering efficiency was superior in DSR + *Azolla*. Pre-emergence application of pretilachlor plus 0.3 kg/ha at 2 DAS *fb* HW at 45 DAS registered lower total weed density (38.5/m^2) and higher weed control efficiency as well as markedly improved the growth and yield characters and grain yield (4.81 t/ha). DSR + *Sesbania* with 100% RDN and pretilachlor plus 0.3 kg/ha at 2 DAS *fb* HW at 45 DAS recorded maximum net profit (` 57,079/ha). It is concluded that direct seeding with dual cropping of DSR + *Sesbania* with 100% RDN and pretilachlor plus 0.3 kg/ha at 2 DAS *fb* HW at 45 DASis significantly best for improving productivity and profitability of direct-seeded rice in Prayagraj region of Eastern Uttar Pradesh. While, considering the residual effect of planting system of preceding *Kharif* season rice with nitrogen levels and weed management practices on succeeding lentil, the application of 100% RDF (recommended dose of fertilizers) recorded maximum yield and net returns with DSR + *Sesbania* + 100% RDN with pretilachlor plus 0.3 kg/ha at 2 DAS *fb* HW at 45 DAS, even though 75% RDF also registered comparable results. Furthermore, such judicious combination of organics (green manures) and inorganic fertilizers build-up the soil fertility in terms of organic carbon, N, P and K besides improving productivity and profitability of rice - lentil cropping system.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-6

Studies on effective pre mix herbicidal with weed management practices in direct-seeded rice under Western Ghat zone

H.M. Patil, P.S. Bodke, Y.J Patil, S.C. Wadile and D.V. Kusalkar

Zonal Agricultural Research Station, Western Ghat Zone, Igatpuri, Dist. Nashik Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722

Email: hemant_patil2006@rediffmail.com

The experiment on studies on effective pre mix herbicidal with weed management Practices in direct-seeded rice under western ghat zone was conducted at ZARS, Western Ghat Zone, Igatpuri, Dist. Nashik. The experiment consisted of eight treatments comprising of weedy check, weed free check, post-emergence application of bispyribac-sodium 25/ha at 15-25 DAS, fenoxaprop 75 g/ha at 15-25 DAS, fenoxaprop 75 g/ha + ethoxysulfuron 18 g/ha at 15-25 DAS, metsulfuron + chlormuron 4 g/ha at 25-30 DAS, tank mix application of bispyribac-sodium 15 g/ha + fenoxaprop 50 g/ha at 15-25 DAS, tank mix application of bispyribac-sodium 15 g/ha +ethoxysulfuron 50g/ha at 15-25 DAS. Result revealed that weed free check (T_2) recorded highest plant height (100.67 cm) and length of panicle (24.67) followed by the treatment tank mix application of byspyribac 15 g/ha+ fenoxaprop 50 g/ha at 15-25 DAS, metsulfuron + chlormuron 4 g/ha at 25-30 DAS and treatment fenoxaprop 75 g/ha + ethoxysulfuron 18 g/ha at 15-25 DAS wich was statistically at par within each other but recorded significantly superior over all the other treatments during the experimentation. As regards the grain yield, treatment tank mix application of byspyribac-sodium 15 g/ha + fenoxyprop 50 g/ha at 15-25 DAS recorded higher grain (4.03 t/ha) and treatment weed free check recorded significantly higher straw yield (3.44 t/ha) followed by treatment metsulfuron + chlormuron 4 g/ha at 25-30 DAS. Amongst the different treatments, Tweed free check has highest gross and net returns and B:C ratio (` 83,195, ` 46,439 and 2.26) than rest of the treatments. This treatment was followed by treatment T_7 *i.e* tank mix application of byspyribac-sodium 15 g/ha + fenoxaprop 50 g/ha at 15-25 DAS (` 72,944, ` 37,466 and 2.06) and treatment metsulfuron + chlormuron 4 g/ ha at 25-30 DAS (` 72,858, ` 37,374 and 2.06). Amongst the weed control treatments, tank mix application of bispyribac-sodium 15 g/ha + fenoxaprop 50 g/ha at 15-25 DAS recorded higher grain (4.03 t/ha) and treatment weed free check recorded significantly higher straw yield (3.44t/ha) followed by treatment metsulfuron + chlorimuron-ethyl 4 g/ha at 25-30 DAS.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-7

Management of weeds in transplanted rice

H.M. Patil*, N.V. Kashid, Y.J. Patil and D.V. Kusalkar
MPKV Rahuri, Ahmednagar, Maharashtra 413 722
Email: hemant_patil2006@rediffmail.com

An experiment entitled “management of weeds in transplanted rice” was conducted during *Kharif* 2014 at Zonal Agriculture Research Station, Western Ghat Zone, Igatpuri, Dist. Nashik. A field experiment consisted of ten treatments comprising of unweeded check, weed free and weed control methods, *viz*. pendimethalin 30% EC 1.0 kg/ha at 2-3 DAT, pretilachlor 50% EC 0.50 kg/ha at 2-3 DAT, metsulfuron-methyl 10% + chlorimuron-ethyl 10% WP 0.02 kg/ha at 25 DAT, pendimethalin 30% EC 1.0 kg/ha at 2-3 DAT + metsulfuron-methyl 10% + chlorimuron-ethyl 10% WP 0.02 kg/ha at 25 DAT, pretilachlor 50% EC 0.50 kg/ha at 2-3 DAT + metsulfuron-methyl 10% + chlorimuron-ethyl 10% WP 0.02 kg/ha at 25 DAT, pendimethalin 30% EC 1.0 kg/ha at 2-3 DAT + 1 hand weeding at 30 DAT, pretilachlor 50% EC 0.50 kg/ha at 2-3 DAT + 1 hand weeding at 30 DAT, metsulfuron-methyl 10% + chlorimuron-ethyl 10% WP 0.02 kg/ha at 25 DAT + 1 hand weeding at 45 DAT. The experiment was laid out in randomized block design with three replications. The midlate variety of rice variety Phule Samruddhi was transplanted during *Kharif* 2014 with recommended package of practices. The fertilizers dose applicable through Urea - DAP Briquettes that is 170 kg per ha. In the experimental plots dominant weed flora consisted of monocots as *Echinochloa colona* and *Cynodon dactylon* among grasses; *Cyperus iria* and *Cyperus defformis* among sedges while dicots like *Eclipta alba*, *Portulaca oleracea, Celosia argentea* and *Ludwigia parviflora*. On the basis of this study, for effective management of weeds in transplanted paddy, the pre-emergence application of pretilachlor 0.50 kg/ha at 2-3 DAT and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.02 kg/ha at 25 DAT in 500 liters of water is recommended as it has having lowest weight of dry matter of weed (15.3 g/m^2) with higher weed control efficiency (91.74%) and lower weed index (2.78) with significantly highest net returns (` 56,004/ha) and B : C ratio (2.0). From the above study for effective management of weeds in transplanted paddy, the pre-emergence application of pretilachlor 0.50 kg/ha at 2-3 DAT and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl 0.02 kg/ha at 25 DAT in 500 liters of water.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-8

Effect of crop establishment methods and weed management practices on weed parameters and yield of rice under the temperate conditions of Kashmir

Aijaz Nazir, M. Anwar Bhat*, Ashaq Hussain, Tauseef Ahmad Bhat, Fayaz Ahmad Bahar Bahar, and Suhail Fayaz

Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Wadura, Sopore, J&K, 193 201

**Email: anwaragri@gmail.com*

Rice is the primary food source for more than half of the world's population and is cultivated in the world over an area of about 158.8 million hectares with a production of 751.9 million tonnes annually (FAO, 2017). In Kashmir valley the shortage of labour and water are pressing farmers to explore the alternatives of conventional transplanting. Transplanting is the most dominant method of rice establishment in Kashmir valley. The area under transplanted rice in world is decreasing due to scarcity of water and labour. So, there is need to search for alternate crop establishment methods to increase the productivity of rice. Direct seeding reduces labour requirement, shortens the crop duration by 7-10 days and can produce as much grain yield as that of transplanted crop. The system of rice intensification was recently promoted as an alternative technology and resource management strategy for rice cultivation that offers the opportunity to boost rice yields with less external inputs. Weed competition is going to be the major constraint in achieving higher productivity. The effective control measures at initial stage of crop growth can help in improving the productivity of rice. A field experiment entitled 'effect of crop establishment methods and weed management practices on weed parameters and yield of rice (*Oryza sativa* L.) under the temperate conditions of Kashmir' was conducted during *Kharif* 2017-2018 at SKUAST-K, Wadura, Sopore Jammu and Kashmir. The experiment comprised of three crop establishment methods in main plots M_1-transplanting (TPR), M_2-direct seeding (DSR), M_3-system of rice intensification (SRI) and seven weed management practices in sub plots (W_1-butachlor, W_2-penoxsulam (22.5 g/ha), W_3-pyrazosulfuran-ethyl + pretilachlor (15 and 600 g/ha), W_4- bensulfuron-methyl + pretilachlor (60 and 600 g/ha), W_5-twice conoweeding/hand weeding, W_6-weed free and W_7- weedy check). The treatments were replicated thrice in a split plot design. The results revealed that among crop establishment methods, significantly lowest weed density (no./m^2) of 3.12 (11.89) and 2.90 (10.69) and weed dry weight (g/m^2) of 4.33 (21.84) and 4.12 (20.04) was recorded with transplanted method over SRI and direct-seeded rice during both the years. Among the herbicides tested penoxsulam 22.5 g/ha provided excellent control of weed species (grasses, sedges, BLW). Application of penoxsulam 22.5 g/ha recorded significantly lowest weed population (no./m^2) of 3.35 (11.76) and 3.16 (10.66) and weed dry matter (g/m^2) of 4.82 (24.55) and 4.57 (22.45), depicting higher weed control efficiency of 9.0 (80.15) and 9.10 (82.01)% during both the years. The data also revealed that crop establishment methods and weed management practices significantly influenced the grain and straw yield of rice. SRI method of crop establishment had resulted in significantly higher rice grain and straw yield over direct seeding and transplanted rice. Among the weed management practices, application of penoxsulam (22.5 g/ha) produced significantly higher grain and straw yield compared to other practices. Average grain yield increase with SRI was 16.66 and 18.19% and 7.5 and 9.43% over direct seeding and transplanting during 2017 and 2018, respectively. These findings led to the conclusion that for realizing higher and sustainable yield of rice under temperate conditions of Kashmir Valley, system of rice intensification proved to be better method of crop establishment and the application of penoxsulam 22.5 g/ha should centre efficient weed management in rice crop.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-9

Standardization of method of transplanting and weed management in rice for lower bhavani project command

Samba Siva Rao Desuri*, Kota Pravallika[1] and Mohammed A. Rafi[2]

Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641003

[1]Vinayaka Agricultural Diploma College, Andhra Pradesh 520 008

[2]Researcher, Crystal Crop Production Pvt. Ltd, Coimbatore, Tamil Nadu 607 005

**Email: samba.desuri@gmail.com*

The experiment was conducted at Agricultural Research Station, Bhavanisagar during September-October 2013-14 to evolve an effective and economic method of transplanting and appropriate weed management practices for rice. The experiment was laid out in randomized block design replicated thrice using rice Co (R) 50 as the test crop. The experiment consisted of three methods of transplanting, *viz.* manual line planting (25 × 25 cm), machine planting (30 × 15 cm) and conventional planting (20 × 10 cm) with three weed management practices like one way and two way weeding with power weeder or conoweeder at 10, 20, 30 and 40 DAT and PE pretilachlor 1.0 kg/ha + hand weeding at 40 DAT. Distinct reduction of total weed density (15.37/m^2) and weed dry weight (47.10 kg/ha) and higher weed control efficiency (97.18%) were observed in manual line planting with two way power weeder weeding. Manual line planting with PE pretilachlor 1.0 kg/ ha + hand weeding on 40 DAT registered significantly higher total weed density, weed dry weight and lower weed control efficiency among the weed management treatments in different methods of transplanting. The NPK removal by weed was significantly lower in manual line planting with two way power weeder weeding compared to other weed management practices. Higher level of NPK removal by weeds was recorded in manual line planting (25 × 25 cm) with PE pretilachlor 1.0 kg/ha + hand weeding on 40 DAT. Among weed management practices imposed in different transplanting methods with respect to mechanical weeding, the actual field capacity, field efficiency, per cent of crop damage and weeding efficiency were higher in machine planting with one way power weeder weeding. Higher number of productive tillers/m^2 (435/m^2) and filled grains/panicle (185) were observed in machine planting (30 × 15 cm) with one way power weeder weeding which was followed by machine planting with one way conoweeder weeding. Machine planting with one way power weeder weeding recorded higher grain yield (6863 kg/ha) and straw yield (8676 kg/ha). Lower grain and straw yield were recorded in conventional planting with PE pretilachlor 1.0 kg/ha + hand weeding on 40 DAT barring conventional planting with unweeded check. Lower cost of cultivation (` 28603/ha), higher gross income (` 99708/ha) and net return of ` 71105/ha with higher B:C ratio of 3.49 was achieved inmachine planting (30×15 cm) with one way power weeder weeding. Higher cost of cultivation was recorded in manual line planting with two way conoweeder weeding and lower gross return, net income and B:C ratio were recorded in conventional planting with PE pretilachlor 1.0 kg/ha + hand weeding on 40 DAT barring conventional planting with unweeded check. From the results of the field experiment, it could be concluded that machine planting (30 × 15 cm) with one way power weeder weeding at 10, 20, 30 and 40 DAT for better weed management, higher yield and economic returns in transplanted rice for lower Bhavani project command.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-10

Floristic composition of weeds in rice nursery soil amended with coal fly ash and vermicompost

Sanat Kumar Dwibedi*, Sanjat Kumar Sahu, Ravi Kumar Patnaik, and Basudev Behera
Odisha University of Agriculture and Technology, Bhubaneswar, Bhubaneswar, Odisha 751 003
**Enail: sanatdwibedi@rediffmail.com*

Fly ash has become the necessary evil, not only in India but all over the entire globe that needs safe, scientific, and productive use in agriculture and allied sectors, apart from its present use in land filling, and construction of building, and road. Its role in altering the physicochemical properties of soil is widely accepted by the researchers However, the researchers are in view of its application at lower concentrations only, keeping in view the adverse microbial activities and heavy metal toxicity at higher levels. Research results have shown higher productivity and profitability due to fly ash, and vermicompost application, at varying levels in many crops, including rice but studies on the floristic dynamics of weeds were lagging behind. An experiment was conducted in the West Central Table Land Zone, Odisha, India during March to May 2017 with factorial complete randomized design to study the effect of fly ash and vermicompost on floristic composition of weeds in rice nursery soil. For raising rice seedlings, the poly-pots were filled in with fly ash, vermicompost, and virgin soil at 0, 20, 40, 60, 80 and 100% by weight giving rise to 21 treatment combinations that were replicated thrice. Fly ash and vermicompost at different levels had significant influence on the floristic composition of weeds in rice-nursery. No weed could emerge in pots containing fly ash and soil only *i.e.* in absence of vermicompost, except in 100% soil with only very limited weed flora. The maximum number of broadleaf weeds emerged in pot with 80% vermicompost and 20% soil followed by 60% vermicompost and 40% soil. But, the maximum number of grasses and sedges emerged in pots with 100% vermicompost so also in soil with 60% vermicompost by weight. The cumulative floristic composition of weeds recorded the highest value in pots with soil containing 60% vermicompost. However, the highest dry matter of weeds was recorded in pots with 100% vermicompost. Among the grasses, *Brachiaria reptans*, *Echinochloa colona*, *Echinochloa crush-galli*, *Cynodon dactylon*; among the sedges, *Cyperus rotundus*, *Cyperus difformis*; and among the broadleaf weeds, *Phyllanthus niruri*, *Ludwigia parviflora*, *Scoparia dolcis*, *Chenopodium album*, *Ammannia baccifera*, and *Phyllanthus urinaria* were prominent. In absence of soil, *Cynodon dactylon* was absent but *Echinochloa sps*. was predominent. *Brachiaria reptans* was absent with 60 and 80% substitution of vermicompost by fly ash. *Cyperus difformis* was more adaptable compared to *Cyperus rotundus* due to its wider existence in test-substrates. Among broadleaf weeds, both species of *Phyllanthus* were abundantly present.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-11

Productivity of rice-rapeseed cropping system in Manipur valley as influenced by integrated weed and nutrient management practices

Priyanka Irungbam, L. Nabachandra Singh and Kumar Sambhav Giri
College of Agriculture, Central Agricultural University, Imphal, Manipur 795 004
**Email: priyanka.irungbam@gmail.com*

Rice has made significant contribution to increase food production in India. Intensive cultivation of rice has caused excessive use of agrochemicals and pesticides and release of higher carbon dioxide to the environment. This has led to go for integrated approach of weed and nutrient management in rice. In view of this, the field experimentation entitled, productivity of rice-rapeseed cropping system in Manipur valley as influenced by integrated weed and nutrient management was carried out at the Research Farm of College of Agriculture, Central Agricultural University, Imphal during two consecutive years i.e. *Kharif* and *Rabi* seasons of 2016-17 and 2017-18. The soil of the experimental field was clayey in texture. The soil was medium in fertility with good drainage facility with 5.34 pH, high in organic carbon with 1.89%, 280.88 kg/ha available nitrogen, 32.20 kg/ha available P_2O_5 and 290.45 kg/ha available K_2O, respectively. The experiment was laid out in a factorial randomized block design (FRBD) in three replications. The treatments comprised of five levels of integrated weed management practices, *viz*. pyrazosulfuron-ethyl 50 g at 7 DAS (W_1), pyrazosulfuron-ethyl at 30 g at 7 DAS + 1 Hand weeding (HW) at 40 DAS (W_2), pyrazosulfuron-ethyl at 30 g at 7 DAS + 1 Mechanical weeding (MW) at 40 DAS (W_3), pyrazosulfuron-ethyl at 30g at 7 DAS + 2, 4-D0.75 kg at 40 DAS (W_4) and Control (W_5) and three levels of integrated nutrient management practices *i.e.* 50% N from RDF + 6 t FYM (N1), 50% N from RDF + Azolla (dual crop) at 10 t/ha + 3t FYM (N_2) and 100% RDF (N_3). The pooled data revealed that among the weed management practices, application of pyrazosulfuron-ethyl at 30 g at 7 DAS + HW at 40 DAS (W2) gave better yield attributes like more number of effective tillers per plant, longer panicle, more number of spikelets and filled grains per panicle and highest grain yield of 4.83 t/ha and straw yield of 6.82 t/ha but it was significantly at par with the plot receiving pyrazosulfuron-ethyl at 30 g at 7 DAS + MW at 40 DAS (W3) with grain and straw yield of 4.67 t/ha and 6.31 t/ha. Similarly, in the succeeding crop of rapeseed, the plots which received the treatments, W_2 and W_3 in preceding *Kharif* rice gave better yield attributes like more number of siliqua per plant and more number of seeds per siliqua and highest seed yield of 988.60 and 988.03 kg/ha, respectively with no significant difference. Among the nutrient management practices, highest grain yield of 4.32 t/ha was obtained with the application of 50% RDF+ 6t FYM (N1) followed by the application of 50% RDF+ Azolla (dual crop) 10 t/ha + 3t FYM (N_2) with 4.19 t/ha grain yield in *Kharif* rice but with no significant difference. The treatments N_1 and N_2 also produced beneficial residual affect and gave higher yield attributes and yield in succeeding rapeseed crop. The economics of the cropping system showed that the plot receiving pyrazosulfuron-ethyl at 30 g at 7 DAS + 1 MW at 40 DAS with 100% RDF (W_3N_3) recorded the highest B:C ratio of 1.50.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-12

Chemical weed management in direct-seeded rice

Kartikeya Choudhary*, V. K. Srivastava, Anoop Kumar Devedee, Ashvin Kumar Meena and Kamlesh Meena

Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh 221 005

**Email: kartikeyachoudhary2011@gmail.com*

Rice (*Oryza sativa* L.) is the world's most important crop and is a staple food for more than half of the world's population as well as India. In present time due to resource constraints, especially water and labours, direct seeding under dry condition is now emerging new trend in rice cultivation. In recent years, due to severe water and labour scarcity, farmers are changing their rice establishment method from transplanting to direct seeding. Direct seeding offers such advantages as faster and easier planting, reduced labour and less drudgery, earlier crop maturity by 7-10 days, more efficient water use and higher tolerance of water deficit, less methane emission and often higher profit in areas with an assured water supply. Low productivity of direct-seeded rice is mainly due to heavy crop-weed competition due to early emergence of weeds along with crop seedling due to favorable soil conditions and their rapid growth result in severe competition for nutrients, space, and light. Direct-seeded rice is highly infested by weeds. In direct-seeded rice (DSR) cultivation, weed is the major constraint mainly due to absence of puddling in field. The yield loss due to weed interference is huge, may be up to 100%. The most common weed flora found in direct-seeded rice was *Dactyloctenium aegyptium*, *Echinochloa colona*, *Echinochloa crus-galli*, *Leptochloa chinensis*, *Paspalum distichum* and *Cynodon dactylon* as grassy weeds, *Ammannia robusta*, *Digera arvensis*, *Eclipta prostrate*, *Euphorbia hirta*, *Phyllanthus niruri*, *Trianthema portulacastrum*, *Lindernia* spp. as broadleaved and *Cyperus difformis*, *Cyperus iria* and *Cyperus rotundus* as sedges. These weeds could be controlled through various methods. Manual method is though very common but cost intensive. Herbicides when applied alone are although economical but may have limitation of resistance development and shift in weed flora etc. Therefore, there is a need to use high efficacy herbicides in combination coupled with broad spectrum nature to control the complex weed flora in rice. Direct-seeded rice systems are subject to greater weed pressure than conventional production systems. In traditional irrigated lowland rice systems, rice has a 2-3 week 'head start' over weeds, which favours rice in competition against weeds that have not emerged yet at transplanting and the water layer after transplanting effectively suppresses the emergence and growth of most weed flora, including upland and semi-aquatic weeds. The lack of 'head start' and the absence of flood water make aerobic and upland rice more weed-infested than irrigated lowland rice. Chemical weed management is a very effective tool for controlling weeds in direct-seeded rice. Various studied shows that pre-emergence application of pendimethalin 1.0 kg/ha and pretilachor 1.0 kg/ha and early post-emergence pyrazosulfuron-ethyl *fb* bispyribac-sodium herbicide found to be most effective against suppression of weed population of different weeds.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-13

Weed management expenses under diversified rice-wheat cropping systems

Gurpreet Singh*, Pawan Pathania, S.S. Rana, V.K. Sharma and Navdeep Singh
Department of Agronomy, Forages and Grassland Management, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062
**Email: gurpreetpitho@gmail.com*

By means of diversification of rice- wheat system with different crops the monetary expenses and gains also changes. The present study was aimed at having an assessment on economic trends in rice based diversified cropping systems. An appraisal of associated returns and expenses under different cropping systems *viz*. rice – wheat, rice – pea – summer squash', 'okra– radish – onion', turmeric– pea – summer squash', 'rice – lettuce – potato', rice – palak – cucumber, rice –broccoli– radish and has been made during *Kharif* and *Rabi* 2016-17. In all 24 weed species invaded different cropping systems in both seasons. Irrespective of the cropping system, *Ageratum* sp. (28%) *Cynodon dactylon* (20%) and *Commelina benghalensis* (19%) were the predominant weeds during *Kharif*. In *Rabi*, *Phalaris minor* (63%) was the most dominating weed followed by *Fimbristylis* sp. (10%), *Spergulla arvensis* (6%) and *Ageratum* sp. (4%). Highest expenses on managing weeds were associated with 'okra – radish - onion' (27,722 `/ha) followed by 'turmeric – pea – summer squash' (25,360 `/ha) mainly due to labour intensive weeding in onion and mulching in turmeric, respectively in addition to expenses on herbicides in okra, radish, onion and peas. Expenses in 'rice – broccoli – radish' (23,895 `/ha), 'rice – pea – summer squash' (21,655 `/ha), 'rice – lettuce – potato' (21,362 `/ha) and 'rice – palak – cucumber' (19,415 `/ha) were also higher because of higher cropping intensity than other cropping systems. Lowest expenses were in rice – wheat system (7,228 `/ha) as there was no imposition of hand weeding in *Rabi*. Percent expenses on weed management out of the total cost of cultivation was highest in 'okra – radish - onion' (71.7%), followed by 'rice – broccoli – radish' (68.0%). Colocasia – pea + coriander' resulted in significantly higher RGEY (24.5 t/ha) due to higher tonnage of colocasia. This system was followed by 'rice – lettuce – potato' (19.1 t/ha) and 'okra – radish – onion' (17.1 t/ha) owed to higher tonnage of lettuce and potato and radish and onion, respectively. Lowest RGEY (9.6 t/ha) was obtained in 'rice- wheat' cropping system.Colocasia – pea + coriander' gave highest net returns (1,81,446 `/ha) among all the cropping systems followed by 'rice – lettuce – potato' (96,930 `/ha), 'okra – radish – onion' (92,054 `/ha), 'rice – wheat' (80,805 `/ha), 'rice – pea – summer squash' (72,617 `/ha), 'rice - broccoli – radish' (58,627 `/ha), 'rice – palak –cucumber' (41096 `/ha) and 'turmeric – pea – summer squash' (2,12,39 `/ ha). This clearly signifies the importance of cropping system or crop rotation approach to increase the net income of farmers from the existing available resources.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-14

Efficacy of post-emergence herbicide for weed control in transplanted rice

Priya Kochale*, P.B. Sharma, Pinki Mehra
Department of Agronomy, college of Agriculture Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
**Email: priyakochale111@gmail.com*

Rice (*Oryza sativa* L.) is the most important staple food crop for more than half of the world's population. Now a days the production of rice has increased but its yield potential has not fully realized due to improper crop management. Unchecked weed growth causes severe reduction in grain yield. Generally puddling and sub-emergence condition of paddy field is created to reduce the weed problem in transplanted rice. However, it is not always possible to maintain the submergence condition due to erratic rainfall or poor availability of irrigation facility. Besides that, the water loving weeds like sedges as well as grasses and broadleaved weeds get associated with the crop. As a consequence weeds emerge and compete for resources such as nutrient, moisture and solar radiation and in turn yield and quality is reduced. Weed competition is one of the most important factor limiting the yield of rice. Competition between crop and weed begins when the supply of any one of the growth factor is limiting and fall below the demand of both crop and weed when they grow in close proximity. Under such situation, application of herbicide is the only way to manage weeds. Herbicide application offer selective and economical control of weeds right from the initial stages, giving the crop a good start. Keeping the facts in mind a field experiment entitled efficacy of post-emergence herbicide for weed control in transplanted rice was conducted during *Kharif* 2019 at research farm college of agriculture Jawahar Lal Nehru Krishi Vishwa Vidyalaya Jabalpur (M.P.) The experiment was laid out in a randomized block design with 8 treatment comprising bispyribac-sodium (10% SC) 25 g/ha at 15 DAT, fenoxaprop-p-ethyl80 g/ha at 25 DAT, fenoxaprop-p-ethyl + 2-4,D (80 +580) g/ha at 30 DAT, metsulphuron (10% SC) +chlorimuron (10%SC) (Almix)2 (1+1) g/ha at 25 DAT, 2-4-Dimethyle amine (58% SC) 580 g/ha at 30 DAT,hand weeding at 20 and 40 DAT, cono-weeder at 20 and 40 DAT and weedy check. The treatments were replicated three times. The yield attributes were recorded at the time of maturity. The predominant weed flora which infested the experimental plot was *Echinochloa colona, Alternanthera sessilis, Cynodon dactylon, Cyperus rotandus, Cyperus iria.* Result of the investigation revealed that all weed management treatment were found significantly superior to weedy check in reducing the growth of weed and increasing growth and yield of rice. Among herbicide treatment Bispyribac-sodium 25 g/ha at 15 DAT resulted in higher grain yield over the rest of the treatments.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-15

Growth, yield and economics of rice based cropping system as influenced by different chemical weed management practices

Rupen Sharma, Pratonu Bandyopadhyay*, Parthendu Poddar
Discipline of Agronomy, Uttar Banga Krishi Viswavidyalaya (UBKV), Pundibari, Cooch Behar, West Bengal 736 165
**Email: pratonu31@gmail.com*

An experiment was carried out at UBKV Farm Pundibari, Cooch Behar, West Bengal during rainy season to study the most effective chemical method of weed management practices in *Kharif* transplanted rice (Var.—*'MTU 1075'*) - rapeseed (Var.—*'B-9'*) cropping system in *Terai Zone* of West Bengal. The experiment was laid out in randomized block design having twelve treatments replicated thrice. Treatments were T_1: Weedy check/Control, T_2: Weed free, T_3: bispyribac-sodium 10% SC 20 g/ha at 14 DAT, T_4: bispyribac-sodium 10% SC 30 g/ha at 14 DAT, T_5: butachlor 1.5 kg/ha at 3-5 DAT, T_6: pendimethalin 1.0 kg/ha at 3-5 DAT, T_7: pretilachlor 0.60 kg/ha 2-3 DAT + 2,4-D sodium salt 0.50 kg/ha at 30 DAT, T_8: butachlor 1.5 kg/ha at 3-5 DAT + 2,4-D sodium salt 0.50 kg/ha at 30 DAT, T_9: metsulfuron--methyl 20% WP 8 g/ha at 14 DAT, T_{10}: pretilachlor 0.60 kg/ha 2-3 DAT + almix 20 g/ha at 21-25 DAT, T_{11}: butachlor 1.5 kg/ha at 3-5 DAT + bispyribac- sodium 10% SC 20 g/ha at 21-25 DAT and T_{12}: Almix 20 g/ha at 21-25 DAT. During 30, 45 and 60 DAT lowest weed dry weight, lowest weed index and highest weed control efficiency were shown by T_2 i.e. weed free. Among different herbicidal treatments, T_{11} recorded significantly lower weed dry weight, higher weed control efficiency and lower weed index at all the stages of crop growth being statistically at par with T_4 and T_3. Control treatment came out as the worst. No herbicide had any phytotoxic effect on crop plants at any stage of the crop.Almost all the growth attributes, yield attributes and yield of rice as well as rapeseed exhibited the best performance with the treatment weed free (T_2). The maximum grain yield of rice and seed yield of rapeseed 5.07 t/ha and 1067.4 kg/ha under T_2 followed by herbicidal treatment T_{11} recording 4.94 t/ha and 1061.9 kg/ha, respectively. The percentage increase over control in rice yield and rapeseed yield were recorded 145% and 77% under T_2 treatment followed by herbicidal treatment T_{11} (139% and 76% respectively). In rice-rapeseed cropping system, highest total variable cost of cultivation (` 74800/ha) was incurred in $T_2$ followed by $T_4$ (` 65,494/ha) and T_{11}(` 65,172 /ha) respectively. Maximum gross return (` 128433/ha) was obtained from T_2 followed by T_{11} (` 1,26,029 /ha) and $T_4$ (` 1,21,888/ha) respectively. However, highest net return (` 60,857 /ha) was obtained from $T_{11}$ followed by $T_4$ (` 56,394 /ha). The Incremental Cost Benefit Ratio (ICBR) in rice- rapeseed cropping sequence were recorded maximum under T_{11} (1: 0.93) followed by T_4 (1: 0.86) herbicidal treatment combinations. So, it can be concluded that the treatment comprising combination of pre-emergence and post-emergence herbicide like T_{11} or application of higher dose of efficient and highly effective post-emergent herbicide molecule like T_4 can be opted for sufficient control of weeds in transplanted *Kharif* paddy in *terai*zone of West Bengal to maximize the economic return.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-16

Weed management in direct-seeded rice under Bhadra Command area of Karnataka

O. Kumara and C.S. Abhishek Gowda

All India Co-ordinated Research Project on Integrated Farming System, AHRS, Kathalagere (UAHS, Shivamogga, Karnataka), Channagiri, Davangere, Karnataka 577 219

**Email: kumarabar@gmail.com*

Rice being important cereal food crop in most of the command areas, there is a lot of scope for introduction of direct-seeded rice. Principal of direct seeding of rice is a crop establishment method which consists of sowing seeds directly to the main field rather than replanting of seedlings grown in nurseries to puddled field. Under such condition weeds are the major biotic constraints and compete for moisture, nutrients, and light that would result in 0 to 100% reduction in yield. In direct-seeded rice establishment method the crop and weeds emerge simultaneously at early growth period causing more completion. In this view, a field experiment was conducted during *Kharif*- 2018 at Agricultural and Horticultural Research Station, Kathalagere with twelve treatments with three replications combination under irrigated condition of Bhadra Command Area of Karnataka coming uder the jurisdiction of University of Agricultural and Horticultural Sciences, Shivamogga *viz.*,inter cultivation, pre-emergent (PE) herbicides, *viz.* pretilachlor 30.7 EC, pendimethalin 38.7 CS, oxadiargyl 80% WP and post-emergent (PoE) herbicides *viz,* bispyribac-sodium 10% SC, chlorimuron--ethyl + metsulfuron-methyl 20 WP and ethoxysulfuron 15 WDG integrated with or without four hand weeding practices at 15 days interval and weedy check was included and was laid outin RCBD.The predominant weed flora observed in the experimental site were grassyweeds *viz., Echinochloa crusgalli, Echinochloa colona, Digitariasan guinalis,* Sedges, *viz. Cyperus rotundus, Cyperus iria,* and broad-leaf weeds, *viz. Digera arvensis, Physallis minima.* The experimental results revealed that inter cultivation *fb* hand weeding at 20 and 40 DAS recorded lower weed population, weed dry weight, weed index (1.81) and higher weed control efficiency (76.89 to 89.29%) with same treatment combination recorded significantly higher growth and growth attributes, *viz.* plant height, number of tillers, number of leaves, leaf area, LAI and total dry mater production. Higher grain yield (5212 kg/ha), straw yield (5928 kg/ha) and major nutrients uptake by crop also recorded in same treatment combination. These results are on par with inter-cultivation at 20 DAS *fb* bispyribac-sodium 10% SC 20 g/ha. Among herbicide combination treatments, pendimethalin 38.7 CS 0.75 kg/ha PE *fb* bispyribac- Sodium 10% SC 20 g/ha PoE recorded significantly higher growth and yield attributes without any phytotoxic effect to the crop. The economic return (B: C ratio) [2.82] was maximum in treatment with pretilachlor 30.7 EC 0.3 kg/ha with safener PE *fb* inter-cultivation at 40 DAS as compared to other treatment combinations. The residual study of herbicides on soil microbial population and succeeding crop showed no deleterious effect.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-17

Management of weed dynamics under different agro-ecosystems in direct-seeded rice in Eastern Madhya Pradesh

K.K. Agrawal, Moh. Naqib Haidari and Manish Bhan
Department of Agronomy, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
**Email: kkagrawal59@gmail.com*

Direct-seeded rice can be introduced as a possible option for transplanted rice in Eastern Madhya Pradesh however, weed emerges in several flushes with more diversity during entire crop growth cycle thereby competing crop plants, and affecting grain yield. Efficacy of different herbicides (Byspyribac- sodium 10% SC) at 17, 22 and 27 g ai/ha, fenoxaprop-p-ethyl (6.7% EC) at 50 and 58 g ai/ha with weed free and control) for controlling weed species under rainfed and irrigated agro-ecosystems was evaluated in a field rice with cultivar MTU 1010) experiment during *Kharif* 2018 at Jabalpur, Madhya Pradesh. The experiment was laid out in randomized block design (RBD) with three replications. The soil of the experiment field was sandy loam clay in texture. The NPK contents in the soil were medium with neutral pH. Total amount of rainfall received 1002 mm in total 37 number of days. The results revealed that dominant weed species include *Echinochloa colona*, *Cyperus iria* and *Alternanthera sessiles* were prominent in both the agroecosystems. At 30 days after herbicide application, *E. colona* density was non-significant (6.5-7.2/m^2) among the agro-ecosystems. Similar was the situation with *C. iria* (10.4/m^2) and *A. sessiles* (13.5/m^2). Among herbicidal treatments at 30 days, fenoxaprop-p-ethyl at 58 g ai/ha reduceed significantly *E. colona* population among the other treatments; whereas byspyribac-sodium at 27 g/ha reduce significantly *C. iria* and *A. sessiles* population. The weed control efficiency exhibited maximum in irrigated (95%) than rainfed (92%) rice, while byspyribac-sodium at 27 g/ha exhibited maximum efficiency in controlling weeds. The weed index was minimum in byspyribac-sodium at 22 g/ha treatments among both rainfed (11.5%) and irrigated (10.5%) agroecosystems. Among all the treatments, weed density was minimum in weed free and maximum in weedy treatments. The grain yield was maximum in hand weeding (4020 kg/ha) in irrigated and (1990 kg/ha) under rainfed and minimum in weedy check (1700 kg/ha) in irrigated and 953 kg/ha under rainfed) treatments among both the agro-ecosystems. Among herbicidal treatments, byspyribac- sodium at 22 g/ha exhibited maximum grain yield under both irrigated (3596 kg/ha) and rainfed (1760 kg/ha) systems. The treatments need further evaluation with the other mixture combinations for controlling weeds effectively in the Kymore Plateau and Satpura Hills Zone of Madhya Pradesh.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-18

Impact of long term conservation agriculture on soil physical and chemical properties under cereal based systems of North West India

Dibakar Roy*, Ashim Datta[1], H.S. Jat[1], Madhu Chaudhary[1], P.C. Sharma[1], Shobha Sondhia and P.K. Singh

ICAR-Directorate of Weed Research, Maharajpur, Jabalpur, Madhya Pradesh 482 004

[1]ICAR-Central Soil Salinity Research Institute, Karnal, Haryana 132 001

**Email: dibakar499176@gmail.com*

Long term conservation agriculture (CA) practice improves soil properties thus enhances overall soil quality and ecosystem productivity vis-a-vis sequester atmospheric carbon in soil. A study was conducted to evaluate the effect of long term CA practices on soil physical properties at CSSRI-CIMMYT research platform, Karnal. The experiment was laid out with six treatments namely (i) farmers' practice with conventional till puddle transplanted rice (TPR)-conventional till wheat (CTW) (ii)) TPR-zero till wheat-mungbean (ZTWMb) (iii) Zero till direct-seeded rice (ZTDSR)-ZTWMb (iv) zero till maize (ZTM)-ZTWMb (v) ZTDSR-ZTWMb + sub-surface drip (SSD) and (vi) ZTM-ZTWMb + SSD. Soil samples were collected from 0-5, 5-15 and 15-30 cm soil depths. ZTDSR-ZTWMb recorded significantly lower bulk density (BD) of 1.39 and 1.58 g/cm^3 in 0-5 and 5-15 cm soil depth whereas highest BD was observed at ZTDSR-ZTWMb +SSD and ZTDSR-ZTWMb + SSD (1.54 and 1.70 g/cm^3) at both 0-5 and 5-15 cm soil layer, respectively. ZTDSR-ZTWMb + SSD and ZTM-ZTWMb + SSD treatments showed significantly higher infiltration rate (1.48 and 1.17 cm/hr respectively) followed by ZTM-ZTWMb and ZTDSR- ZTWMb (0.95 and 0.83 cm/hr) and lowest observed in TPR-CTW (0.5 cm/hr). Higher cumulative infiltration was observed in ZTM-ZTWMb + SSD followed by ZTDSR-ZTWMb + SSD. Soil penetration resistance (SPR) values start increasing from 15-20 cm depth and highest SPR was observed in TPR- ZTWMb (3.18 MPa) followed by TPR-CTW (2.67 MPa). Lower penetration resistance associated with CA based ZTDSR-ZTWMb + SSD (2.17 MPa) and ZTM-ZTWMb + SSD treatments (2.09 MPa). Long term zero tillage and residue incorporation practice resulted accumulation of higher soil organic carbon (SOC) in CA based ZTDSR-ZTWMb (10.6 g/kg) followed by ZTM-ZTWMb + SSD (9.6 g/kg) in 0-5 cm soil and at 5-15 cm soil, accumulation of SOC was highest in ZTDSR-ZTWMb (7.90 g/kg) followed by ZTM-ZTWMb (7.30 g/kg). Available nitrogen content was increased by 23-50 and 64-98% and available potassium content by 13-28 and 42-71% in 0-5 and 5-15 cm soil depth respectively in CA based treatments. Thus our study suggests that long term CA practice with diversified cropping system has significant role in improving soil physical and chemical properties.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-19

Weed management in rice-based cropping system under high rainfall zone of Konkan region of Maharashtra

S.S. Pinjari*, P.S. Bodake, V.A. Rajemahadik, V.G. Chavan, V.V. Sagvekar and A.S. Pol
Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra 415 712
**Email: pinjari94222@gmail.com*

Rice (*Oryza sativa* L.) is the main staple food crop of Konkan Region of Maharashtra. In recent years, the rice-based cropping system fatigue intensive tillage and residue burning has deteriorated the natural resource base, which influence the crop yield, losses of soil and environment degradation. Amongst the various factors weeds are one of the responsible factor for production of rice cropping system, causing enormous losses in yield and quality of crop if not managed timely can increase the cost of production. The experiment was laid in split plot design with three replications in consecutive years 2015-16, 2016-17 and 2017-18 on the farm Department of Agronomy, college of Agriculture, Dapoli. Main plot treatments consist tillage methods for *Kharif*- rice, *viz.* T_1- conventional tillage transplanted (CTT), T_2- CTT, T_3- CT (direct -seeded), T_4- zero tillage (ZT) (direct-seeded), T_5- ZT (direct-seeded) and during *Rabi* (mustered) grown with CT, ZT, CT, ZT, RZT (R-residue) and in summer (Cowpea) ZT, ZT, ZT, ZT, However in sub-plot treatment various weed control measures for *Kharif*- Rice, *viz.* W_1: oxadiargyl 0.1 kg/ha (PE), W_2: oxadiargyl 0.1 kg/ha PE + HW at 40 DAS/DAT, for *Rabi* (mustered), *viz.* W_1: pendimethalin 0.5 kg/ha PE, W_2: Pendimethalin 0.5 kg/ha PE+ HW at 30- 40 DAS while in respect to summer (Cowpea), *viz.* W_1: pendimethalin 1.0 kg/ha PE, W_2: pendimethalin 1.0 kg/ha PE + HW at 30 DAS and W_3: weedy check during all the seasons. Result reveals that the number of tillers at harvest, grain and straw yield of rice was significantly influenced by different tillage practices. The treatment T_1 (CT: transplanted rice) and T_2 (CT: transplanted rice) remained at par with each other and recorded significantly maximum number of tiller as well as grain and straw yield of rice as compared to all other tillage practices during all the years of experimentation and in the pooled results. As regards weed control measures integration of oxadiargyl + 1 HW at 40 DAS/DAT recorded significantly higher number of tillers during the year 2015 and pooled results, as well as grain yield during the year 2017 than application of oxadiargyl alone and weedy check while growth and yield parameters were remain at par with the application of oxadiargyl + 1 HW at 40 DAS/DAT and oxadiargyl alone during rest of the years. The data in relation to economics revealed that the economics of the different treatment combinations, T_5W_1 (ZT (direct -seeded) – ZT + residue – ZT + pendimethalin 1.0 kg/ha recorded higher net returns (` 48,173.54) with B:C ratio 2.05 followed by $T_4W_1$ (ZT (direct-seeded) – ZT – ZT + pendimethalin 1.0 kg/ha treatment combination with net returns of ` 42,891.82/- with B:C ratio 1.93. From three years study it can be concluded that, cultivation of all crops under zero tillage with application of pre-emergence herbicide oxadiargyl for *Kharif* rice and pendimethalin for *Rabi* mustard and summer cowpea reduced weed growth with increase in total REY of the rice – mustard – cowpea cropping system under Konkan region of Maharashtra.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-20

Weed management strategies in rainfed rice production in central india – A review

Badal Verma*, Manish Bhan, V.K. Shukla, M.L. Kewat, V.B. Upadhyay and Bheru Lal Kumhar
Department of Agronomy, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
Email: Badalv82282@gmail.com

Rice *(Oryza sativa* L.*)* is a major *Kharif* season crop of eastern Madhya Pradesh (MP), grown in an area of 2.02 million hectare, production of 3.58 million tonnes with an average yield of 1.7 t/ha. Rainfed rice production may be a common practice due to fewer availability of water in the coming years, thereby adapting strategies for managing it. The strategies include new techniques for applying fertilizer, seeds, variety, irrigation and weeds however, weed is a major constraint in this type of rice, as weed compete and dominate well with rice plants under alternate wetting and drying in rainfed situation. In Madhya Pradesh, common weed flora include *Echinochloa crusgalli* (barnyard grass), *E. colona* (jungle rice), *Cyperus iria* (yellow nut sedge), *C. rotundus* (purple nut sedge), *Amaranthus spinosus* (spiny pigweed), *Cynodon dactylon* (bermuda grass), *Eclipta alba* (false daisy), *Fimbristylis miliacea* (forked fimbry), *Dactyloctenium* (crowfoot grass), *Digiteria* sp. *(*crab grass), *Commelina benghalensis* (benghal dayflower). Weed management in rice is mostly herbicide based with adaptation of chemicals. Hand-weeding was found to be effective in all methods of rice establishment however, it is time consuming and costly because labour is becoming scare and unavailable. Due to industrialization, labour constraints at peak growth period, small family size and under specific situations where weeds are very difficult to be removed manually, the herbicide use becomes inevitable. Regular use of the same herbicide year after year has led to problem of herbicide resistance. The sole dependence on herbicide of single mode of action is also not advisable as it has contributed to shift towards difficult to control weeds and rapid evolution of multiple herbicides resistance, which is a threat to rice production. Field experiment was conducted at Agricultural Engineering Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, for *Kharif* season of 2019 to study the efficacy of different herbicides applied in rainfed rice. Several herbicides are bispyribac-sodium, fenoxaprop-p-ethyl, fenoxaprop-p-ethyl plus penoxsulam, cyhalofop plus penoxsulam, bispyribac-sodium plus metsulfuron-methyl plus chlorimuron-ethyl and triafamone plus ethoxysulfuron. Application of cyhalofop plus penoxsulam and bispyribac-sodium plus metsulfuron-methyl plus chlorimuron-ethyl resulted in better weed control after herbicide application. There were various methods of weed control as like best management practices way forward to effective weed control in rainfed rice. The need for developing location- specific, sustainable, integrated weed management practices followed by disseminating of technologies need to be emphasized.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-21

Study of herbicide mixtures, its quantum of phytotoxicity and effect on soil microbes in wet direct-seeded rice

Sunita Meher*, Sanjoy Saha[1], Nitish Tiwari and Ashirbachan Mahapatra
College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh492 012
[1]ICAR-NRRI, Cuttack, Odisha 753 006
*Email: *sunitameher60@gmail.com*

Herbicides or mixtures are one of the promising options of weed management in direct-seeded rice as it is characterized by floristically diverse weed communities despite of fact that some herbicides show some prejudicial effect like phytotoxicity, weed flora shift, herbicide resistance and deleterious effect on soil health. So, to study the phytotoxicity of herbicide mixtures and its effect on soil microbes, an experiment was conducted at Institute Research Farm of ICAR-National Rice Research Institute, Cuttack (Odisha) during *Kharif* season of 2017 with the test rice variety '*CR Dhan 203*'. The experiment was laid out in Randomized block design (RBD) with three replications and twelve treatments, *viz.* nine herbicide mixtures (azimsulfuron 50% DF+ bispyribac sodium 10% SC at (22+25) g/ha, flucetosulfuron 10% WDG (w/w) + bispyribac-sodium 10% SC at (25+25) g/ha, penoxsulam 21.7% SC + cyhalofop-butyl 12% EC (w/v) at (25+100) g/ha, fenoxaprop-p-ethyl 6.7% EC (w/w) + ethoxysulfuron 15% WDG (w/w) at (50+15) g/ha, bispyribac-sodium 10% SC + ethoxysulfuron 15% WDG (w/w) at (25+15) g/ha, cyhalofop-butyl 12% EC (w/v) + ethoxysulfuron 15% WDG (w/w) at (75+15) g/ha, XR-848 benzyl ester 2.5% EC (w/v) + cyhalofop-butyl 12% EC (w/v) at (25+100) g/ha, flucetosulfuron 10% WDG (w/w) + pretilachlor 30.7% EC at (25+500) g/ha, bensulfuron-methy l 0.7% + pretilachlor 7% GR at (70+700) g/ha, single herbicide bispyribac-sodium 10% SC at 30 g/ha, weed free and weedy check. Among all the treatments, the weed free treatment registered significantly highest yield (5.23 t/ha) and was at par with T_4, T_3 T_1 and T_2. Phytotoxicity symptoms, *viz.* leaf injury on tips/surface, wilting, necrosis and chlorosis were observed initially in all herbicide treated treatments. The treatment flucetosulfuron 10% WDG (w/w) + bispyribac-sodium 10% SC at (25+25) g/ha followed by XR-848 benzyl ester + cyhalofop-butyl 12% EC (w/v) at 150 (25+125) g/ha (T_7) showed a little phytotoxic effect *i.e.* 10% to 20% (20 DAA (days after application of herbicides) to 3 DAA) unlike other herbicide mixtures had negligible phytotoxic effect limited to 3-7 DAA. There was a significant increase in microbial biomass carbon (MBC) content in all herbicide treated treatments at all observations (5, 10, 20, 30 DAA). The treatment fenoxaprop-p-ethyl 6.7% EC (w/w) + ethoxysulfuron 15% WDG (w/w) at (50+15) g/ha (T4) was recorded highest MBC content *i.e.* 249.51 µg/g, 293.51 µg/g, 277.08 µg/g and 266.08 µg/g at 5, 10, 20 and 30 DAA respectively while bispyribac sodium 10% SC at 30 g/ha was recorded lowest at 5 DAA (146.15 µg/g) and at 10 DAA (200.25 µg/g).The herbicides drastically decreased the microbial populations and enzymatic activities up to 3 to 4 days after spraying of herbicides, after which they started to recover gradually as time advanced and became normal up to 20 days after spray of herbicides proving them environmentally safe. Hence the treated post-emergence herbicide mixtures are found as an effective weed management strategy showing negligible phytotoxicity with no harmful effect on soil microbes in wet direct-seeded rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-22

Weed management in dry seeded rice under different tillage practices in lateritic soil of West Bengal

D.K. Jaiswal* and B. Duary
Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal 731 236
**Email: jaiswaldk1993@gmail.com*

A field study was conducted during *Kharif* 2019 to evaluate the effect of tillage and weed management practices on weed growth and productivity of dry seeded rice on a lateritic soil of West Bengal. Conventional tillage (CT) and zero tillage (ZT) in main plot and eight weed management practices *viz.* oxadiargyl *fb* bispyribac-sodium at 90 + 25 g/ha, penoxsulam + cyhalofop-butyl at 180 g/ ha, oxadiargyl *fb* penoxsulam + cyhalofop-butyl at 90 +180 g/ha, fenoxaprop-p-ethyl with safener + ethoxysulfuron at 90 +15 g/ha, oxadiargyl at 90 g *fb* fenoxaprop-p-ethyl with safener + ethoxysulfuron at 90 + 15 g/ha, pendimethalin *fb* bispyribac- sodium at 1000 + 25 g/ha, weed free check and unweeded control in sub-plot were assigned in a split-plot design with three replications. Experimental field was dominated by grassy weeds (91.00% of total biomass) out of which *Digitaria sanguinalis* (87.00%) and *Echinochloa colona* (3.90%) was dominant followed by sedge (7.00%) comprising of *Cyperus iria* (5.50%) and *Fimbristylis miliacea* (1.50%) and broad leaved (2.00%) species *viz. Eclipta alba*, *Ludwigia parviflora* and *Spilanthes calva*. No significant difference was found between zero and conventional tillage practices with respect to biomass of grassy, sedges and total weed. Weed competition caused about 90% yield reduction of rice. Conventional tillage recorded higher grain yield (3.5 t/ha) which was statistically at par with zero tillage (3.3 t/ha). Oxadiargyl at 90 g *fb* fenoxaprop-p-ethyl with safener + ethoxysulfuron at 90+15g/ha exhibited 100% reduction in biomass of *Digitaria sanguinalis* and *Echinochloa colona* at 30 DAS and registered the lowest total weed biomass and highest grain yield (4.8 t/ha) of rice. Pendimethalin *fb* bispyribac-sodium at 1000 + 25 g/ha though exhibited 97% of total weed control efficiency but reduced germination and seedling emergence of rice due to rainfall within 2 hours of its application. Oxadiargyl *fb* penoxsulam + cyhalofop-butyl at 90 +180 g/ha (WCE 96.90%) and oxadiargyl *fb* bispyribac - sodium at 90 + 25 g/ha (WCE 95%) exhibited greater selectivity to rice even after high rainfall within 2 hours of oxadiargyl spray. Severe infestation of *Digitaria sanguinalis* in unweeded control plot and poor control of this weed with ready mix post-emergence herbicide penoxsulam + cyhalofop-butyl at 90 +180 g/ha resulted in crop lodging. Poor control of *Digitaria sanguinalis* also resulted in the production of chaffy grain of rice due to attack of insect *Leptocorisa acuta* at milking stage and also reduction of the number of panicles/m^2, grain yield and deterioration in the quality of grains. Attack of the disease sheath blight (*Rhizoctonia solani*) after rainfall was found more in *Digitaria sanguinalis* infested plot. Application of pre-emergence oxadiargyl at 90g *fb* post-emergence tank-mix fenoxaprop-p-ethyl with safener + ethoxysulfuron at 90 + 15 g/ha or penoxsulam + cyhalofop-butyl at 90 + 180 g/ha appeared to be promising both under conventional and zero tillage practices for effective weed management and obtaining higher yield of dry seeded rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-23

Weed management in direct-seeded rice through sequential application of herbicides

Linganagouda*, N. Ananda, B.G. Masthanareddy, M.Y. Ajayakumar and J. Vishwanatha
Department of Agronomy, College of Agriculture, UAS, Raichur, Karnataka 584 104
**Email: linganagoudasm@gmail.com*

A field experiment entitled weed management in direct-seeded rice (*Oryza sativa* L.) through sequential application of herbicides was conducted during *Kharif*, 2018 on medium black soil at ARS, Gangavathi, UAS, Raichur. Karnataka state. The experiment comprised of 11 weed management practices (sequential applications) *viz.,* pendimethalin 38.7 CS 700 g/ha (PE) *fb* bispyribac sodium 10 SL 25 g/ha (PoE), pendimethalin 38.7 CS 700 g/ha (PE) *fb* bentazone 48 SL 960 g/ha (PoE), pendimethalin 38.7 CS 700 g/ha (PE) *fb* penoxulam 1.02% + cyhalofop-butyl 5.1% OD 135 g/ha (PoE), pendimethalin 38.7 CS 700 g/ha (PE) *fb* (chlorimuron-ethyl + metsulfuron-methyl) 20 WP 4 g/ha (PoE), pyrazosulfuron-ethyl 10 WP 20 g/ha (PE) *fb* bispyribac-sodium 10 SL 25 g/ha (PoE), pyrazosulfuron-ethyl 10 WP 20 g/ha (PE) *fb* bentazone 48 SL 960 g/ha (PoE), pyrazosulfuron-ethyl 10 WP 20 g/ha (PE) *fb* penoxulam 1.02% + cyhalofop-butyl 5.1% OD 135 g/ha (POE) pyrazosulfuron-ethyl 10 WP 20 g/ha (PE) *fb* (chlorimuron-ethyl + metsulfuron-methyl) 20 WP 4 g/ha (PoE), hand weeding at 20 and 40 DAS weed free check and weedy check. These treatments were laid out in randomized block design with three replications. Pre-emergence herbicides were applied at one day after sowing the crop, post-emergence herbicides were applied at 2-4 leaf stage of weeds using a hand operated knapsack sprayer fitted with flat fan nozzle and at a spray volume of 500 l/ha. Rice crop (GNV 10-89) was sown on 22nd July 2018 at a spacing of 20 x 10 cm. The recommended fertilizer dose of 150 kg N, 75 kg P205 and 75 kg K20/ha was applied as per package of practices. Weed density was recorded by putting a quadrate of 0.25 m2 at random in each plot and converted to m^2. Weeds were cut at ground level, washed with tap water, oven dried at 70 ^{0}C for 48 hours and then weighed for biomass. The major grassy weeds observed in the experimental plot were *Cynodon dactylon, Echinochloa colona, Dinebra retroflexa* and *Chloris barbata* while *Cyperus rotundus, Cyperus iria*, *Cyperus difformis* and *Fimbristylis miliacea* were the dominant weeds among sedges and broad-leaved weeds*, viz. Ammannia baccifera, Caesulia axillaris, Commelina benghalensis, Eclipta alba, Phyllanthus niruri* and *Amaranthus viridis* were found dominant. Among different weed management practices, sequential application of pendimethalin 38.7 CS 700 g/ha (PE) *fb* (chlorimuron-ethyl + metsulfuron-methyl) 20 WP 4 g/ha (PoE) recorded significantly lower density of grasses, sedges, broad-leaved weeds and total number of weeds (2.31, 2.30, 2.77 and 4.04/m^2, respectively), dry weight of total number of weeds (0.78 g/m^2), weed index (6.85%) and higher weed control efficiency (87.59%) at 40 DAS as compared to weedy check. Significantly higher growth parameters, *viz.* plant height (93.7cm), number of tillers (414/m^2), total dry matter production (84.29 g/plant), yield parameters, *viz.* number of panicles (331/m^2), weight of panicle(3.25 g), number of filled grains/ panicle (141) was recorded with sequential application of pendimethalin 38.7 CS 700 g/ha (PE) *fb* (chlorimuron-ethyl + metsulfuron-methyl) 20 WP 4 g/ha (PoE). Indeed, the same treatment also recorded higher grain yield (` 5777 kg/ha), net returns (` 61629/ha), BC ratio (2.61) and higher uptake of nitrogen, phosphorus and potassium (128.50, 30.80 and 142.53 kg/ha, respectively) compared to weedy check.Thus from the present investigation it can be concluded that application of pendimethalin 38.7 CS 700 g/ ha (PE) *fb* (chlorimuron-ethyl + metsulfuron-methyl) 20 WP 4 g/ha (PoE) was effective in controlling the weeds with higher yield components consequently higher yield in direct-seeded rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-24

Herbicides for weed management in direct-seeded rice through FLDs in Sidhi district of Madhya Pradesh

Dhananjai Singh, Alka Singh, Amrita Tiwari and M S Baghel
JNKVV – Krishi Vigyan Kendra, Sidhi, Madhya Pradesh 486 661

Rice (*Oryza sativa* L.) is an important staple crop in India, where it is mainly grown by manual transplanting of seedlings into puddled soil. Recently, however, there is a trend toward direct-seeded rice due to labour and water scarcity. In DSR, weeds are the main biological constraint mainly due to absence of puddling in field. The yield loss due to weed interference is huge, may be up to 100%. However, manual weeding is becoming less effective because of labor crisis at critical times and increased labor costs. Herbicides are replacing manual weeding as they are easy to use but there are concerns about the sole use of herbicides, such as evolution of resistance in weeds, shifts in weed populations, cost of weed management to farmers and concerns about the environment In this perspective, the present experiment was conducted to study the efficacy of selected herbicides. Thesuccess of direct seeding is almost totally depend on effective weed control, so weed control is the key factor in direct-seeded rice. Keeping in view Krishi Vigyan Kendra, Sidhi conducted front line demonstrations under direct supervision of KVK scientist in Teduha village of Sidhi district during 2017-18 and 2018-19. Three weed management practices (T1-Weedy check, T2-Pendimethalin and T3 - pendimethalin + bispyribac-sodium) were carried out on farmers field through FLDs. In the front line Demonstrations the observations were taken e.g. number of weeds per squre meter, number of tillers per squre meter, Plant height, gross encome (` per hectare), net income (` per hectare), cost: benifit ratio. All the herbicide treatments reduced the weed intensity as compared to weedy check, however minimum weed density was observed in pendimethalin + bispyribac-sodium (17.3). Among the herbicides application, pendimethalin followed by bispyribac sodium gave highest benefit to cost ratio (4.15), grass return (` 55300/ha) and net benefits (` 41980/ha). Overall, application of pendimethalin followed by bispyribac-sodium is an efficient and economic approach to reduce weed infestation which results in improved yield of rice (4.56 t/ha). The variation in per cent increase in the yield and economics was found due to the lack of knowledge, and poor socio economic condition. Under sustainable agricultural practices, with this study it is concluded that the demonstrations programmes were effective in changing attitude, skill and knowledge of improved weed management practices of direct-seeded rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-25

Weed seed bank dynamics in rice-based conservation agricultural system as influenced by tillage and crop rotation

JS Mishra*, Rakesh Kumar, Surajit Mondal, Mausam Verma, SP Poonia, RK Malik and BP Bhatt

ICAR Research Complex for Eastern Region, Patna, Bihar 800 014

**Email: jsmishra31@gmail.com*

The influence of tillage system and crop rotation on weed seed bank dynamics was investigated in a long-term field experiment conducted during 2009-10 to 2017-18 at the ICAR Research Complex for Eastern Region, Patna (25030‘N latitude, 85015‘E longitude, and 52 m above mean sea level), Bihar, India. The treatments included four scenarios, *viz.* conventional till (CT) rice-wheat-summer fallow system (S1), CT rice-NT wheat-NT greengram (S2-partial CA), NT rice-NT wheat-NT greengram (S3-full CA), and NT rice-NT mustard-NT summer maize (S4-full CA). Around 30% crop residues of each crop (except greengram) were left anchored on the soil surface after crop harvest (except in S1, where crops were harvested from ground level). In case of greengram, after removing matured pods, 100% crop residue was knockdown in the field as surface mulch by spraying non selective herbicide (paraquat) in S3 and S4, however, in S2, the greengram plants were ploughed down in soil before puddling. Sampling of weed seed bank was done at the end of the 8-year rotation from 0-10 and 10-20 cm soil depths. These soil samples (1 kg soil) were spread in a plastic trays and placed in a greenhouse and watered daily. The emerged weed seedlings were identified, counted, and removed until emergence was nil. Soil was then dried, rewatered, and stirred to initiate further emergence. This cycle was repeated approximately monthly through July to December. Estimation of the vertical distribution of the weed seeds was made from the number of seedlings that emerged from the soil cores of different depths. *Echinochloa colona*, *Leptochloa chinensis* and *Digitaria sanguinalis* were the dominant grasses. *Trianthema portulacatrum* was the major broad-leaved weeds and *Cyperus iria*, the prominent sedge. Irrespective of the weed species, around 3/4th was present at 0-10 cm soil depth and 1/4th at 11-20 cm depth. Significantly higher weed seeds were present in S4 (full CA with rice-mustard-maize rotation) followed by S3 (full CA with rice-wheat-greengram) as compared to S1 (conventional rice-wheat) and S2 (partial CA). Tillage system had significant influence on vertical distribution of weed seeds. Higher amount of grassy weeds (58-72%) were present at 10-20 cm depth in S2, S3 and S4, but in S1, the trend was reverse. Around 72% of the *T. portulacastrum* seeds were present at 10-20 cm depth in S1as against only 15% in S3. Maximum seeds of the *C. iria* (63-85%) were recorded at 0-10 cm depth, irrespective of the tillage and crop rotation.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-26

Effect of tillage practices and techniques of weed control on weed management under rice- wheat cropping system

T.D. Pandey*, R.B. Tiwari R.K. Shukla
BTC, College of Agriculture and Research Station, Bilaspur, Chhattisgarh 495 001
**Email: tdp1963@rediffmail.com*

A field experiment was conducted during the year 2015-16 at the experimental farm of BTC, College of Agriculture and Research Station, Bilapur (C.G.) which is located at 82012'N latitude, 2209'E longitude and at an altitude of 292.3M above mean sea level and characterized as sub-humid monsoon type climate with annual average rainfall of 1250mm out of 87 rainy days. The soil of experimental plot was clay loam in texture having neutral pH (7.3), low organic carbon (0.29%), low available Nitrogen (226.2kg/ha), medium available Phosphorus (16.8 kg/ha) and medium available Potassium (231.8 kg/ha). The experiment was conducted in split plot design with three replications. In Kharif, the rice crop (variety-Karma Masuri) was sown uniformly in whole plot area as per recommended package of practices and in *Rabi* the wheat cultivar GW-27 was used as the test variety and the experiment was laid out in split-plot design with four treatments in main plots, *viz.* Conventional tillage, Zero-tillage, Conventional tillage +Residue (rice straw), Zero-tillage + Residue (rice straw) and three treatments in sub-plot, *viz*. Recommended herbicide (Clodinofop + Metsulfuron at 30 DAS –Vesta) , Integrated weed management (herbicide + hand weeding)-hand weeding at 20 DAS followed by Metsulfuron at 35 DAS and Unweeded check . The data indicated that the tillage practice i.e., Conventional tillage + Residue (rice straw) produced significantly lower weed dry weight as compare to other treatments at each of the stage. As regards weed control methods the treatment unweeded check produced significantly higher weed dry weight. In other hand the tillage practices affected the grain yield significantly. The conventional tillage +residue (rice straw) gave significantly higher grain yield (26.23qha-1) over zero-tillage (20.18qha-1) and zero-tillage + residue (rice straw) (21.89q/ha) this increase in grain yield was might be due to more number of effect tillers. However, treatment conventional tillage was at par. In case of weed management treatment, the application of recommended herbicides (25.81 q/ha) and integrated weed management (26.33 q/h) were statistically at per whereas, both were gave superior yield over unweeded check.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-27

Efficacy of bensulfuron-methyl + pretilachlor against weeds in transplanted rice

Anay Rawat* and A. K. Jha
Department of Agronomy, JNKVV, Jabalpur, Madhya Pradesh 482 004
**Email: rawatanay@rediffmail.com*

The problem of extensive weed incidence during early stages of rice crop growth can not be determined which competes with crop plants for moisture, nutrients, light, space and other growth factors. This crop competition leads to significant yield losses to the tune of 35-55% in transplanted rice. Traditionally weed control in rice is done by manual and mechanical means which are most effective and common methods but they are tedious, costly, time taking and are difficult due to continuous rains during *Kharif*. Besides, adequate laborious are also not available during critical period of crop weed competition. The present investigation was conducted at the Krishi Nagar Farm, Department of Agronomy, JNKVV, Jabalpur during *Kharif* 2015. The experiment was laid out in randomized block design with seven weed control treatments comprising of bensulfuron-methyl + pretilachlor (48+480), (60+600) and (72+720) g/ha as pre-emergence, pendimethalin 1300 g/ha, butachlor 1500 g/ha, hand weeding twice at 20 and 40 DAT and weedy check replicated four times.Seedlings of rice variety JRH-5 were raised in nursery and transplanted in main field on 14rd July 2015 after its thorough puddling and leveling.The data was recorded on density and dry weight of weeds and the comparison in the treatment means were done on transformed values. There was predominance of monocot (*Cyperus difformis*, *Cyperus iria* and *Echinochloa colona)* and broad leaved (*Ludwigia perennis*, *Eclipta alba* and *Monochoria vaginalis*) weeds in the experimental field. Among the weeds *Cyperus difformis* followed by *Cyperus iria* were more rampant (47.83 and 22.43% at 30 DAT and 29.50 and 26.65 at harvest) due to their continuous regrowth during the crop season. Grain and straw yields were significantly higher under all the weed control treatments over weedy check plots. Application of bensulfuron-methyl + pretilachlor (60+600) g/ha recorded higher of grain and straw yields (5.15 and 9.30 t/ha) followed by bensulfuron-methyl + pretilachlor (72+720) g/ha. Even though the highest yields were recorded with hand weeding twice (5.89 and 9.96 t/ha). bensulfuron-methyl + pretilachlor (60+600) g/ha was the economically viable treatment among all the weed control treatments. The cost of cultivation was maximum under hand weeding twice owing to an additional expenditure of ` 8000/ha on weeding, showing that control of weeds through hand weeding was more expensive than the use of herbicide in rice crop. Although the gross monetary returns was maximum in hand weeding twice among all the treatments. Whereas, the net monetary returns and B:C ratio were maximum under bensulfuron-methyl + pretilachlor (60+600) g/ha (` 79045/ha and 3.37) as pre-emergence to rice followed by bensulfuron-methyl + pretilachlor (72+720) g/ha (` 75609/ha and 3.25).

Theme 2

Sustainable weed management in cereals, pulses, oil seed crops, commercial crops, fibre and fodder crops under irrigated and rain-fed agriculture

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-28

Herbicide options for effective weed management in maize in Northern Hill Region of Chhattisgarh

Arun Tripathi*, Anup Paul* and D.P. Patel

Directorate of Extension Services, Indira Gandhi Krishi Vishwavidyalaya, Raipur Chhattisgarh 492 012

**Krishi Vigyan Kendra, Balrampur, Chhattisgarh 497 119*

**Email: aruntripathi847@gmail.com*

Maize (*Zea mays L.*) is the third most important cereal crop after rice and wheat, which is widely grown in the world and is used as primary staple food in many developing countries. Due to the wider adoptability and high yield potential of the crop, it can be included in many cropping systems. The increasing demand for maize is rapidly transforming cropping systyems in different parts of India as well as Bastar plateue and Northern hill zone of Chhattisgarh. Maize has emerged as an important cash crop replacing minor millets in hilly areas of Northern part of Chhattisgarh. Major contributing factor for the drastic increase in area of maize is the intervention of herbicide like atrazine among farmers of the area. A study was carried out during *Kharif* season of 2016-17 at farmers fields in different villages, *viz*. Paraswar, Chilma, Parsagudi and Pasta of district Balrampur-Ramanujganj of Northern Hill Region of Chhattisgarh with the objective of finding best pre- and post-emergence herbicide option and its effect on weeds, yield and economics of maize (*Zea mays* L.). The study was conducted with 7 treatments and 6 replications. The results of the study revealed that among broad leaved weeds, *Euphorbia geniculata* was the dominant one while in grasses, *Brachiaria eruciformis* was most prevalent and the long sedge observed was *Cyprus rotundus*. From the results, it is concluded that sequential application of atrazine 50% WP 500 g/ha at 0-3 DAS *fb* halosulfuron 75% WDG 90 g/ha at 30 DAS not only reduced the total weed population, weed dry weight at different crop growth stages and weed index but also increased the weed control efficiency and grain yield. Highest net return of ` 70074/ha and B:C of 3.07 was obtained with the treatment atrazine 500 g/ha at 0-3 DAS *fb* halosulfuron 90 g/ha at 30 DAS.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-29

Weed management for conservation agriculture: A study

M.J. Konwar* and Dr. I.C Barua
Department of Agronomy, Assam Agriculture University, Jorhat, Assam 785 013
**Email: milonjyotikonwar202@gmail.com*

Agriculture production in today's era is stagnant due to various causes, out of which land degradation and soil fertility are the major one. Negative effects on the natural resource of the farming can be so serious that they may jeopardize the agricultural productive potential in the future. This form of intensive and subsistence agriculture is destructive to soil health and accelerates the loss of soil. Conservation agriculture (CA), a system avoiding or minimizing soil mechanical disturbance is considered a sustainable agro-ecological. It is a resource saving, environment friendly crop production practice having minimum soil disturbance, permanent soil cover and crop rotation. CA is becoming increasingly important in overcoming the problems of declining agricultural productivity both in developing and developed countries. Weeds are major biological constraints in adoption of CA-based technologies due to changes in different patterns of tillage, planting systems, and other management strategies. It is possible to achieve the same or even higher yield with CA practice as compared with conventional tillage if the weeds are controlled efficiently. The practices of CA particularly crop rotation and surface residue retention, are themselves methods of weed control. A major objective of tillage is supposed to be weed control- repeated ploughing only changes the weed population, but does not control weeds in the long term- in intensive agriculture. While in the short term some tillage operations can control on farm weeds, tillage systems can increase and propagate weeds off-farm. The same applies to the mechanical uprooting of weeds. Through herbicide application weeds can be controlled, however, environmental concerns and herbicide resistance highlight the need for alternative weed control strategies that are effective and accessible for small and marginal farmers adopting CA. Herbicides which are considered to be an integral component of weed control in CA can be used in conjuction with other management options. Sustainable weed management with minimum use of herbicides is an integrated approach to the challenge presented by the weed interference problem and has a role to play in achieving sustainable crop production to feed the burgeoning world's population. So, weed control should be done through conservation tillage as well as by adopting preventive and cultural methods to maintain the sustainability along with the management.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-30

Effect of planting geometry on weed incidence in lesser yam [*Dioscorea esculenta* (Lour.) Burkill]

P. Prameela* and Anasooya Sebastain

Department of Agronomy, College of Horticulture, Vellanikkara, KAU (P.O), Thrissur, Kerala 680 656

**Email: prameela.p@kau.in*

A study on the effect of planting geometry and seed tuber size in lesser yam was conducted at the College of Horticulture, Vellanikkara, Thrissur during May to December 2018. One of the objectives was to study the effect of weed incidence and competition during early vegetative growth on yield of yam. Seed tubers weighing 50 g, 100 g, and 150 g were planted at spacing of 50 x 50 cm (high density), 75 x 50 cm (medium density) and 75 x 75 cm (low density: recommended spacing), adopting randomized block design with nine treatment combinations. Diverse weed flora was present in the field of which broad leaved weeds like *Borreria diffusa, Ludwigia parviflora, Cleome viscosa, Ageratum conyzoides*. *Panicum maximum, Pennisetum* spp. and *Digtaria ciliaris* were major grasses. Though weed population was comparable in various treatments at both 30 and 60 days after planting (DAP), difference in weed dry matter accumulation could be observed at 60 DAP with respect to seed tuber size. Significantly higher weed dry matter production (DMP) was observed at wider spacing as it favoured more weed growth due to more interspace and availability of sunlight. The weed dry matter accumulation was 179.56 g/m^2 at wider spacing of 75 x 75 cm where as it was only 91.56 g/m^2 at closer spacing of 50 x 50 cm. The intermediate value of weed DMP was recorded at medium planting density of 75 x 50 cm (142.22 g/m^2) and each differed significantly from one another. Weeding was done in all treatments after 60 DAP at the time of final earthing up and further competition on plant growth was not there. Hence tuber yield was not influenced due to weeds. This indicates that in lesser yam weed competition during initial growth phase has not much effect on the tuber yield. This is also due to the mound planting where weeds are in the interspaces and plants on the mounds do not experience any competition. The DMP of lesser yam was influenced by seed tuber size as well as spacing. Due to more vigorous vegetative growth and more space available to individual plants, higher dry matter accumulation by both aerial portions and tubers were observed in combination of wider spacing and large seed tubers. Productivity was higher under closer spacing irrespective of seed size. Highest tuber yield per plant was realized from 150 g seed tubers (1270 g/vine), followed by 100 g (1053 g/vine) and 50 g seed tubers (929 g/vine). The highest productivity of 44.20 t/ha was realized with 150 g tubers followed by 100 g (37.09 t/ha) and 50 g (35.36 t/ha) tubers, all planted at closer spacing of 50 x 50 cm and they differed statistically.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-31

Response of soybean to weed management practices under rainfed condition of Nagaland

Bikram Ghimere, A. P. Singh* and D. Nongmaithem
School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema, Nagaland 797 106
**Email: apsinghagronomy@gmail.com*

Among all the various factors which are responsible for the lower yield of soybean, weeds have been considered to be of prime importance. One of the major constraints in soybean production is crop-weed competition; being a rainy season crop, as it is heavily infested with grasses, sedges and broadleaved weeds. Declined production in soybean is the result of heavy infestation by a large number of weed species during the *Kharif* season. Thus, intense weed competition is one of the main constraints for increasing soybean productivity. One of the oldest and most efficient methods of weed control is manual weeding. Unavailability of adequate labour during peak period of weeding and difficulty in use of mechanical weeding in heavy soil as well as receiving heavy rains create problem for effective weed management in soybean crop. There are several herbicides like pendimethalin, fluchloralin, metalochor and alachlor, which has been used for controlling weeds associated with soybean but were found not much effective in controlling all sorts of weeds in soybean. Therefore it is important to evaluate the efficacy of suitable post-emergence herbicides when added alone or in mixture for effectively controlling dominant and diversified weed flora in soybean fields. As reported, imazethapyr is found to be very effective as post-emergence herbicides for controlling some grassy and broad-leaf weeds in soybean. Therefore a field experiment was undertaken in the Agronomy farm at School of Agricultural Sciences and Rural Development, Medziphema Campus, during the *Kharif* season of 2017. The experiment was laid out in Randomize Block Design (RBD) with 7 treatments and three replications. The predominant weed species which were most common in the experimental field were *Eleusine indica*, *Digitaria sanguinalis*, *Poa annua*, *Borreria hispida*, *Cyperus rotundus* and *Cynodon dactylon*. The minimum weed population, weed biomass and highest weed control efficiency were observed with two hand weeding at 20 and 40 DAS which was closely followed by imazethapyr 75 g/ha at 10 DAS and imazethapyr 50 g/ha at 10 DAS. Imazethapyr 75 g/ha at 10 DAS recorded the highest plant height (cm), number of branches/plant, number of seeds/pod, test weight, harvest index, seed and stover yield. Application of imazethapyr 75 g/ha at 10 DAS gave higher B: C ratio as compared to two hand weeding at 20 and 40 DAS and it was cost effective.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-32

Integrated weed management in pulses based cropping system in SAT region

Gajanan Sawargaonkar*, Prasad Kamadi and Sreenath Dixit

ICRISAT Development Centre (IDC), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana 502 324

**Email : g.sawargaonkar@cgiar.org*

Reducing poverty and ensuring future food and nutritional security are essential targets for developing countries like India. The concerns in the SAT region, which is characterized by rapid population growth, food shortages, and an increasing changing climate. Efforts to increase crop productivity and reduce existing crop yield gaps, by identifying constraints, such as weeds and alleviating their negative impacts, are essential to meet the targeted food and nutritional security goals in the SAT region. The integrated weed management experiments carried out on pulses based cropping systems at Research Farm at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad India during 2017 to 2019. The results revealed that pre-emergence application of systemic herbicide viz pendimethalin 0.45 kg/ha along with one inter-cultivation at 25-30 day after sowing reduced the weed infestation significantly compared to other management practices. Pendimethalin 0.45 kg/ha (PE) along with one hand weeding at 25-30 DAS was on par with pendimethalin 0.45 kg/ha (PE) + paraquat 0.48 kg/ha at 6 WAS and pendimethalin 0.45 kg/ha (PE) + paraquat 0.48 kg/ha at 8 WAS and both these treatments recorded significantly higher pods/plant than other treatments except two hand weedings at 25 and 50 DAS. These two treatments recorded lower weed infestation compared to other treatments thereby showcasing efficiency of the treatment over others. The seeds/pod and 100-seed weight were not influenced significantly by different weed control treatments. Hand weeding at 25 and 50 DAS recorded the highest biological yield whereas pendimethalin 0.45 kg/ha (PE) along with one hand weeding at 25-30 DAS and pendimethalin 0.45 kg/ha (PE) + paraquat 0.48 kg/ha 6 WAS recorded the highest grain yield. The integrated use of pendimethalin 0.45 kg/ha (PE) + paraquat 0.48 kg/ha at 6 WAS, pendimethalin 0.45 kg/ha (PE) + paraquat 0.48 kg/ha at 8 WAS and pendimethalin 0.45 kg/ha (PE) + hand weeding at 50 DAS recorded biological yield and grain yield statistically similar to that in two hand weedings at 25 and 50 DAS and pendimethalin 0.75 kg/ha (PE). Higher yield in these treatments was due to better control of weeds. In terms of productivity gain, there was 15-20% increase in system's productivity with pendimethalin 0.45 kg/ha (PE) along with one hand weeding at 25-30 DAS, besides incremental increase in economic gain by ` 13500 to 17000 per hectare with PE application of systemic herbicide, *viz.* pendimethalin 0.45 kg/ha along with one inter-cultivation at 25-30 day after sowing. The cost benefit ratio varies from 1:2.3 with greengram based cropping system to 1:2.85 with pigeonpea based cropping system.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-33

Controlling weeds with new herbicides in linseed

Pankaj Chopra* and Gurudev Singh
College of Agriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh 176 062
**Email: pankuch@rediffmail.com*

Linseed is a food and fibre crop and almost every part of the plant is commercially utilized either direct or after processing. It is becoming popular as a nutritional and functional food. As linseed is winter oilseed crop, its initial slow growth habit with less leaf canopy exerts no smothering effect on weeds. Weeds can cause upto 66% yield losses and can further aggravate if weeds are not controlled within a specific period of time. Due to increased cost of manual weeding, and non-availability of labour during critical period of growth, use of herbicides is an alternative for weed control. Among herbicides, isoproturon is recommended for weed control in this crop but presently this chemical is not available due to its non manufacturing. This necessitates the use of some other molecules which are quite effective against associated weeds along with resistant weeds. Moreover, for wider spectrum weed control, it is desirable to incorporate the strength by mixing two herbicides into one complementary mixture. Therefore, the present investigation has been undertaken. The field experiment consisting of ten treatments, *viz.* oxyflurofen 125 g/ha, metribuzin 250 g/ha + oxyflurofen 125 g/ha as pre-emergence (PE), imazethapyr 4 g/ha, metsulfuron-methyl 4 g/ha, clodinafop 60 g/ha, oxadiargyl 80 g/ha, clodinafop 60 g/ha + metsulfuron-methyl 4 g/ha as post-emergence (PoE), pendimethalin 1.0 kg/ha (pre) *fb* metsulfuron-methyl 4 g/ha PoE, hand weeding and weedy check was carried out at CSKHPKV, Palampur in RBD with three replications during *Rabi* 2018-19. *Phalaris minor*, *Lolium temulentum* and *Avena ludoviciana* among grassy weeds and *Anagallis arvensis*, *Vicia sativa* and *Tulipa* sp. among broad leaved weeds along with some other weeds were present in the study area. In total, the major proportion (77.1%) of the total weed flora was constituted by grassy weeds and only 14.9% and 8.01% by broad leaved and other weeds, respectively. All the weed control treatments were significantly superior over weedy check for recording significantly higher plant stand. All the herbicides tried either alone or in combinations were found to be safe to crop except tank mix combination of metribuzin 250 g/ha with oxyflourfen 125 g/ha PE, which was found to be slightly toxic to crop and rated 1 on phytotoxicity rating. Among herbicide treatments, pendimethalin 1.0 kg/ha PE *fb* metsulfuron-methyl 4 g/ha PoE and clodinafop + metsulfuron-methyl 60 + 4 g/ha PoE were found to be equally effective to hand weeding twice and recorded significantly lower total count and dry matter of weeds. The weed control efficiencies achieved through these treatments were 76.6 and 75.9%, respectively, which were very close to hand weeding twice (81.5%). Effective control of weeds by these herbicides resulted in better growth and higher yield attributes, which contributed in getting significantly higher seed yield as compared to other weed control treatments. Highest net return and B: C ratio were obtained from pendimethalin 1.0 kg/ha (pre.) *fb m*etsulfuron-methyl 4 g/ha PoE application. Hence, under Palampur conditions, application of pendimethalin 1 kg/ha PE *fb m*etsulfuron-methyl 4 g/ha PoE was found to be the best treatment for recording higher yield with better return in irrigated linseed.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-34

Effect of diclosulam on weed management and yield in soybean crop

S.K. Tiwari*, R.C. Sharma, Sandhya Mure, Jagrati Borkar R.C. Jatav, Sarvesh Kumar and M.K. Bankoliya

JNKVV, Krishi Vigyan Kendra, Harda, Madhya Pradesh 461 331

**Email: glorious.k@gamil.com*

Harda district lies under central valley zone. Major cropping system of the district is soybean-wheat or soybean-chickpea. During *Kharif* season soybean occupied an area of 150.50 thousand ha. The productivity of *Kharif* crops especially soybean is decreasing year by year due to many abiotic and biotic factors. Among them weeds is major cause of reducing crop yield. Field experiments were conducted on soybean crop during *Kharif* 2018-19 in Harda district of Madhya Pradesh to find out the effect of diclosulam applied as pre-emergance for weed management in soybean. Results revealed that among the different herbicides, the highest grain yield was recorded with application of diclosulam (84 WDG) 26 g/ha as pre-emergence supplemented with one hand weeding at 20 DAS. Also, the highest grain yield of 22.75 q/ha was recorded under this treatmement which was significantly higher than the control plot *i.e.* 18.20 q/ha which was 20% higher than the farmers practice plot. The highest weed control efficiency of 100% was recorded in weed-free treatment followed by application of diclosulam (84 WDG) 26 g/ha as pre-emergence with one hand weeding at 20 DAS (87.2%). The highest net return of ` 27875/- per ha was recorded under this treatment along with B: C ratio of 1:1.96. However, it was ` 25600/- per ha under the control plot with B: C ratio of 1:1.88. The experimental field comprised with *Echinocloa crus-galli*, *Euphorbia geniculata Phylanthus niruri*, *Cynodon dactylon*, *Parthenium hysterophorus*, *Celosia indica*, *Echniochola colona*, *Digitataria sangunalis*, *Lindernia cilata*, *Eclipta alba*, *Trianthema monogyna* and *Cyprus rotundus*. The weed intensity was counted at 30, 45 and 60 DAS. Category wise weed count was recorded at 30, 45 and 60 DAS. There was 68% weed count of grassy weeds, 17% of broad leaved weeds and only 15% of sedge at 45 DAS. *Cynodon dactylon* was also observed in experimental plots at later stage i.e at 60 DAS. Among the broadleaved weeds, the lowest weed density of *Trianthema monogyna* was counted at 45 DAS and *Cyprus rotunus* was major sedge weed at this stage of weed count. As a result of application of diclosulam herbicide as pre-emergence followed by one hand weeding at 20 DAS effectively controls sedges and broad leaved weeds in experimental plots. Observation on yield and yield attributes revealed that more no. of pods/plant was recorded with diclosulam (84 WDG) 26 g/ha followed by one hand weeding at 20 DAS. Also, significant increment in nodule count/plant was found in this treatment may be due to supplement of hand weeding at 20 DAS which can enhance the activity of symbiotic bacteria.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-35

Brown manuring and legume residue incorporation a sustainable approach of weed management in rice

J. Padmavathi*, U. Sai Sravan, U. Triveni and Rajendra Prasad Singh
Agricultural Research Station, Ghantasala, Krishna, Andhra Pradesh 521 133
**Email: kk325537@gmail.com*

Rice (*Oryza sativa* L.) is one of the major staple foods in the world since centuries, especially in South and South East Asian countries. Legume is a natural mini-nitrogen manufacturing factory in the field and also helps in solubilizing insoluble P in soil, improving the soil physical environment, increasing soil microbial activity, restores organic matter, and also has smothering effect on weed. Among all the pulses in India, Greengram (*Vigna radiata* (L.) R. Wilczek) or mungbean is one of the popular short duration grain legumes, which can be grown during summer season. Since, it is a high value pulse so that seeds can be harvested and residue can be incorporated into soil as manure. Brown manuring is a no-till version of green manuring, using herbicide to desiccate the intercrop (and weeds) at flowering instead of using cultivation. This practice reduces weed population by greater than 50% without any adverse effect on rice yield. It facilitates better emergence of rice where soil usually forms crust, conserves moisture with brown mulch, improves soil C content and increases farmers' income. With this backdrop, a field experiment was laid out in strip plot design replicated thrice with four summer greengram management treatments in vertical factor during summer and seven integrated nutrient management practices in horizontal factor during *Kharif* 2012 and 2013 at the Agricultural Research Farm, Banaras Hindu University, Varanasi (U.P.), India. Among the treatments, application of RDF (20 kg N, 40 kg P_2O_5, 20 kg K_2O and 20 kg S/ha) + Seed inoculation (SI) with *Rhizobium* + PSB + 2% urea spray at 30 DAS (Pre-flowering stage) and 40 DAS with crop incorporation in summer greengram, being at par with RDF + SI with crop incorporation and application of 100% RDF (120 kg N, 60 kg P_2O_5, 60 kg K_2O, 20 kg S and 5 kg Zn/ ha) + brown manuring (Co-culture of *Sesbania*) to rice, showed its significant superiority to rest of the treatments in respect of weed density, weed dry weight, yield attributes, yield, gross return, net return and B: C ratio during both the years of study.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-36

Conservation tillage and weed management practices in maize influences weed prevalence and crop productivity in wheat-greengram-maize cropping system

V.K. Choudhary, R.P. Dubey, Chethan C.R., A. Chauhan, A.K. Patel and P.K. Singh
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: ind_vc@rediffmail.com*

Conservation agriculture (CA), comprising as a system based minimum soil disturbance, permanent soil cover through crop residue retention and crop rotations/diversification with legume as an important component is widely promoted to harness several benefits. However, weeds are the major biotic constraint in CA, posing a great challenge towards its adoption. Any reduction in tillage intensity or frequency may, therefore, influence the weed infestation. Therefore, we evaluated *Kharif* maize in 2018 under six crop establishment methods (CT, conventional tillage; ZT, zero-tillage; WR, wheat residues; GR, greengram residues; MR, maize residues) *i.e.* CT-CT-CT, ZT-ZT-CT, ZT-ZTWR-ZTGR, ZTMR-ZTWR-ZT, ZTMR-ZTWR-ZTGR and ZT-ZT-ZT in main plots and four weed management practices *i.e.* atrazine+tembotrione (625+120 g/ha), atrazine+topramezone (625+25.2 g/ha), atrazine 1000 g/ha followed by hand weeding at 30 DAS and weedy check. In sixth *Kharif* season at fixed plots the triple ZT with mulch (ZTMR-ZTWR-ZTGR) has lower weed density and dry biomass (46.1 no./m^2 and 31.5 g/m^2, respectively) followed by ZT-ZTWR-ZTGR. This was mainly due to retention of previous crop residues, which acted as mulch and created an obstacle for germination, emergence and establishment of weeds. These helped to achieve higher WCE in ZTMR-ZTWR-ZTGR (61.9%) followed by ZT-ZTWR-ZTGR (58.1%). However, the highest weed density and dry biomass recorded in CT-CT-CT (78.7 no./m^2 and 82.8 g/m^2, respectively). Reduction in weed parameters improved the growth parameters and yield attributes and it was recorded maximum in triple zero tilled and mulched plots followed by triple zero-tilled and double mulched plots. Better growth and yield attributes resulting in the highest grain and straw yield in ZTMR-ZTWR-ZTGR (3.41 and 6.70 t/ha, respectively) with highest net return and B: C ratio (` 47900/ha and 4.18, respectively) followed by ZT-ZTWR-ZTGR. The lowest grain and straw yield was recorded in CT-CT-CT (2.73 and 5.36 t/ha, respectively) with lesser net return and B: C ratio (` 28792 and 2.33, respectively). Among weed management practices, weedy check recorded the highest weed density and dry biomass (148.6 no./m^2 and 138.4 g/m^2, respectively). The lowest weed parameters was recorded with atrazine 1000 g/ha *fb* hand weeding at 30 DAS (20.8 no./m^2 and 15.1 g/m^2, respectively) resulting in 89.1% WCE followed by application of atrazine + topramezone (625+25.2 g/ha) which also considerably suppressed the weeds (29.33 no./m^2, 22.38 g/m^2 and 83.9%, respectively). Better weed control helped to harvest the highest grain and straw yield in atrazine 500 g/ha *fb* HW (4.13 and 8.56 t/ha, respectively) and net return and B: C ratio (` 50311/ha and 2.90, respectively) followed by atrazine + topramezone 625+25.2 g/ha. The lowest grain and straw yield was recorded with weedy check (0.98 and 1.77 t/ha, respectively) with negative return of ` 6505/ha and B: C ratio (0.73). Overall, our results showed that CA and retention of crop residue coupled with weed management found effective for enhancing the maize grain yield and minimizes weed prevalence.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-37

Integrated weed management in *Rabi* pop corn under South Gujarat condition

A.P. Patel* and H. N. Chaudhary
Department of Agronomy, N. M. college of Agriculture, Navsari Agricultural University, Navsari, Gujarat 396 450
**Email: arya5122005@gmail.com*

A field experiment was carried out during *Rabi* 2017-18 at the College Farm, Navsari Agricultural University, Navsari on integrated weed management study in *Rabi* pop corn (*Zea mays* L. var. everta) under south Gujarat condition. Ten treatments including in weed management practices, *viz.* T_1: atrazine 0.75 kg /ha as a Pre-emergence, T_2: atrazine 0.5 kg, ha as pre-emergence *fb* HW and IC at 40 DAS, T_3: pendimethalin 0.9 kg/ha as pre-emergence *fb* HW and IC at 40 DAS T_4: atrazine 0.5 kg/ha + pendimethalin 0.45 kg/ha tank-mix as pre-emergence *fb* HW and IC at 40 DAS, T_5: atrazine 0.5 kg/ha *fb* tembotrione 0.12 kg/ha as post-emergence at 20 DAS, T_6: atrazine 0.5 kg/ha *fb* topramezone 0.025 kg/ha as post-emergence at 20 DAS, T_7: atrazine 0.5 kg/ha as a pre- emergence *fb* 2,4-D (Na salt) 0.5 kg/ha as post-emergence at 40 DAS, T_8: HW and IC at 20 and 40 DAS, T_9: weed free T_{10}: unweeded control were evaluated in randomized block design with three replications. Different growth and yield parameters like plant height, number of leaves/ plant, number of cobs/plant, length of cob, girth of cob, number of grains/ cob, grain weight/cob, 100 grain weight and grain yield were significantly affected by weed management treatments. In case of different growth, yield attributes and yield, the weed free was performed better than all the other treatments, but statistically remained at par with atrazine 0.5 kg/ha *fb* topramezone 0.025 kg/ha as post-emergence at 20 DAS, atrazine 0.5 kg/ ha *fb* tembotrione 0.12 kg/ha as post-emergence at 20 DAS and atrazine 0.5 kg/ha + pendimethalin 0.45 kg/ha tank-mix as pre-emergence *fb* HW and IC at 40 DAS. Significantly higher grain and stover yield (3748 and 7898 kg/ha, respectively) was registered with treatment weed free treatment but which is being statistically at par with atrazine 0.5 kg/ha *fb* topramezone 0.025 kg/ha as post-emergence at 20 DAS, 3689 and 7614 kg/ha, respectively, weed index and highest weed control efficiency (WCE) were registered under the treatment of atrazine 0.5 kg/ ha *fb* topramezone 0.025 kg/ha as post-emergence at 20 DAS, whereas, the maximum dry weight of weeds at harvest, weed index, the maximum B: C ratio was recorded by treatment T_5 followed by T_6 and T_9.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-38

Efficacy of new combined herbicides on yield attributes and yield of summer greengram

R.R. Pisal*, R. H. Patel and A.P. Patel
Department of Agronomy, Navsari Agricultural University, Navsari, Gujarat 396 450
**Email: rrpagri@gmail.com*

A field experiment, entitled efficacy of new era combined herbicides in summer greengram (*Vigna radiata* L.) was conducted at Instructional Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during summer 2018. The ten weed management practices like, pendimethalin 900 g/ha as pre-emergence + 1 HW at 30 DAS, sodium acifluorfen + clodinafop-propargyl (RM) 250 g/ha as post-emergence at 20 DAS, imazathapyr + pendimethalin **(**RM) 750 g/ha as pre-emergence, imazathapyr + imazamox (RM) 70 g/ha as pre-emergence, imazethapyr + propaquizafop (RM) 125 g/ha as post-emrgence at 20 DAS, quizalofop-p-ethyl 100 g/ha post emergence at 20 DAS, fenoxaprop-p-ethyl 100 g/ha post-emergence at 20 DAS, 2 HW at 20 and 40 DAS, unweeded control, weed free were evaluated with three replications in a randomized block design (RBD). From the results of experiment observed that significantly highest value of yield attributes and yield of greengram *viz.* plant height, number of internode/plant, length of ear head, seed weight/plant, 1000 seed weight, seed and straw yield and harvest index were observed under weed free treatment, which was statistically at par with the treatment pendimethalin 900 g/ha as pre-emergence + 1 HW at 30 DAS and sodium acifluorfen + clodinafop-propargyl (RM) 250 g/ha as post-emergence at 20 DAS and 2 HW at 20 and 40 DAS. In case of weed control by different treatment 2 HW at 20 and 40 DAS was found effective in reducing the weed population (viz., monocot, dicot and sedge), which resulted in lowest dry weed weight (315 kg/ha), the highest weed control efficiency (84.7%) as well as lower weed index (10.01%). The residual N, P_2O_5 and K_2O present in the soil after harvest of the crop was significantly higher under weed free treatment (238.1, 62.7 and 329.6 kg/ha, respectively), which was significantly at par with T_1, T_2, T_6 and T_8.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-39

Efficacy of post-emergence herbicides on growth, yield and quality of late sown wheat (*Triticum aestivum*)

P.G. Chavan*, P.P. Pawar, S.C. Wadile, P.U. Raundal and P.P. Girase
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra 431 401
**Email: chavan_pg@rediffmail.com*

An experiment, entitled efficacy of post-emergence (PoE) herbicides on growth, yield and quality of late sown wheat (*Triticum aestivum*) was conducted during *Rabi* 2014 at Post Graduate Research Farm, Agronomy Section, College of Agriculture, Dhule. Experiment consisted of eight treatments laid out in randomized block design with three replications. The treatments consist with weedy check, weed free check, clodinafop (60 g/ha), sulfosulfuron (25 g/ha), metsulfuron-methyl (4 g/ha), metribuzin (100 g/ha), clodinafop + metsulfuron-methyl (60 + 4 g/ha), sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha). The different weed control treatment significantly influenced the weed population, growth and yield of wheat. Weed flora (monocot and dicot), weed intensity and weed dry weight were significantly reduced due to weed free check. Among herbicide treatments tank-mix application of herbicide i.e sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha, PoE) recorded less weed flora, weed intensity and weed dry weight which was at par with clodinafop + metsulfuron-methyl (60 + 4 g/ha, PoE). Significantly maximum weed control efficiency was recorded under weed free check followed by sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha, PoE). Besides weed free situation the lowest weed index was recorded in sulfosulfuron + metsulfuron-methyl (25 +4 g/ha, PoE). Significantly the highest weed index was recorded under weedy check. All the growth parameter of wheat *viz*., plant height, number of tillers and total dry matter accumulation were significantly higher in weed free check. This was followed by application of sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha, PoE) however, it was at par with clodinafop + metsulfuron-methyl (60 +4 g/ha, PoE). The significant effect on growth character of plant was noticed due to different treatments which resulted in enhance yield contributing character, *viz.* number of grain/earhead, length of earhead (cm), weight of grain (g). The highest grain and straw yield of wheat (4.7 t /ha and 5.9 t/ha, respectively) were noticed in weed free check. This was followed by application of tank-mix herbicide *i.e.* mulfosulfuron + metsulfuron-methyl (25 + 4 g/ha, PoE) (4.3 t/ha and 5.4 t/ha, respectively) and it was found at par with application of clodinafop + metsulfuron-methyl (60 +4 g/ha). This may be due positive effect of herbicides mixture in controlling complex weed flora as compared to its alone application. The gross and net monetary returns were found maximum in weed free check treatment followed by tank-mix application of herbicide i.e. sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha). Benefit cost ratio was maximum in tank-mix application of herbicide i.e. sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha) (2.91) followed by clodinafop + metsulfuron-methyl (60 +4 g/ha) (2.76). However, the gross and net monetary returns were maximum under weed free check but the lowest B:C ratio as compared to tank-mix application of herbicide i.e. sulfosulfuron + metsulfuron-methyl (25 + 4 g/ha) due to higher cost for weeding.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-40

Effect of tillage and weed management on weed dynamics and crop productivity of greengram under maize-mustard-greengram system

Akhilesh Kumar Patel*, V.K. Choudhary and P.K. Singh
ICAR-DWR Maharajpur Jabalpur, Madhya Pradesh 482 004
**Enail: akhileshp759@gmail.com*

Greengram (*Vigna radiata* L.) is one of the most important and extensively cultivated pulse crops in arid and semi arid region of India. It can be grown throughout the year as seed and fodder crop. Greengram improves the soil health and maintains its environment; due to availability of short duration varieties it can be suggested to grow between two main crops to utilize the residual soil moisture. Hence, greengram has potential to be included under conservation agriculture as a core principle of crop diversification. The productivity of greengram is very low in India and weed is a major biological constraint which plays crucial role. Therefore, we evaluated summer greengram during 2018 at ICAR-DWR, Jabalpur under long-term conservation agriculture plots of maize-mustard-greengram system in split-plot design and replicated thrice with six tillage practices conventional tillage (CT)-CT-CT, zero tillage (ZT)-ZT-CT, ZT-ZTMsR-ZTGR, ZTMR-ZTWR-ZT, ZTMR-ZTMsR-ZTGR and ZT-ZT-ZT (MsR, mustard residue; GR, greengram residue; MR, maize residues) in main plots and four weed management practices *i.e.* pendimethalin 678 g/ha, pendimethalin 678 g/ha *fb* quizalofop 50 g/ha, pendimethalin 678 g/ha *fb* hand weeding at 30 DAS and weedy check. Results show that among tillage practices, the highest weed density was recorded in CT-CT-CT (59.8 no./m^2) followed by CT-ZT-ZT (49.3 no./m^2), whereas the lowest weed density was recorded with ZTGR-ZTMR-ZTMsR (27.3 no./m^2). The higher density of weeds resulted in the highest weed dry biomass was recorded in CT-CT-CT (32.7 g/m^2), whereas the lowest weed dry biomass was recorded in ZTGR-ZTMR-ZTMsR (14.3 g/m^2) with 51.2% WCE. Weed dry biomass in rest of the tillage treatments were significantly lower, yet their effect was less in relation to CT-CT-CT. The highest WCE and lower weed dry biomass with ZTGR-ZTMR-ZTMsR recorded higher seed and stover yield (0.99 and 2.04 t/ha, respectively) followed by ZT-ZTMR-ZTMsR. The lowest seed and stover yield were recorded with CT-CT-CT (0.86 and 1.67 t/ha, respectively). Among weed management practices, weedy check recorded the highest weed density (94.1 no./m^2), whereas the lowest weed density was recorded with pendimethalin 678 g/ha *fb* hand weeding at 30 DAS (10.2 no./m^2). Weedy check has the highest weed dry biomass (49.7 g/m^2) and lowest with pendimethalin 678 g/ha *fb* hand weeding (5.6 g/ha). The highest WCE was recorded with pendimethalin 678 g/ha *fb* hand weeding (88.7%) followed by pendimethalin 678 g/ha *fb* quizalofop 50 g/ha (78.2%) than weedy check. The grain and stover yield were highest with pendimethalin 678 g/ha *fb* hand weeding (1.28 and 2.64 t/ha, respectively) followed by pendimethalin 678 g/ha *fb* quizalofop 50 g/ha (1.17 and 2.28 t/ha, respectively). It can be concluded that retention of previous crop residues in ZT coupled with integrated weed management pendimethalin 678 g/ha *fb* hand weeding gave better weed control with higher seed yield of greengram in irrigated ecosystem.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-41

Herbicide management in maize through pre and post-emergence application in rainfed vertisols

N.B. Mohod*, M.R. Deshmukh, J.P. Deshmukh, N.D. Parlawar and A.G. Kirange
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola, Maharashtra 444 104
**Email : eopnileshmohod@gmail.com*

A field investigation was carried out at the farm of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the *Kharif* season of 2015 to study the relative efficacy of herbicides on weed control in maize and to analyse its effect on growth and yield of maize. The soil of experimental field was characterized as clay loam in texture, having slightly alkaline pH (7.8), moderate in organic carbon status (0.40%), low in nitrogen content (224.27 kg/ha), medium in available phosphorus content (17.86 kg/ha), and high in potassium status (384.25 kg/ha). Maize (*PKVM shatak*) was sown on 21th June 2015 at 60 cm x 30 cm spacing with recommended dose of fertilizers as 120:60:30 NPK kg/ha. The experiment was laid out in randomized block design with eight treatments replicated thrice. The treatments comprised of weed free, weedy check, 2,4-D sodium salt 0.80 kg/ha PoE 30 DAS, 2,4-D sodium salt 1.20 kg/ha PoE 30 DAS, atrazine 1 kg/ha PE, atrazine 0.50 kg *fb* 2,4-D 0.50 kg/ha PoE 30 DAS, pendimethalin 1 kg/ha PE and atrazine 0.50 kg/ ha + pendimethalin 0.50 kg/ha PE (tank mix). In the experimental field, predominant weed flora was *Euphorbia geniculata, Euphorbia hirta* L., *Parthenium hysterophorus, Digera arvensis, Argemone mexicana, Phyllanthus niruri, Celosia argentia* among the dicot weeds, and *Cynadon dactylon, Ischaemum pilosum, Digitaria sanguinalis, Panicum* spp., *Commelina benghalensis* among the monocot. Weedy condition throughout the crop growth period caused 40 to 70% reduction in grain yield of maize. Among the herbicidal treatments, atrazine 0.50 kg *fb* 2,4-D 0.50 kg/ha PoE 30 DAS was found to be effective in controlling weeds across the crop growth period. However, weed free treatment recorded significantly higher values of major parameters. In herbicidal treatments, the maximum growth and yield attributes were recorded with treatment atrazine 0.50 kg *fb* 2,4-D 0.50 kg/ha PoE 30 DAS followed by atrazine 1 kg/ha PE. The same treatment recorded better weed control efficiency and lowest weed index. The nutrient uptake by weeds was more in weedy condition. However, total nutrient uptake by crop was observed maximum with application of atrazine 0.50 kg *fb* 2,4-D 0.50 kg/ha PoE 30 DAS. Application of atrazine 0.50 kg *fb* 2,4-D 0.50 kg/ha PoE 30 DAS was found most economical with maximum values of GMR (65797 `/ha), NMR (21139 `/ha) and B:C ratio (3.11).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-42

Weed management in groundnut through post-emergence herbicide application under rainfed condition of Vidarbha region

M.R. Deshmukh*, N.B. Mohod, J.P. Deshmukh, N.D. Parlawar and R.B. Ingale
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola, Maharashtra 444 104
**Email: manish_pkv@rediffmail.com*

A majority of groundnut farmers (51 to 67%) owned farm land smaller than two hectares in Maharashtra. Out of which most of the farmers grow the groundnut crop during *Kharif* season.The heavy black cotton soils of Vidarbha region of Maharashtra pose a big challenge to small farmers regarding persistence of weeds during crop growth stages. Keeping this in view, a field investigation was carried out to study weed control in rainy season groundnut (*Arachis hypogaea* L.) through post-emergence herbicides and also to study its effect on growth and yield of groundnut at the farm of Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during *Kharif* of 2015. The experiment was laid out in randomized block design with eight treatments replicated thrice. The treatments comprised of pendimethalin 1.0 kg/ha P.E. (T_1), imazethapyr 0.10 kg/ha PoE 20 DAS (T_2), imazethapyr+ imazomox 0.10 kg/ha PoE 20 DAS (T_3), fluazifop-P-butyl 0.125 kg/ ha PoE 20 DAS (T_4), quizolofop-ethyl 0.10 kg/ha + imazethapyr 0.10 kg/ha (tank mix) PoE 20 DAS (T_5), oxyflurofen 0.20 kg/ha PoE 20 DAS (T_6), weed free (T_7) and weedy check (T_8). The soil of experimental field was characterized as clay loam in texture, having slightly alkaline pH (7.8), moderate organic carbon status (0.40%), low nitrogen content (224.27 kg/ha), medium available phosphorus content (17.86 kg/ha), high potassium status (384.25 kg/ha). Groundnut (variety *TAG-24*) was sown on 19th June 2015 at 30 cm x10 cm spacing with 25:50:00 NPK kg/ha. The crop was harvested on 13th October 2015. In the experimental field, predominant weed flora were *Euphorbia geniculata, Achyranthus aspera, Parthenium hysterophorus, Digera arvensis, Argemone mexicana, Phyllanthus niruri, Celosia argentia* among the dicot weeds, and *Cynadon dactylon, Ischaemum pilosum, Digitaria sanguinalis, Panicum* spp, *Commelina benghalensis,* among the monocot. Weedy condition throughout the crop growth period caused 60.37% reduction in pod yield of groundnut. Among the herbicidal treatments, imazethapyr + imazomox 0.10 kg/ha PoE 20 DAS was found to be effective in controlling weeds across the crop growth period. Among the various treatments under study, weed free treatment recorded significantly higher values of major parameters whereas, in herbicidal treatments, the maximum growth and yield attributes were recorded with treatment imazethapyr + imazomox 0.10 kg/ha PoE 20 DAS followed by quizolofop-ethyl 0.10 kg/ha+ imazethapyr 0.10 kg/ha (tank mix) PoE 20 DAS. The same treatment recorded better weed control efficiency and lowest weed index. The nutrient uptake by weeds was more in weedy condition. However, total nutrient uptake by crop was observed maximum with application of imazethapyr + imazomox 0.10 kg/ha PoE 20 DAS. Application of imazethapyr + imazomox 0.10 kg/ha PoE 20 DAS was found most economical.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-43

Integrated weed management in preseasonal sugarcane

B.S. Raskar*, S.K. Ghodke and D.S. Thorave
Central Sugarcane Research Station, Padegaon, Maharashtra 415 521
**Email: bsraskar@gmail.com*

An experiment was conducted for three consecutive years at Central Sugarcane Research Station, Padegaon, Maharashtra, India during 2016-17 to 2018-19 to study the integrated weed management in preseasonal sugarcane. Dominant weeds observed in sugarcane crop were *Brachiaria eruciformis, Cyperus rotundous, Alternanthera sessils, Parthenium hysterophorus* L., *Euphorbia geniculata, Cardiosoermum lalicacabum, Ipomoea hederacea* and *Hylandis latiprosa*. The result showed that mean total weed count (4.41 m^2) and weed dry weight (3.59 g/m^2) reduced with post-emergence application of metribuzin 1.00 kg/ha + 2,4-D 1.0 kg/ha at 25 DAP *fb* hoeing at 60 and 90 DAP and found at par with treatment post-emergence application of metribuzin 0.50 kg/ha + 2,4-D 1.0 kg/ha at 25 DAP *fb* hoeing at 60 and 90 DAP. Among the herbicidal treatments, post-emergence application of metribuzin 0.50 kg/ha + 2,4-D 1.0 kg/ha at 25 DAP *fb* hoeing at 60 and 90 DAP recorded significantly the highest germination per cent (66.73%), number of internodes per cane (22) and average cane weight (1.93 kg) over all herbicidal treatments which was at par with pre-emergence spray of metribuzin 1.0 kg/ha and post-emergence spray of 2,4-D1kg/ha at 60 DAP *fb* hoeing at 90 DAP for number of internodes per cane (21.90) and average cane weight (1.92 kg). Among the herbicidal treatments, maximum weed control efficiency of 60.69%, 56.37% and 76.30% was found in treatment of post-emergence application of metribuzin 0.50 kg/ha+ 2,4-D 1.0 kg/ha at 25 DAP *fb* hoeing at 60 and90 DAP to sugarcane crop at 30, 60 and 90 days after application, respectively followed by post-emergence application of metribuzin 1.0 kg/ha+ 2, 4-D1 kg/ha at 25 DAP with hoeing at 60 and 90 DAP. Similarly, the significantly highest cane yield (155.21 t/ha) and sugar yield (21.38 t/ha) was recorded by same treatment over all herbicidal treatments which was at par with treatment metribuzin 1.0 kg/ha as pre-emergence, 2,4-D 1.0 kg/ha aspost-emergence application at 60 DAP *fb* hoeing at 90 DAP for sugar yield. The maximum net return (` 278454) and benefit cost ratio (3.13) was also reported by same treatment followed by post-emergence application of metribuzin 1.0 kg/ha + 2,4-D 0.5 kg/ha at 25 DAP *fb* hoeing at 60 and 90 DAP. The cane quality like commercial cane sugar%, sucrose%, brix% and purity% was not affected by hand weeding, mechanical weed control and application of any herbicide.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-44

Weed management in blackgram under organic production system

G.D Sharma*, Rameshwar, Sangeeta Kanwar, Sandeep Manuja and M.C. Rana
Department of Organic Agriculture and Natural Farming, COA, CSKHPKV, Palampur, Himachal Pradesh 176061
**Email: gurbhan_sharma@rediffmail.com*

Black gram (*Vigna mungo* L.), locally known as "mash", is one of the important pulse crops in India. Mash is a rich source of protein and phosphoric acid, is commonly used as a "dal". In Himachal Pradesh, black gram is the major pulse crop grown mostly during *Kharif* season both as a sole crop and as an intercrop with maize. It is also raised as a catch crop during summer, especially under irrigated conditions. Amongst different factors limiting the production potential of black gram, weeds pose a big problem in high rainfall areas having high temperature especially under organic production system. High intensity rainfall usually leads to water stagnation in the growing crops, thus causing harmful effects on growth and yield of crops. Keeping these points in view, a field experiment was conducted in organic farm of department of Organic Agriculture and Natural Farming, CSKHPKV Palampur with the objective of studying effect of raised beds, hand weeding and mulching on weed density, growth and productivity of black gram during the *Kharif* season of 2019. Twelve treatments were tested with combination of two raising bed techniques, *viz.* flat and raised beds and six weeding methods consisting of one hand weeding (at 15 days after sowing , DAS), two hand weedings (15 & 45 DAS), three weddings (15, 45 and 60 DAS), mulch 10 t/ha + one weeding (15 DAS), mulch10 t/ha and weedy check. Among diverse weed flora *Echinochloa colona, Panichum dichotomiflorum, Eleusine indica* were major grass weeds; *Cyperus rotundus* and *Cyperus iria* major sedges and *Polygonum alatum, Ageratum conyzoides, Phyllanthus niruri, Gallinsoga parviflora* were the dominant broad-leaf weeds in black gram. The results revealed that growing black gram on raised beds resulted in 22.1% higher seed yield as compared to flatbeds. Similarly, highest seed yield (10.76 q/ha) was recorded with three hand weedings at 15, 45 and 60 DAS, which was at par with two hand weedings at 15 and 45 DAS but significantly better than all other treatments. Application of organic mulch10 t/ha alongwith one hand weeding at 30 DAS remaining statistically at par with two hand weedings gave significantly higher seed yield compared to one hand weeding at 15 DAS, mulching and weedy check. Lowest seed yield of black gram was obtained in weedy check. Higher seed yield in raised plots could be ascribed to significantly lesser number of weeds and weed dry weight recorded at 75 days after sowing compared to flat beds. Similarly, significantly lowest weed count and weed dry weight were recorded with three hand weedings at 15, 45 and 60 DAS followed by two hand weedings and mulch + one hand weeding whereas, highest weed count and weed dry weight were recorded in the plots with uncontrolled growth of weeds (weedy check). Similarly, statistically similar weed count and weed dry weight were observed with two hand weedings at 15 and 45 DAS and mulch + one hand weeding at 30 DAS, which were superior to one hand weeding at 15 DAS and mulch only. Therefore, growing of black gram in raised beds and two hand weedings at 15 and 45 DAS or mulching with one hand weeding at 30 days after sowing are the suitable options for raising black gram under organic conditions.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-45

Effect of different herbicides on weed control, yield and economics of maize

S.S. Shinde*, S.U. Pawar
Collage of Agriculture, VNMKV Parbhani, Maharashtra 431 401
Email: shilashinde110@gmail.com

An investigation was conducted to study the effect of different herbicides on weed control, yield and economies of maize in *Kharif* season of 2015 at experimental farm, Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was laid out in Randomised block design in three replications, which has ten treatments. PoE-2, 4-D 80% 1000 g/ha, PoE-atrazine 50% WP 1000g/ha, PoE-metsulfuron-methyl 20% WP 4 g/ha, PoE-metsufuron-methyl 10% + clorimuron-ethyl 10% WP 4 g/ha, PoE-carfentazone-ethyl 40% DF 20 g/ha, PoE-imazethapyr 10% SL100 g/ha, PoE-propaquizafop 10% EC 500 g/ha, two hand weeding, teed free, and weedy check. Each experimental plot size was 5.4 m x 4.8 m of gross and 4.8 m x 3.6 m of net plot area. The soil of experimental site was clayey in texture, slightly alkaline in reaction, medium in available nitrogen, low in available phosphorous and very rich in available potassium. Variety used for experimental study was 'Pinacle' by seeds were sown at spacing of 60 cm x 20 cm by dibbling on 25 June 2015. The herbicides were applied as post-emergence herbicides. The data on meteorological parameters *i.e.* total precipitation received during crop growth period was 282.5 mm and well distributed in 19 rainy days during crop growth period. Mean maximum temperature varied from 29.6°C to 36.2°Cand mean minimum temperature was 19.4°C and 25.8°C. The relative humidity was observed 69 to 90% in morning hours and 29 to 68% in afternoon during the period of experiment. The weeds associated with maize crop were the *Eragrostis major, Cynodon dactylon, Cyperus rotundus, Brachiaria eruciformis, Commelina benghalensis, Cyanotis oxillaris, Convolvulaceae arvensis, Acalypha indica, Euphorbia geniculata, Phylanthus niruri, Digera arvensis, Parthenium hysterophorus, Amaranthus polygamous, Merrenia emerginata.* The data indicated that grain and straw yield of maize was significantly affected by different herbicidal treatments, all the weed management practices significantly improved grain and straw yield over weedy check. The treatment weed free recorded highest grain yield over rest of treatments. However, it was found at par with two hand weeding, which was further at par with the application of PoE-2,4-D 80% 1000 g/ha. The lowest grain yield was recorded with treatment weedy check. This may be due to higher degree of crop weed competition which affected the growth and yield of maize drastically. The treatment PoE-metsulfuron-methyl 20% WP 4 g/ha and PoE- propaquizafop 10% EC 500 g/ha also recorded lower grain yield. This may be due to stunted growth of crop and higher weed density observed in these treatments. As per the findings, it could be stated that either weed free or two hand weeding or PoE-2,4-D 80%1000 g/ha were found satisfactory to manage the weeds in maize and produced higher yield of maize. Two hand weeding and POE-2,4-D 80% 1000 g/ha were found highly effective for weed control and economical with higher benefit:cost ratio as compared to other weed control treatments in maize.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-46

Weed management in *Kharif* greengram

S.C. Wadile*, P.P. Pawar, H.M. Patil, S.S. Chitodkar, P.P. Girase R.T. Surywanshi, and P.U. Raundal

Agronomy section, College of Agriculture, Dhule,
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722
**Email : scwadile72@gmail.com*

An experiment entitled, integrated weed management in *Kharif* greengram (*Vigna radiata* (L.) was conducted during *Kharif* 2017 at Post Graduate Research Farm, Agronomy Section, College of Agriculture, Dhule. The different weed management treatments were significantly influenced the weed population, growth and yield of greengram. Weed flora (monocot, dicot and sedges), weed intensity and weed dry weight were significantly reduced due to weed free treatment. Among the different weed control treatment, integrated weed management treatment *i.e.* spraying of pendimethalin 580 g/ha as PE followed by one hand weeding at 20 DAS treatment (exhibited less weed flora, weed intensity and weed dry weight which was at par with imazethapyr 75 g/ha as PE + HW at 20 DAS. Significantly the maximum weed control efficiency and lowest weed index was recorded under weed freefollowed by pendimethalin 580 g/ha as PE followed by one hand weeding at 20 DAS treatment. The significantly highest weed index was recorded under weedy check. All the growth parameter of green gram, *viz*. plant height, number of branches and total dry matter accumulation/plant were significantly higher in weed free. The next best and among the different weed management treatments, application of pendimethalin 580 g/ ha as PE followed by one hand weeding at 20 DAS treatment produced higher growth attributes than other method of weed control. But it was at par with imazethapyr 75 g/ha as PE + HW at 20 DAS. The significant effect on growth character of plant was noticed due to different integrated weed management treatments which resulted in enhanced yield contributing character, *viz*. number of pods/plant, number of seeds/pod, seed yield/plant,100 seed weight (g), seed and haulm yield (kg/ha). The highest seed and haulm yield was obtained in weed free treatment (1250.19 and 2229.57 kg/ ha, respectively). All the treatments were found significantly superior over weedy check. Among the different weed management treatments application of herbicide, pendimethalin 580 g/ha as PE followed by one hand weeding at 20 DAS resulted significantly higher seed yield than rest of weed control treatment under study in this experiments. But treatment pendimethalin 580 g/ ha as PE + HW at 20 DAS was found at par with application imazethapyr 75 g/ha as PE followed by one hand weeding at 20 DAS. The same trend in case of nutrient uptake by plant was observed. The gross and net monetary returns were found maximum in weed free treatment followed by application of pendimethalin 580 g/ha as PE + HW at 20 DAS. Benefit cost ratio was the maximum in pendimethalin 580 g/ ha as PE + HW at 20 DAS (2.89) followed by weed free (2.76). However, the gross and net monetary returns were the maximum under weed free check but lowest B: C ratio as compared to integrated weed management treatment due to higher cost of manual labour for weeding.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-47

Weed management practices on growth and yield of rainfed Pigeonpea

Prashant P. Pawar*, S.C. Wadile, R.T. Surywanshi, P.U. Raundal and P.P. Girase
Agronomy section, College of Agriculture, Dhule,
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722
**Email: prashantpawar57@gmail.com*

An experiment was conducted during *Kharif* 2016 at Post Graduate Research Farm, Agronomy Section, College of Agriculture, Dhule. Experiment consisted of ten treatments laid out in randomized block design with three replications. Among integrated weed management treatments, sequential application of pendimethalin 1.0 kg/ha as PE + imazethapyr 35 EC + imazamox 35 EC 0.075 kg/ha (20 DAS) *fb* HW at 40 DAS exhibited less weed flora, weed intensity and weed dry weight which was at par with pendimethalin 1.0 kg/ha as PE *fb* HW at 20 and 40 DAS. Significantly the maximum weed control efficiency was recorded under weed free followed by pendimethalin 1.0 kg /ha as PE + imazethapyr 35 EC + imazamox 35 EC 0.075 kg/ha (20 DAS) *fb* HW at 40 DAS. Besides weed free situation, lowest weed index was recorded in pendimethalin 1.0 kg /ha as PE + imazethapyr 35 EC + imazamox 35 EC 0.075 kg/ha (20 DAS) *fb* HW at 40 DAS. All the growth parameter of pigeonpea, *viz.* plant height, number of branches and total dry matter accumulation/plant were significantly higher in integrated weed management treatments, application of pendimethalin1.0 kg /ha as PE + imazethapyr 35 EC + imazamox 35 EC0.075 kg /ha (20 DAS) *fb* HW at 40DAS than other method of weed control. But it was at par with pendimethalin 1.0 kg /ha as PE *fb* HW at 20 and 40 DAS. The significant effect on growth character of plant was noticed due to different integrated weed management treatments which resulted in enhanced yield contributing character, *viz.* number of pods/plant, number of seeds/pod, seed yield/plant,100 seed weight (g), seed and straw yield (kg/ha). Among the integrated weed management treatments, application of pendimethalin 1.0 kg/ha as PE + imazethapyr 35 EC + imazamox 35 EC0.075 kg /ha (20 DAS) *fb* HW at 40 DAS produced significantly higher grain and straw yield of pigeonpea (2.2 and 5.6 t /ha, respectively) than other method of weed control and it was found at par with application of pendimethalin1.0 kg/ha as PE *fb* HW at 20 and 40 DAS (2.2 and 5.6 t/ha, respectively). The same trend in case of nutrient uptake by plant was observed. However, the gross and net monetary returns were the maximum under weed free treatment but lowest B:C ratio as compared to sequential application of pendimethalin 1.0 kg/ha as PE + imazethapyr 35 EC + imazamox 35 EC 0.075 kg/ha (20 DAS) *fb* HW at 40 DAS and pendimethalin 1.0 kg/ha as PE *fb* HW at 20 and 40 DAS due to higher cost of manual labour for weeding.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-48

Weed dynamics and yield improvement of greengram under interactive effect of different land configurations and weed management regimes in acidic soils of Manipur

K.S. Shashidhar*, Samuel Jeberson N. Premaradhya and Priyanka Irungbam
Central Agricultural University, Imphal, Manipur 795 004
**Email: shashi_uas@rediffmail.com*

Greengram (*Vigna radiata*), belongs to legume family. It is one of the important short duration pulse crops which rich in proteins (25%) play a major role in augmenting the income of small and marginal farmers besides giving food and nutritional security. The main reason is lack of appropriate planting techniques and weed management practices to increase the productivity of the crop. Thus identifying appropriate land configuration and weed control regimes would help to increase the productivity. A field experiment on, yield maximization and weed dynamics of greengram (*Vigna radiate* (L.) R. Wilczek) under interactive effect of different land configurations and weed management regimes in acidic soils of Manipur was conducted at C.A.U. research farm, Andro, Imphal East of CAU, Manipur during *Kharif* 2015 and 2016. It was laid out in strip plot design with 2 land configurations in main plots, *viz* flatbed method (FB) and ridge method (RM) and 4 weed management regimes in sub plots, *viz* weedy check (W_1) pre-emergence application of pendimethalin 30 EC 1 kg/ha (W_2), post-emergent application of imazathapyr 10% SL55 g/ha at 20 DAS, (W_3) and W_1 + imazathypr 55 g/ha, (W_4) with four replications. The major weed species identified in the experimental field were broad leaved weeds like; *Amaranthus viridis, Physallis minima, Phyllanthus niruri, Celosia argentia, Euphorbia hirta* and *Datura stramonium* grasses like; *Cynodon dactylon, Sorghum halepense, Eulisina* spp., *dactyloptinun aegyptium* and *Cyperus rotundus* among sedges. The ridges and furrow method (966 kg/ha) of planting recorded significantly higher seed yield of 10.6% in mungbean compared to flatbed method (873 kg/ha) over two years. Application of pendimethalin 30 EC 1.0 kg/ha as pre-emergent spray *fb* imazthapyr 10% SL at 20 DAS as post-emergent spray recorded significant reduction in weed count, weed dry matter (20.2 g/m^2), weed control efficiency (74%) and increase in seed yield (1.14 t/ha) upto 120% over weedy check. Significantly higher number of pods/plant, seed and stover yield and growth attributes like plant height and no. of branches/plant, total dry matter accumulation/pant recorded with the same treatment. The higher net returns B:C ratio was recorded with the ridges and furrow method with the application of pendimethalin 30 EC 1.0 kg/ha as pre-emergent spray *fb* imazthapyr 10% SL at 20 DAS as post-emergent spray. From two year of experiment, it is concluded that pre-emergent application of pendimethalin 30 EC at 1.0 kg/ha *fb* Imzathapyr 2 EC 10% SL 55 g/ha is most effective in controlling weeds in greengram crop under acidic soils of Manipur.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-49

Effect of green manuring with dhaincha (*Sesbania aculeata*) on weed dynamics and crop growth under different rice establishment methods

T.K. Samant* and L.M. Garnayak
College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha 751 003
**Email: tksamant_2003@yahoo.co.in*

Rice (*Oryza sativa* L.) is the predominant crop of Odisha covering about 10% of total rice area in the country and 53% of the total cultivable area in the state. The productivity of the crop in the state (1.74 t/ha) is about 18% less than the national productivity of 2.49 t/ha. Among the several constraints, weeds pose a major threat for increasing productivity of the crop. Uncontrolled weed growth caused 33-45% reduction in grain yield of rice. Growing a green manure crop adds diversity to the rotation and reduces the opportunities for weeds to become adapted to a particular cropping pattern. A field trial was conducted during *Kharif* season of 2019 in Agronomy Main Research Farm, Odisha University of Agriculture and Technology, Bhubhaneswar to study the effect of green manuring with dhaincha (*Sesbania aculeata*) on weed dynamics and crop growth under different rice establishment methods. The experiment involved two main plot treatments comprising of crop establishment methods, *viz.* direct seeding and transplanting and three green manuring practices *viz*. no green manuring + RDF of rice; green manuring with *dhaincha* 22 kg/ha + 1/3rd RND as vermicompost +1/3rd N as neem oil cake to rice; green manuring with *dhaincha* 30 kg/ha +50% RDF of rice as subplots in split plot design with three replications. In direct seeding, rice was sown with *dhaincha* and in transplanting rice was transplanted after incorporation of *dhaincha*. The observations were taken before incorporation of *dhaincha.*Maximum plant height of *dhaincha* was observed when grown alone at the seed rate of 22 kg/ha in transplanted plots (97.3 cm) and green manuring with *dhaincha* 22 kg/ha (95.9 cm). Mixed sowing of *dhaincha* with direct-seeded rice reduced plant height of *dhaincha* by 8.2 cm. Rice plant height was maximum in direct seeding (17.5 cm) than transplanting (10.5 cm). Growing *dhaincha* along with direct-seeded reduced plant height of rice by 16.2 cm, where as increased height by1.8 cm in case of transplanted rice. No green manuring recorded significantly the highest weed density (355.2/m^2) and weed dry weight (84.2 g/m^2) at 30 DAT. Among different green manuring practices, green manuring with *dhaincha* 30 kg/ha recorded the maximum weed control efficiency (54.8%) with low in both weed density (122.0/m^2) and weed dry weight (16.3 g/m^2) in comparison to no green manuring practice and was at par with green manuring with *dhaincha* 22 kg/ha. This might be due to effective control of weeds during early stages of crop growth by *dhaincha* covering. Similarly, average over the three green manuring treatments direct seeding recorded weed control efficiency of 41.5% with weed density of 86.1/m^2 and weed dry weight of 11.8 g/m^2 as compared to 24.5% in the tobe transplanted field.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-50

Effect of organic weed management practices on weed flora, yield and yield attributes of soybean-gram sequence under irrigated condition

A.A. Chavan*, W.N. Narkhede and H.S. Garud

Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Agricultural University, Parbhani, Maharashtra 431 402,

**Email: ashachavan1992@gmail.com*

A field experiments were conducted at Experimental Farm of AICRP on Integrated Farming System, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS) during *Kharif* and *Rabi* seasons of 2017-18 and 2018-19. The experiment include 10 treatments in randomized block design *i.e* T_1 - two hand weeding at 20-25 and 45-50 DAS, T_2 - one hoeing 20-25 DAS + one hand weeding at 45-50 DAS, T_3 - soybean + sunhemp incorporation after 35-40 DAS in *Kharif* and T_3 – gram + safflower (2:1) in *Rabi* season,T_4- stale seed bed + reduced spacing + 2 tonne of wheat straw + one hand weeding at 25 DAS, T_5- soil mulch at the time of sowing + one hand pulling at 25 DAS, T_6- incorporation of neem cake 1.5 t/ha 15 days before sowing + one handweeding at 25 DAS, T_7-soil solarization with 25 µ polythene mulch during summer + one hand weeding at 25 DAS, T_8- mulching with straw, T_9- weed free and T_{10} -weedy check. The predominant weed flora in soybean were *Cynodon dactylon, Brachiaria eruciformis, Commelina benghalensis, Cyperus rotundus, Phyllanthus niruri, Parthenium hysterophorus* and *Euphorbia geniculata*. The predominant weed flora in gram was *Cynodon dactylon, Cyperus rotundus, Phyllanthus niruri, Convolvulus arvensis* and *Amaranthus viridis*. The significantly lower number and dry weight of weeds was recorded with weed free (T_9) followed by T_1 (two hand weeding at 20-25 and 45-50 DAS) at harvest in soybean and gram during both the year. The higher values of yield attributes observed in T_1 (two hand weeding at 20-25 and 45-50 DAS) in both soybean and gram. The treatment T_4 (stale seed bed + reduced spacing + 2 tonne of wheat straw + one hand weeding at 25 DAS) recorded significantly more sees yield (2541 kg/ha) was on par with T_9 (weed free) treatment *i.e.* 2417 kg/ha and T_1 (two hand weeding at 20-25 and 45-50 DAS) treatment *i.e.* 2370 kg/ha in soybean crop. In gram treatment (T_3) gram + safflower (2:1) recorded significantly more seed yield (2771 kg/ ha) which was at par with T_4, T_9, T_7 and T_6 treatments and significantly superior over rest of the treatments.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-51

Weed management in preseasonal sugarcane

P.M. Chaudhari[1], N.V. Kashid, K.C. Ombase[3] and D.S. Bhoite[4]
Central Sugarcane Research Station, Padegaon Dist. Satara
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722
**Email: omrutusan@gmail.com*

A field experiment was conducted at the Central Sugarcane Research Station, Padegaon, Tal. Phaltan, Dist. Satara (M.S) during 2017-18 to evaluate the effective method of weed management in sugarcane. The experiment was laid out in randomized block design replicated thrice with 10 treatments *viz.* T_1-weedy control, T_2: weed free check, T_3: two weeding, at 30 and 60 DAP +1 hoeing at 90 DAP, T_4: metribuzine 1.0 kg/ha as PE, 2,4-D1kg/ha PoE at 60 DAP, hoeing at 90 DAP, T_5: metribuzine 0.50 kg/ha + 2,4-D 0.50 kg/ha PoE at 25 DAP, hoeing at 60 and 90 DAP, T_6: metribuzine 0.75 kg/ha + 2,4-D 0.75 kg/ha PoE at 25 DAP, hoeing at 60, T_7: metribuzine 1.00 kg/ha + 2,4-D 1.00 kg/ha PoE at 25 DAP, hoeing at 60 and 90 DAP, T_8: metribuzine 1.00 kg/ha + 2,4-D 0.50 kg/ha PoE at 25 DAP, hoeing at 60 and 90 DAP, T_9: metribuzine 0.50 kg/ha + 2,4-D 1.00 kg/ha PoE at 25 DAP, hoeing at 60 and 90 DAP, T_{10}: atrazine 2.00 kg/ha +2,4-D 0.50 kg/ha POE at 25 DAP, hoeing at 60 and 90DAP. metribuzine + 2,4-D were applied as a tank mixin T_5, T_6, T_7, T_8,T_9 and T_{10}. pre-emergence (PE), post-emergence (PoE), followed by (*fb*). The gross and net plot size was 10 x 6 m^2 and 8 x 4 m^2, respectively. Planting of sugarcane variety CoM 0265 was done at 120 cm. row spacing in October and harvested after 15 months. The recommended fertilizer dose 340:170:170 NPK, kg/ha was applied. The soil was medium deep black. All the weed management practices caused significant reduction in weed density over weedy check. At 30 DAA, weed free check (T_2) recorded the highest weed control efficiency (39.48%) followed by treatment T_7 (38.67%) and two weeding at 30 and 60 DAP + 1.0 hoeing at 90 DAP (T_3) (38.52%). At 60 DAA, application of metribuzine 1.00 kg/ha + 2,4-D1.00 kg/ha PoE at 25 DAP, hoeing at 60 and 90 DAP (T_7) recorded highest weed control efficiency (79.57%) followed weed free check (T_2) (78.63%) and treatment (T_3) (77.89%). At 90 DAA, application of metribuzine 1.00 kg/ha + 2,4-D 1.00 kg/ha PoE at 25 DAP, hoeing at 60 and 90 DAP (T_7) recorded highest weed control efficiency (83.54%) followed by treatment (T_3) (81.46%) and treatment (T_9) (80.43%). Weed free check (T_2) recorded significantly the highest cane yield and CCS yield (157.85 t/ha, 21.29 t/ha) which was found at par with treatment metribuzine 0.50 kg/ha + 2,4-D1.00 kg/ha PoE at 25 DAP, hoeing at 60 and 90DAP(T_9) (154.22 t/ha, 20.96 t/ha), metribuzine 1.0 kg/ha as PE, 2,4-D1 kg/ha PoE at 60 DAP, hoeing at 90 DAP (T_4) (150.19 t/ha, 21.02 t/ha), metribuzine 1.00 kg/ha + 2,4-D 0.50 kg/ha PoE at 25 DAP, hoeing at 60 and90 DAP(T_8) (150.97 t/ha, 20.95 t/ha) and two weeding, at 30 and 60 DAP +1.0 hoeing at 90 DAP (T_3) (149.83 t/ha, 20.78 t/ha).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-52

Assessment of chemical weed management on transplantedrice in northern hillzone of chhattisgarh

Sandeep Sharma* and R. S. Rajpoot
Krishi Vigyan Kendra Mainpat and Korea,Chhattisgarh 497 559
**Email: sameer_sandy2002@yahoo.com*

Rice (*Oryza sativa*), the staple food of more than half of the population of the world, is an important target to provide food security and livelihoods for millions. In India it is cultivated in a wide range of ecosystems from irrigated to shallow lowlands, mid-deep lowlands, and deep water to uplands. Transplanting is one of the major rice cultivation methods in India as well as at Korea district of Chhattisgarh. The major associated weeds were observed in the rice field were *Echinochloa colona, Euphorbia* sp., *Commelina benghalensis, Cyperus* spp. etc. Weed management is an important key factor in obtaining higher crop yield. Weed infestation is the major threat to productivity of transplanted rice. Weeds by the virtue of their high adaptability and faster growth dominate the crop habitat and reduce the yield potential of the crop. These weeds could be controlled through manual and chemical methods. Manual method is though very common but cost intensive. Herbicides when applied alone is although economical but may have limitation of resistance development and shift in weed flora etc. Therefore, there is a need to use high efficacy herbicides in combination coupled with broad spectrum nature to control the complex weed flora in transplanted rice Also, the combination of herbicides increase the range of weed control, save time and reduce the cost of cultivation. Unchecked weed growth causes a reduction in grain yield by about 30- 36% in transplanted rice. Weeds compete for an adequate supply of the nutrients, moisture, light and the growing space. Different chemical weed management practices were conducted on farm trail during 2015—18 at different location of farmers' fields were studied in rice were comprised of application of Pre-emergence herbicide, pretilachlor+ pyrazosulfuron-ethy 615 g ai/ha and Pre-emergence herbicide, bensulfuron + pretilachlor 660 g/ha. among weed management practices, pre-emergence application of pretilachlor+ pyrazosulfuron –ethy 615 g/ha followed by bensulfuron + pretilachlor 660 g/ha resulted in higher B:C ratio compared to farmer practices and gavesignificantly lower total weed density, weed dry weight and higher weed control efficiency and it is kept the weed dry weight below the economic threshold level and increased the grain yield in rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-53

Effect of spacing and weed management on summer moth bean

H.H. Patel*, B.J. Patel, H.M. Patel and T.U. Patel
Department of Agronomy, N. M. College of Agriculture, NAU, Navsari, Gujarat 396 450
Email: hhpatel@nau.in

A field experiment was conducted at the College Farm, Navsari Agricultural University, Navsari to study effect of spacing and weed management on summer moth bean (*Vigna aconitifolia*) during summer 2017. Total eighteen treatment combinations consisting of three row spacing, *viz*. S1: 45 cm between two rows, S2: 60 cm between two rows and S3: 90 cm between two rows and six weed management practices, *viz*. pendimethalin 750 g/ha as PE, imazethapyr 75 g/ha as PoE, quizalofop-p-ethyl 100 g/ha as PoE, one hand weeding at 20 DAS, weed free (two hand weeding at 20 and 40 DAS) and W6: unweeded control were evaluated for moth bean var. GMO-1 by employing in factorial randomized block design with three replications. The predominant weed flora observed in the experimental field were *Echinochloa crus-galli* (L.) Beauv, *Cynodon dactylon* (L.) pers and *Brachiaria ramose* L. as major monocot weed flora, while *Amaranthus viridis* L., *Alternanthera sessillis* L., *Digera arvensis* Forsk L., *Convolvulus arvensis* L., *Phyllanthus niruri* L., *Portulaca oleracea* L., *Physalis minima* L. and *Abutilon indicum* (Linn.) Sweet *etc.* were predominant dicot weeds of experimental area, only *Cyperus rotundus* L. was found in sedge type of weed in the experiment. Weed control efficiency was observed maximum at 60 DAS and at harvest (33.17% and 67.83%, respectively) when moth bean under weed free treatment (two hand weeding at 20 and 40 DAS) followed by imazethapyr 75 g/ha as PoE at 20 DAS (28.66% and 61.83%, respectively) and pendimethalin 750 g/ha as PE (27.35% and 59.20%, respectively). However weed index was minimum under pendimethalin 750 g/ha as PE (7.24%). Seed and stover yield of mothbean was significantly influenced by different spacing and weed management treatments. Significantly the higher seed (913 kg/ha) as well as stover (2031 kg/ha) yields were recorded when crop sown at 45 cm between two rows (S1) which was under same bar when crop sown at 60 cm between two row. Among the weed management practices crop weeded twice at 20 and 40 DAS (W5) gave significantly higher seed as well as stover yield (1050 and 2219 kg/ha, respectively) but found at par with application of pendimethalin 750 g/ha as PE. From the results of the study, it can be concluded that profitable yield of summer moth bean can be obtained by keeping row spacing of 60 cm between two rows and following two hand weeding at 20 and 40 DAS or in case of labour shortage application ofPre-emergence of pendimethalin 750 g/ha.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-54

Bio-efficacy of post-emergent herbicides on weed growth and yield of greengram

Narayani Priyadarshini Panda*, K.N. Kalyana Murthy and Kommireddy Poojitha
Department of Agronomy, College of Agriculture, UAS, GKVK, Bangalore, Karanatka 560 065
**Email: npanda24@gmail.com*

A field experiment was conducted during *Kharif* 2018 to study the bio-efficacy of post-emergent herbicides on weed growth and yield of greengram at field unit of AICRP on Agro-forestry, University of Agricultural Sciences, GKVK, Bengaluru. Experiment comprised of eleven treatments including the application of three post-emergent herbicide molecules and their combinations (fomesafen, propaquizafop and imazethapyr) applied at 25 DAS, two hand weedings at 15 and 30 DAS, weed free check and unweeded control were replicated thrice in randomized complete block design. Major weed flora observed in the experimental site were *Borreria articularis, Alternanthera sessilis, Euphorbia geniculata, Acanthospermum hispidum, Parthenium hysterophorus, Amaranthus viridis* among broad-leaved weeds, *Eleusine indica, Dactyloctenium aegyptium* and *Echinochloa colona* among the grassy weeds and *Cyperus rotundus* among the sedges.Among the various herbicide treatments, post-emergent application of fomesafen 18.8% SL + propaquizafop 5.83% EC 294 + 91 g/ha and fomesafen 18.8% SL + propaquizafop 5.83% EC 252 + 78 g/ha resulted in significantly good control of weeds as they have recorded lower weed dry weight at 45 DAS (11.65 and 12.78 g/m^2, respectively) and at harvest (15.59 and 18.69 g/m^2, respectively) due to reduced weed population at 45 DAS (21.5 and 23.4 m^2, respectively) and at harvest (15.90 and 18.01 m^2, respectively). where as, higher weed dry weight (44.48 and 71.42 g/m^2 at 45 DAS and at harvest, respectively) and total weed population (75.73 and 79.9 m^2 at 45 DAS and at harvest, respectively) were recorded with unweeded check. All the herbicide treatments produced significantly higher seed yield compared to the unweeded check. Significantly, higher seed yield was recorded with post-emergent application of fomesafen 18.8% SL + propaquizafop 5.83% EC 294 + 91 g/ha (1058 kg/ha) and fomesafen 18.8% SL + propaquizafop 5.83% EC 252 + 78 g/ha (1007 kg/ha) and were statistically on par with hand weeding at 15 and 30 DAS (1094 kg/ha). Significantly higher yield of greengram with post-emergent application of fomesafen 18.8% SL + propaquizafop 5.83% EC 294 + 91 g/ha and fomesafen 18.8% SL + propaquizafop 5.83% EC 252 + 78 g/ ha was attributed to more number of pods/plant (26.9 and 25.5, respectively), higher test weight (5.83 and 5.72 g, respectively) and higher pod length (5.71 and 5.65 cm, respectively) resulted in significantly higher pod yield/ plant. Unweeded check recorded the lower seed yield (402 kg/ha). At harvest, hand weeding at 15 and 30 DAS recorded higher weed control efficiency (87.19%) followed by treatment receiving post-emergent application of fomesafen 18.8% SL + propaquizafop 5.83% EC 294 + 91 g/ha (71.60%) and fomesafen 18.8% SL + propaquizafop 5.83% EC 252 + 78 g/ha (69.09%).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-55

Effect of weed management practices on growth and yield of wheat

Smita Singh*, Arpita Shrivastava, B.K.Tiwari,A.K.Patel, Akhilesh Kumar and Veena Pani Shrivastava

Krishi Vigyan Kendra, Rewa, Madhya Pradesh 486 001

**Email: sapnapuat@gmail.com*

Wheat [*Triticum aestivum* (L.)] is one of the most important cereal crops of India as well as of world. During the green revolution phase of Indian agriculture, there was tremendous increase in area, production and productivity of this crop. It occupies second position both in terms of area and production in our country. It is cultivated in an area of 31.19 million hectares with annual production of 95.91 million tonnes and productivity of 3075 kg/ha in 2014-15, whereas, in Madhya Pradesh, it is cultivated in 5.79 million ha land with an annual production of 13.93 million tonnes with productivity of 2405 kg/ha. A yield gap of 1.5 to 2 t/ha between field demonstrations and what the farmers are harvesting indicates the scope for substantial in wheat yields. Improper weed management is one of the major bottlenecks in realizing the potential of wheat crop under different agro ecological situations. Estimates of losses by weed reveal that weeds alone account for 45% of the annual loss of agricultural produce by pests in India. In wheat, yield losses by weeds may range from 10 to 82% depending upon type of weed species, the improper weed management is one of the major bottlenecks in realizing the potential of wheat crop under different agro-ecological situations.On farm trials (OFT) were conducted in Chhatarpur district of Madhya Pradesh under supervision of Krishi Vigyan Kendra. Total 05 OFT under irrigated situations were conducted during *Rabi* seasons of 2017-18 at different villages namely; Singravankala and Chaukhada; respectively under Krishi Vigyan Kendra operational area. The area under each trial was 0.4 ha. The treatment comprised of T1-Non adoption of weed management practices (Farmer's practice), T2-application of clodinofop 15% WP 60g/ha at 25-30 DAS, T3-Use of sulfoosulfuron 75% WP 25 g/ ha +metsulfuron-methyl 5% WP (6g/ha) at 25-30 DA**S.** In this study we evaluated the effective weed management practices for weed management in wheat on yields and yield attributing characters under irrigated conditions. On the basis of one year mean result of on farm testing (OFT) shown a greater impact on farmer's economy due to significant increase in crop yield 37.66 q/ha under T_3 followed by 34.69 q/ha under T2 as compared to 29.6 q/ha in FP than weed intensity was highest under T1 (Farmer's practice) 106/ m^2, T2 (17.89/ m^2) and it was lowest under T3 (13.66/m^2). The net profit under T3 was ` 37700/ha followed by ` 34587/ha under T2 as compared to ` 27356/ha. By conducting OFT of proven technologies, yield potential and net income from integrated weed management of wheat cultivation can be enhanced to a great extent with increase in the income level of the farming community of the district.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-56

Effect of tillage and weed management practices on growth and yield of quality protein maize

Gayatree Mishra*, Mahua Banerjee and Ashok Kumar Mohapatra[1]

Palli Siksha Bhavana, Visva- Bharati, Sri Niketan, West Bengal 731 236

[1]Institute of Agricultural Sciences, Siksha o Anusandhan, Odisha 751 003

**Email: gayatree.tt.mishragmail.com*

Field experiment was conducted on sandy loam soils of Paralakhemundi, Odisha during *Kharif* of 2018 to study the effect of tillage and weed management practices on growth and yield of quality protein maize. The experiment was conducted in split plot design with two tillage practices, *viz.* conventional tillage and zero tillage as main plot and eight weed management practices, *viz.* metribuzin 200 g/ha as pre-emergence *fb* hand weeding at 35 days after sowing, oxadiargyl 90 g/ha as pre-emergence *fb* hand weeding at 35 days after sowing,metribuzin 200 g/ha as pre-emergence *fb* topramezone 35 g/ha at 35 days after sowing,oxadiargyl 90 g/ha as pre-emergence *fb* topramezone 35 g/ha at 35 days after sowing,metribuzin 200 g/ha as pre-emergence *fb* 2,4-D Na salt 500 g/ha at 35 days after sowing, oxadiargyl 90 g/ha as pre-emergence *fb* 2,4-D Na 500 g/ha salt at 35 days after sowing, hand weeding at 15 and 35 days after sowing, weedy check as sub plot in three replication. Among the tillage practices significantly higher dry matter production, plant height, number of cobs/m^2, cob length, number of seeds/cob and yield of quality protein maize observed in conventional tillage compared to zero tillage system whereas among different weed management practices significant difference was observed in dry matter production, plant height, number of cobs/m^2, cob length, number of seeds/cob and yield of quality protein maize at different days after sowing and harvesting. Height of plant and dry matter accumulation was significantly highest in hand weeding treatment throughout growth stages. Highest weed control efficiency was observed in hand weeding plots under different tillage practices due to significant reduction in weed population and dry matter of weeds, which resulted in higher number of cobs/plant, number of seeds/cob and yield of maize. It was comparable to pre-emergence application of metribuzin and oxadiargyl when performed in combination with one hand weeding practice and sequential application with topramezone and 2,4-D. Weed control efficiency of 72.4% was observed in hand weeding plots under conventional tillage which was on a par with metribuzin 200 g/ha *fb* topramezone 35 g/ha at 35 days after sowing at harvesting. The maximum yield obtained with hand weeding (6.21 t/ha) under conventional tillage was significantly superior to rest of the treatments. The next best treatment was metribuzin 200 g/ha as pre-emergence *fb* 2,4-D Na salt 500 g/ha at 35 days after sowing which was on a par with metribuzin 200 g/ha *fb* topramezone35g/ha at 35 days after sowing.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-57

Weed species richness in grass based cropping system in context to changing climate at Kymore plateau and Satpura hills zone of Madhya Pradesh

Bheru Lal Kumhar, Kamal Kishore Agrawal, Vijay Bahadur Upadhyay, Amit Kumar Jha, Hitendra Kumar Rai, Vijay Kumar and Satish Kumar

Department of Agronomy, College of Agriculture, Jawaharlal Nehru Agricultural University, Jabalpur 482 004

**Email: praapatiagro09@gmail.com*

Present investigation was conducted at the research farm, College of Agriculture, Jawaharlal Nehru Agricultural University (JNKVV), Jabalpur during July 2018 to December 2019. The experiment comprised of eight treatments like that pearlmillet Napier (PN) hybrid at recommended spacing, Guinea grass at recommended spacing , PN hybrid in paired rows + ricebean (*Kharif*) -Egyption clover (*Rabi*) , PN hybrid in paired rows + *Desmanthus* (Perennial) , PN hybrid in paired rows + *Sesbania grandiflora*, Guinea grass in paired rows + Ricebean (*Kharif*) -Egyption clover (*Rabi*), Guinea grass in paired rows + *Desmanthus* (Perennial) , Guinea grass in paired rows+ *Sesbania grandiflora* in randomized block design (RBD) with thrice replication. The experimental field was sandy clay loam in texture, slightly alkaline in reaction with low OC content and having normal, medium in available NPK. The weed species dominant *Cynodon dactylon, Alternanthera philoxeroides, Eclipta alba, Cyperus iria, Dinebera retroflexa* and *Echinochloa colona* reordered during *Kharif* and *Anagalis arvensis, Spergula arvensis L., Cichorum intybus, Chenopodium album, Medicago denticulate, Vicia sativa* and *Convolvulus arvensis* were also found associated during *Rabi* season. Good agriculture practices choosing different grass based cropping system, residue retention, minimum tillage and crop diversification will be promoted organic matter accumulation in soil, leads to carbon sequestration and thereby improving soil physical, chemical and biological properties and for reclamation of degraded lands and sustaining agro biodiversity. Sequestering CO_2 from atmosphere through natural techniques is more economically and ecologically sounds in increasing the carbon storage capacity of the terrestrial ecosystems. Potential of grass based cropping systems (CS) as a climate resilient adaptive strategy for managing sustainable fodder production in Indian agriculture. Weed species richness in grass based cropping system in context to changing climate at Kymore Plateau and Satpura hills zone of Madhya Pradesh might help to anticipate and adapt farming to maximize green fodder production throughout the year.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-58

Chemical weed control studies in rainfed fingermillet

K. Sivagamy* and P. Parasuraman
Tamil Nadu Agricultural University, Thiruvannamalai, Tamil Nadu 606 604
**Email: ksivagamy@yahoo.com*

Finger millet commonly known as ragi, is one of the important staple food crops of South India. Delayed weeding will be less effective because sufficient damage would have occurred at the critical period. Apart from expensive labour charges, timely availability of labour is a limitation for undertaking cultural operations like hand weeding. In such situations, suitable technology with less labour requirement will be most helpful to farmers for controlling weeds effectively and chemical weed control is one of such measures. A field experiment was conducted at Centre of Excellence in Millets, Athiyandal during *Kharif* 2017 to find out the effect of different herbicides and weed management practices to control the weed spectrum in the finger millet. The soil texture of the experimental site was r sandy loam with a alkalil pH (78.2) and was medium in organic carbon content (0.53%). The experimental plot was laid out in randomized block design with three replications. The treatment details were are pre-emergenceapplication of pendimethalin 0.5 kg/ha (30 EC), PE application of pendimethalin 0.75 kg/ha (30 EC), pre-emergence application of bensulfuron-methyl + pretilachlor 2.0 kg/ha, pre-emergence application of bensulfuron -methyl + pretilachlor 3.0 kg/ha, pre-emergence application of isoproturon 0.5 kg/ha, pre-emergence application of pendimethalin 0.5 kg/ha (30 EC),+ one inter cultivation at 40-45 DAS, Pre-emergence application of pendimethalin 0.75 kg/ha (30 EC), + one inter cultivation at 40-45 DAS, pre-emergence application of bensulfuron-methyl + pretilachlor2.0 kg /ha + one inter cultivation at 40-45 DAS, pre-emergence application of bensulfuron-methyl + pretilachlor3.0 kg /ha + one inter cultivation at 40-45 DAS, Pre-emergence application of isoproturon 0.5 kg a. I /ha + one inter cultivation at 40-45 DAS, two Inter cultivation + onehand weeding and unweeded check (control). Dominent weed species was found at experimental site were *Parthenium hysterophorous*, *Digitaria sanguinalis*, *Boerhevia diffusa* and *Cyperus rotundus*. Higher weed control efficiency was observed higher in pre-emergence application of isoproturon 0.5 kg/ha with one inter cultivation at 45 DAS recorded (83.66%). Among the various weed control treatments, pre-emergence application of isoproturon 0.5 kg/ha with one inter cultivation at 45 DAS, which recorded 2188 kg/ha of grain yield and 3650 kg/ha of straw yield followed by two inter cultivation with one hand weeding recorded higher grain yield of 2329 kg/ha with the straw yield of 3768 kg/ha and, higher net monetary return of ` 46,014 / ha with B:C ratio of 2.91.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-59

Weed management in black gram using different pre-plant, pre and post-emergence herbicide combinations

Navish Kumar Kamboj*, Todar Mal Poonia[1], Samunder Singh[1]
Cotton Research Station, Sirsa, CCS Haryana Agricultural University, Hisar, Haryana 125 055
[1]Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: navishkamboj62@gmail.com*

Black gram (*Vigna mungo* L.) is one of the most important pulse crop of India. Poor yield of pulses may be attributed to luxurious growth of weeds in these crops and failure to control them in time. Being a short duration and initially slow growing crop, black gram is heavily infested with narrow, broad-leaved weeds and sedges. Weeds compete for resources and cause 43.2 to 90% yield loss in black gram. Weed management using herbicides is advantageous under such conditions as it provides both timely and economical protection against weeds. Although, the effectiveness of soil-applied herbicides is dependent upon several factors, including movement of the herbicide into the soil either through water provided by rainfall or irrigation or by mechanical incorporation. So keeping this in view, a field experiment was conducted with the objective to compare the efficacy of pre- emergence and pre-plant incorporation of herbicides alone and in combination with sequential post-emergence application of herbicides at Agronomy Research Area of CCS Haryana Agricultural University, Hisar, Haryana, India (29010'N latitude, 75046'E longitude and 215.2 M altitude) during *Kharif* 2018 in randomized complete block design having thirteen treatments with three replications. The treatments were pendimethalin (PPI) (1500 g/ha), pendimethalin (PRE) (1500 g/ha), pendimethalin + imazethapyr (PPI) (tank mix) (1000+50 g/ha), pendimethalin + imazethapyr (PRE) (tank mix) (1000 +50 g/ha), imazethapyr (PPI) (75 g/ha), imazethapyr (PRE) (75 g/ha), imazethapyr (POE) (75 g/ha), imazethapyr + imazamox (PPI) (ready mix) (40 g/ha), imazethapyr + imazamox (PRE) (ready mix) (40 g/ha), imazethapyr + imazamox (POE) (ready mix) (40 g/ha), pendimethalin (PPI) *fb* propaquizafop (POE) (1500 *fb* 62.5 g/ha), pendimethalin (PRE) *fb* propaquizafop (POE) (1500 *fb* 62.5 g/ha), weed free and weedy check. The predominant weed flora present at the experimental site were *Echinocloa colona*, *Cyperus rotundus*, *Trianthema portulacastrum* and *Convolvulus arvensis*. All the herbicide treatments were found to have significantly better control of weeds at 30 DAS as compared to weedy check. Among different treatments, weed control efficiency of pre plant incorporated herbicides alone or in combination was higher as compared to pre-emergence application of herbicides. Pre plant incorporation of pendimethalin + imazethapyr (ready mix)1000 g/ha or tank mix (1000 +50 g/ha) resulted in lower weed dry matter and higher weed control efficiency. Pendimethalin (PPI) *fb* propaquizafop (POE) (1500 *fb* 62.5 g/ha) resulted in higher weed control efficiency and better control of both broad as well as grassy weeds and was found to be at par with weed free treatment.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-60

Weed management in conservation agriculture – A review

S. Ganapathi*, G.N. Dhanapal and S. Kamala Bai
University of Agriculture Science, UAS, GKVK, Bengaluru, Karnataka 560 065
**Email: ganapathisamardi18@gmail.com*

Weed control in semi-arid regions is one of the most intensive management practices in different production systems and can affect both agricultural productivity and environmental impact. Given the significance of this question, studies documenting the action of various weed control methods on soil physical properties and their impact on soil and water management and conservation require a greater understanding of the adequacy of management systems. Weeds are considered as one of the major crop production constraints and can significantly reduce yield if not properly controlled. Depending on the crop, ecological and climatic conditions, possible yield reductions caused by uncontrolled weeds are estimated at 45% to 95%.Conservation agriculture involves a soil and water conservation system approach on which to develop a sustainable strategy for intensification. In all continents and most agro-ecologies, this is happening now. Control of land degradation, particularly soil erosion was promoted in conservation programs involving reduced tillage. The methods of agriculture and land management that were considered to adequately address the goals of soil and water conservation are focused on no-till seeding and soil mulch cover maintenance. This series of practices led to what became known as conservation tillage, although by nature no-till systems prevent soil disturbance by direct no-till seeding and retain an organic mulch cover on the surface of the soil. For conservation agriculture, the entire ecosystem and all natural ecosystems, including soil microorganisms and soil fauna are used to create soil health and productive capacity and protect crops against weeds, insects and pathogens. Given the ability of conservation farming to enhance rainfall penetration and soil moisture retention as well as soil and root size, interactions between plant roots and soil nutrients and between plant roots and soil microorganisms are enhanced so that biotic and abiotic stress tolerance in conservation farming systems is increased compared to tillage systems. Tillage farming causes destruction of soil structure, porosity, soil life, and biodiversity, and excessive breathing, and decomposition of soil organic matter, resulting in accelerated soil erosion. As a net emitter of greenhouse gases, tillage farming continuously decreases the soil's organic matter content, which has a direct correlation with soil quality and productive capacity. When farmers decide to switch from tillage farming to conservation agriculture, the expected mix of economic and environmental benefits will appear over time. The benefit mix varies in terms of make-up and time scale depending on several factors including agro-climatic conditions and variance within and between seasons, initial soil health and drainage status under tillage systems, farm size and farm power source, complexity of the crop system, yield rates under tillage systems. Agriculture conservation is not a universal solution, but it provides an essential alternative approach which integrates ecological values into crop production systems. It is more complex information and management, and it is usually necessary to adapt technology for different production environments. In the initial years, it may be difficult to establish conservation agriculture, especially in some semi-arid areas, with more clay soils, compact soils, and poorly drained soils.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-61

Effect of weed management practices on growth and yield of pigeonpea

B.K. Tiwari*, Smita Singh, K.S. Baghel, A.K. Patel, Akhilesh Kumar and A.K. Pandey
Krishi vigyan Kendra, (JNKVV Jabalpur), Rewa, Madhya Pradesh 486 001
**Email: bktiwari22_syngenta@rediffmail.com*

In India, pigeonpea is second most important pulse crop of India, which has diversified uses as food, feed, fodder and fuel, next to chickpea producing 3.29 million tons annually from 3.88 million ha. The Indian sub-continent alone contributes nearly 92% of the total pigeonpea production in the world. Although India leads the world both in area and production of pigeonpea, its productivity is lower (697 kg/ha) than the world average (775 kg/ha). In India, pigeonpea is grown in *Kharif* season. Due to rainy season, slow initial growth and sowing at wider spacing, severe infestation of weeds was observed in pigeonpea which results in low grain yield. Crop yield losses due to weeds have been estimated to range from 55-60% has been reported. Moreover non availability of labour for hand weeding is another problem. On farm trials (OFT) were conducted in Rewa district of Madhya Pradesh under supervision of Krishi Vigyan Kendra. Total 30 OFT under farming situations were conducted during *Kharif* of 2016-17, 2017-18 and 2018-19 (three consecutive years) at five different villages namely; Khokham, Purena, Semarikala, Reethi and Majhiayar, respectively under Krishi Vigyan Kendra operational area. The area under each trial was 0.2 ha. The treatment comprised of T_1-non adoption of weed management practices (farmer's practice), T_2-application of pendimethalin 1000 g/ha at 0-3 DAS, T3-T2+ application of imazethapyr 100 g/ha at 25-30 DA**S.** In this study we evaluated the effective weed management practices for weed management in pigeonpea on yields and yield attributing characters under rainfed conditions. On the basis of three years mean result of on farm testing shown a greater impact on farmer's economy due to significant increase in crop yield 14.32 q/ha under T_3 followed by 10.90 q/ha under T_2 as compared to 0.79 t/ha inFP (T_1), it was 81% higher under T_3 followed by 38% under T_2 than T_1; weed intensity was highest under T_1 (farmer's practice) 325/ m^2 followed by T_2 (139/ m^2) and it was lowest under T_3 (30/m^2) the net profit under T3 was Rs 53,925/ha followed by ` 37,804/ha under $T_2$ as compared to ` 22,839/ha under T1 (FP). Benefit cost ratio was 3.40 under T_3 followed by 2.88 under T_2, while it was 2.19 under T_1. By conducting OFT of proven technologies, yield potential and net income from integrated weed management of pigeonpea cultivation can be enhanced to a great extent with increase in the income level of the farming community of the district.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-62

Productivity of clusterbean as influenced by weed management and fertility levels

Priyanka Kumawat and M.K. Kaushik[1]
Sri Karan Narendra Agriculture University, Jobner, Rajasthan 303 329
[2]Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan 313 001
Email: priyanka91_agri@rediffmail.com

A field experiment was conducted during *Kharif* seasons of 2014 and 2015 at Udaipur (Rajasthan) to find out the effect of weed management on productivity of clusterbean under varying fertility levels. The experiment consisted of eight weed management treatments *viz.* weedy check, pendimethalin 1.0 kg/ha, one hand weeding at 20 DAS, two hand weeding at 20 and 40 DAS, imazethapyr 0.1 kg/ha, imazethapyr 0.1 kg/ha *fb* hand weeding 40 DAS, pendimethalin 0.75 kg/ha *fb* hand weeding 40 DAS, pendimethalin 0.75 kg/ha *fb* imazethapyr 0.1 kg/ha 20 DAS with three fertility levels (10 kg N + 20 kg P_2O_5/ha, 20 kg N + 40 kg P_2O_5/ha and 30 kg N + 60 kg P_2O_5/ha), thereby making 24 treatments combinations. The experiment was laid out in split plot design, assigning weed management to main plots and fertility levels to sub plots. The treatments were replicated thrice.The results revealed that among various weed management practices, two hand weeding 20 and 40 DAS recorded significantly highest weed control efficiency (85.02%), seed (1.30 t/ha), haulm (2.57 t/ha) and biological (3.88 t/ha) yield during both the years overrest of the treatments except sequential application of pendimethalin *fb* imazethapyr which was statistically at par with it. Further, application of imazethapyr *fb* hand weeding and pendimethalin *fb* hand weeding also gave comparable results with pendimethalin *fb* imazethapyr in terms of weed control efficiency and yields. Among the fertility levels, application 20 Kg N + 40 Kg P_2O_5/ ha significantly increased seed (1.06 t/ha), haulm (2.16 t/ha) and biological (3.22 t/ha) yield and harvest index (31.98%) of clusterbean over 10 Kg N + 20 kg P_2O_5/ha, however, it was found statistically at par with fertility level 30 Kg N + 60 Kg P_2O_5 /ha. So looking to the laborious pressure of hand weeding, application of pendimethalin *fb* imazethapyr can be an effective weed control option in cluster bean crop with higher seed and haulm yield under rain fed agro-ecosystem in semi arid and arid regions of Rajasthan. Further, it was concluded that in Southern zone of Rajasthan, clusterbean should be fertilized with 20 kg N + 40 kg P_2O_5/ha.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-63

Integrated weed management in irrigated pearl millet

Charul Chaudhary*, V.S. Hooda, D.P. Nandal, Samunder Singh and Lovish Chaudhary[1]
Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004
[1]School of Agricultural Sciences, Uttaranchal University, Dehradun, Uttarakhand 248 001
**Email: ccsagwal@gmail.com*

A field experiment was conducted at Agronomy Research Farm of CCS Haryana Agricultural University, Hisar, Haryana during *Kharif* 2017 and 2018 on pearl millet crop at latitude of 29° 10´N, longitude of 75° 46´E and at a height of 112 meters above mean sea level with semi-arid and subtropical climate.The treatments were 3 pre-emergence herbicides, *viz.* atrazine at 500 g/ha, atrazine at 750 g/h aand pendimethalin at 1000 g/ha, one pre-emergence herbicides mixture, *viz*. atrazine + pendimethalin at (0.4+0.75 kg/ha), 4 post-emergence herbicides, *viz.* atrazine at 0.5 kg/ha application at 10-14 DAS, atrazine at 0.75 kg/ha at 10-14 DAS, tembotrione (Laudis) at 80 g/ha at 2-4 leaf/10-15 DAS and tembotrione (Laudis) at 100 g/ha (PoE) at 2-4 leaf/ 10-15 DAS, 2 pre-emergence herbicides with one hand weeding, *viz.* atrazine at 0.4 kg/ha + one HW at 21 DAS and pendimethalin at 0.75 kg/ha + one HW at 21 DAS, 1 pre-emergence herbicides mixture with one hand weeding, *viz*. atrazine + pendimethalin at (0.4+0.75 kg/ha) + one HW, 3 post-emergence herbicides with one hand weeding, *viz*. atrazine at 0.4 kg/ha (PoE) at 10-14 DAS + one HW at 30 DAS, tembotrione (Laudis) at 80 g/ha (POST) at 2-4 leaf/10-15 DAS +one HW at 30 DAS and tembotrione (Laudis) at 100g/ha (PoE) at 2-4 leaf/10-15 DAS +one HW at 30 DAS and two hand weedings at 15 and 30 DAS were compared, with weed free and weedy check. Seventeen treatments were tested using a randomised block design with three replications. There were four major weeds in the field *i.e. Cyperus rotundus*, *Echinocoloa colona*, *Digera arvensis* and *Trianthema portucalastrum*. Among pre-emergence herbicide treatments the lowest weed density, dry weight and higher weed control efficiency were obtained in case of atrazine at 0.75 kg/ha PRE at 20, 40, 60 DAS and at harvest. But, pre-emergence herbicides with one hand weeding gave better results than sole pre-emergence herbicides *i.e.* atrazine 0.4 kg/ha PRE + 1HW at 21 DAS. Among post-emergence herbicides, the application of tembotrione 100 g/ha PoE at 2-4 leaf/10-15 DAS observed lowest weed density, dry weight and higher weed control efficiency at all stages but post-emergence herbicide treatments with one hand weeding performed better than sole post-emergence herbicides. The lowest dry weight was observed under tembotrione 100 g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS. Among herbicidal treatments, tembotrione 100 g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS recorded lowest weed density, weed dry weight and higher weed control efficiency which was at par with two HW/hoeing at 15 and 30 DAS and tembotrione 100 g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS. Higher grain yield was obtained with application of tembotrione (Laudis) 80g/ha (PoE) at 2-4 leaf/10-15 DAS + one HW at 30 DAS (3.6 t/ha) which was on par with tembotrione (Laudis) 80g/ha (PoE) at 2-4 leaf/10-15 DAS + one HW at 30 DAS (3.5 t/ha) and two HW/hoeing at 15 and 30 DAS (3.4 t/ha).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-64

Sustainable weed management for conservation agriculture

Ashvin Kumar Meena*, R.N. Meena, Kartikeya Choudhary, Anoop Kumar Devedee and Kamlesh Meena

Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh 221 005

**Email: ashvin.agro@gmail.com*

The intensive chemical and mechanized conventional agriculture led to a variety of issues associated with sustainability of production system. Clean cultivation involving removal or burning of residues after harvesting led to continuous mining of nutrients and moisture from the soil profile. Intensive tillage, bare soil with no soil cover, indiscriminate use of insecticides and pesticides, and imbalanced use of chemical fertilizers further deteriorated soil health leading to declining input-use efficiency. Conservation agriculture (CA) is a reply to sustainable land management, environmental protection, and climate change adaptation and mitigation. It promotes maintenance of a minimum soil disturbance, permanent soil cover, and diversification of plant species. It enhances biodiversity above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production. However, weed control may be critical for successful implementation of CA. Even though CA is gaining recognition for its optimistic effect on soil conservation, it is still not widely known by many farmers around the world. For those who are well-known with the concept, a major challenge lies with weed management. In addressing weed control challenges, scientific studies have provided evidence that minimum and no-tillage encourage shifts of weed population particularly towards perennial weeds, thus create a long-lasting weed problem. In compare to conventional tillage, the presence of weed seeds is higher in the soil surface under zero tillage, which favours relatively high weed germination. Hence, reduction in tillage frequency and intensity, as practiced under CA, generally increases weed infestation. Further, changes from conventional to conservation farming practices often lead to a weed flora shift in the crop field, which in turn read out the requirements of new weed management technologies involving various approaches.Weed control in CA is hard task than in conventional agriculture because there is no weed seed burial by tillage operations. The weed species that germinate in response to light are likely to be more problematic in conservation agriculture. In addition, perennial weeds become more challenging in this system. Various approaches that may be working to successfully manage weeds in CA systems are preventive weed control measures, stale seedbed practice; zero till wheat in a rice-wheat system reduces little seed canary grass infestation, soil cover using crop residues, crop rotations and diversification, herbicide integration and rotation.Pre-planting weed management in a CA system may need to be controlled with a nonselective herbicide such as glyphosate, paraquat or glufosinate. Pre-emergence herbicides applied as granules (alachlor, cyanazine and metolachlor) provided better weed control than liquid-formations in no tillage systems. The granules are assumed to move to the soil surface through the stubble more effectively than a liquid applied herbicide. Any single method of weed control cannot provide season-long and effective weed control. Therefore, a combination of different weed management strategies should be evaluated for widening the weed control spectrum and efficacy for sustainable crop production.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-65

Sustainable weed management through allelopathic aqueous extracts and their combination with herbicides in sugarcane

Anoop Kumar Devedee*, R.K. Singh, Kartikeya Choudhary, Kamlesh Meena, Ashvin Kumar Meena, Tikendra Kumar Yadav

Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh 221 005

**Email: anoopk.devedee3@bhu.ac.in*

Sugarcane an old energy source for human beings and more recently, a substitute of fossil fuel for motor vehicles in most sugarcane grown countries. In India productivity of sugarcane is low as compared to other sugarcane growing countries of the world. Various factors such as major acreage under small and marginal holdings, non availability of quality inputs, weed infestation, attack of diseases and insect-pest and occurrence of various inevitable stresses during the crop growth period restrict the crop yield. Increase in weed free period at early stage of growth. In sugarcane weed competition took up to 3-4 months. The critical period is maximum during the competition between weeds and crop plant from the shooting stage to root transition stage. Therefore, it is recommended that weeds must be controlled during the critical period of competition to enhance the yield of crop. Allelopathy is an environment friendly technique in suppressing weeds and helpful in reducing cost of herbicides. The major weed flora in the sugarcane plant crop were *Cyperus rotundus*, *Cynodon dactylon*, *Trianthema monogyana, Echinochloa colona, Trianthema portulacastrum, Cleome viscose* and Other weed spp. like *Eclipta alba* and *Dactyloctenium aegyptium* were also present in the experimental field. To, reduce the weed problem, an experiment was conducted in this direction at Agricultural Research Farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during 2017-18 to evaluate the efficacy of halosulfuron 6% + metribuzin 50% WG tank-mix (TM) with different plant water extract *viz*. Sorghum, sunflower and *parthenium*. Results reveals that the maximum weed suppression, highest weed control efficiency and weed index were obtained with application of halosulfuron + metribuzin (TM) at higher doses (67.5+652.5 g/ha) applied as pre- and post-emergence *fb* halosulfuron--methyl 6% + metribuzin 50% (50% of RD) + 25% SWE (sorghum water extract) + 25% SUWE (sunflower water extract), 50% reduce the application of halosulfuron-methyl 6% + metribuzin 50% of recommended doses. Combination of halosulfuron-methyl 6% + metribuzin 50% (TM) even applied at 67.5+652.5 g/ha *fb* halosulfuron--methyl 6% + metribuzin 50% (50% of RD) + 25% SWE + 25% SUWE was also found superior over rest of the treatments except hand hoeing (60 days after planting (DAP).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-66

Chemical weed management in summer groundnut

A.D. Tambe*, A.G. Adsule and B.T. Sinare
Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722
**Email: atavitambe04@gmail.com*

An experiment was conducted to study the effect of chemical weed management on weed control and yield of summer groundnut (*Arachis hypogaea* L.) was conducted at AICRP on Summer Groundnut, Mahatma Phule Krishi Vidyapeeth Rahuri. The experiment was laid out in randomized block design with three replications and eleven treatments *viz.* unweeded control, weed free, pendamethalin 1.0 kg/ha + 1 HW at 30-35 DAS, quizolofop--ethyl 50 g/ha at 20 DAS, quizolofop-ethyl 75 g/ha at 20 DAS, quizolofop-ethyl 100 g/ha at 20 DAS, imazethypyr50g/ha at 20 DAS, imazethypyr 75 g/ha at 20 DAS, imazethypyr 100 g/ha at 20 DAS, pendamethalin 1.0kg/ha and quizolofop-ethyl 50 g/ha at 20 DAS and pendamethalin 1.0 kg/ha and imazethapyr 75 g/ha at 20 DAS. The pendimethalin was used as pre–emergence herbicide while quizolofop-ethyl and imazethapyr were used as post-emergence herbicides. The groundnut variety TPG-41 was used for the experimentation.Weed intensity and weed dry matter at harvest was significantly lower in weed free check. It was followed by weed control treatments *viz.* pendimethalin 1.0 kg/ha + 1 HW at 30-35 DAS and pendimethalin 1.0 kg/ha + quizalofop-ethyl 50 g /ha at 20 DAS. Weed control efficiency at harvest was significantly higher in weed free check. It was followed by and at par with weed control treatments *viz.* pendimethalin 1.0 kg/ha + 1 HW at 30-35 DAS and pendimethalin 1 kg /ha + quizalofop-ethyl 50 g /ha at 20 DAS. The growth attributing characters of groundnut, *viz.* plant height, plant spread, number of leaves and dry matter per plant were significantly more in weed free check. This was followed by pendamethalin 1.0 kg/ha + 1 HW at 30-35 DAS and pendimethalin 1.0 kg /ha + quizalofop-ethyl 50 g /ha at 20 DAS. Beneficial effects due to above treatments on growth characters resulted in enhancement of yield attributing characters *viz.* total no of developed pods, hundred pod weight, kernel weight, and shelling percentage. Maximum value of yield attributes were observed in weed free check followed by pendimethalin 1.0 kg/ha + 1 HW at 30-35 DAS. The yield of groundnut pods 3.33 t/ha and haulm 5.25 t/ha was recorded higher in weed free check followed by pendimethalin 1.0 kg/ha + 1 HW at 30-35 DAS (3.15 t/ha and 50 t/ha, respectively).Maximum net returns were obtained in weed free check (Rs.44, 207/ha) followed by pendimethalin 1.0 kg/ha + 1 HW at 35 DAS (Rs.42, 061/ha). Similarly, the benefit cost ratio was also higher in case of pendimethalin 1.0 kg/ha + 1 HW at 30-35 DAS (2.75) followed by weed free check (2.73), pendimethalin 1.0 kg/ha + quizalofop -ethyl 50g /ha at 20 DAS (2.62).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-67

Integrated weed management on growth, yield and soil quality of transplanted rice in new alluvial zone of West Bengal

Kanu Murmu*, Sukanya Dutta, Salil Saha, Anindita Das and Mahafuzar Rahaman
Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal 741 252
**Email: kanumurmu@gmail.com*

Rice is the most important cereal crop which plays major role in Indian food economy as well as dietary needs of the world. Transplanted rice is the most common practice throughout the world. Normally puddling is done to reduce percolation losses, to control weeds and to make transplanting operation easier. Thus, management of weeds is a fundamental requirement in transplanted rice cultivation. Weed free period during the critical period of competition is essential for obtaining optimum rice yield. Raising cost of labour and their reduced availability has led to search for alternative methods such as herbicide use either alone or in combination with manual or mechanical weeding. Hence, the field investigations were carried out at 'C' block in check farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal during wet seasons of 2017 and 2018 to study the effect of integrated weed control on growth and yield of transplanted rice. Experiments were tested in randomized block design replicated thrice. Treatments consisted of application of herbicides, *viz.* clomazone 500 g/ha, butachlor 1250 g/ha, pretilachlor 500 g/ha, bispyribac -sodium 25 g/ha followed by (*fb*) hand weeding (HW) on 45 days after transplanting (DAT). Pre-plant incorporation of glyphosate 2.5 L/ha *fb* Pre-emergence application of bensulfuron-methyl plus pretilachlor 660 g/ha was also tested with two hand weeding and unweeded control.The highest grain yield (4.32 and 4.51 t/ha) were recorded under bispyribac-sodium 25 g/ha followed by (*fb*) hand weeding on 45 DAT during both years as a result of reduced weed dry weight and increased growthattributes. Among the various agronomic indices, highest agronomic management index (AMI), weed management index (WMI) and integrated weed management index (IWMI) and best weed index (WI) value observed in bispyribac -sodium 25 g/ha followed by (*fb*) hand weeding on 45. In respect to physico-chemical and biological properties of soil application of different herbicidal treatments the bulk density, water holding capacity and moisture content of soil did not vary after harvesting of paddy. No variations were found among the different textural classes of soil, the sand, silt and clay due to the application of herbicide as compared to before application of treatments. The soil pH and electrical conductivity at crop harvest was not differed with the testing herbicide applied.The population of total bacteria (*Pseudomonas fluorescens*, *Bacillus* spp), fungi (*Trichoderma viride*, *Trichoderma harzianum*) and actinomycetes recorded at crop transplanting and at crop harvest. The population of bacteria, fungi and actinomycetes in various treatments were more or less similar as no significant difference was found at crop transplanting and at crop harvest.Hence, it can be concluded that post-emergence application of bispyribac-sodium 25 g/ha *fb* one HW on 45 DAT can be recommended for better weed control and productivity in transplanted rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-68

Effect of chemical weed management on green forage yield, seed yield and quality of berseem

B.T. Sinare* and H.P. Pardeshi

All India Coordinated Research Project on Forage Crops and Utilization, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722

**Email :Sinarebt69@gmail.com*

The field experiment was conducted to study the effect of chemical weed control in berseem at All India Coordinated Research Project on Forage Crops and Utilization, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, during *Rabi* seasons of 2012-2013, 2013-2014 and 2014-2015. The field experiment was laid out in a randomized block design with three replications and 10 weed control treatments *viz*., weedy check (control), pendimethalin 0.3 kg/ha, pendimethalin 0.4 kg/ha, pendimethalin 0.5 kg/ha, oxyfluorfen 0.1 kg/ha, imazethapyr 0.1 kg/ha (immediate after harvest of I^{st} II^{nd} cut), oxyfluorfen 0.1 kg/ha *fb* imazethapyr 0.1 kg/ha (immediate after harvest of I st cut), pendimethalin 0.3 kg/ha *fb* imazethapyr 0.1 kg/ha(immediate after harvest of I^{st} cut), pendimethalin 0.4 kg/ha *fb* imazethapyr 0.1 kg/ha (immediate after harvest of I st cut) andpendimethalin 0.5 kg/ha *fb* imazethapyr 0.1 kg/ha (immediate after harvest of I st cut).Pendimethalin and oxyfluorfen were used as pre-emergence, while imazethapyr as post-emergence. The crop was fertilized with the recommended dose of fertilizer *i.e* 20 kg N, 80 kg P_2O_5 and 40 kg K_2O/ha. The variety '*Wardan*'was used in experimentation. First two cuts were taken for green forage purpose and after harvesting of second cut for fodder, crop was left for seed production. Among the weed control treatments weed count of monocot weeds (18) and dicot weeds (9) were recorded lower in the application of oxyfluorfen 0.1 kg/ha *fb* imazethapyr 0.1 kg/ha (immediate after harvest of I st cut). It was par with the application of imazethapyr 0.1 kg/ha immediate after harvest of Ist cut and IInd cut which recorded monocot weed count 20/ m^2 and dicot 12 /m^2.Weed dry weight monocot weed (47 g/m^2), and dicot weed (21 g/m^2) wasrecorded significantly lower in the application of oxyfluorfen 0.1 kg/ha *fb* imazethapyr 0.1 kg/ha (immediate after harvest of I^{st} cut). However, it was at par with the application of imazethapyr 0.1 kg/ha immediate after harvest of I^{st} cut and IInd which recorded monocot and dicot weed dry weight 54 g/m^2 and 24 g/m^2, respectively. The total weed control efficiency (70%) was recorded significantly higher at the application of oxyfluorfen 0.1 kg/ha *fb* imazethapyr 0.1 kg/ha (immediate after harvest of I st cut). However, it was at par with the application of imazethapyr 0.1 kg/ha immediate after harvest of Ist and IInd cut (64%). Plant height of berseem was recorded significantly higher in weedy check (51.0 cm) it was followed by the application of imazethapyr 0.1 kg/ha (immediate after harvest of I^{st} and II^{nd} cut) (49.0 cm). Leaf: Stem ratio was found to be non significant due to various weed control treatments. Plant population was recorded significantly higher at application of imazethapyr 0.1 kg/ha (Immediate after harvest of I^{st} and II^{nd} cut). The green forage yield (41.61 t/ha), dry matter yield (6.90 t/ha), seed yield (0.18 t/ ha) and straw yield (1.13 t/ha) and gross monetary returns (` 96,522/ha), net monetary returns (` 48,966/ha) with B: C ratio (2.09) were significantly higher in the application of the imazethapyr 0.1 kg/ha (immediate after harvest of I^{st} and II^{nd} cut). It was followed by Pre-emergence application of oxyfluorfen 0.1 kg/ha *fb by* post immergence application of imazethapyr 0.1 kg/ ha immediate after harvest of I^{st} cut. Application of imazethapyr0.1 kg/ha found to be effective for control of weeds and obtaining higher green forage, seed and straw yield with higher remunerations in berseem.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-69

Integrated weed management in maize- A review

G. Sairam*, Monika Raghuwanshi and Amit Kumar Jha
Department of Agronomy, JNKVV, Jabalpur, Madhya Pradesh 482 004
**Email: sairam812aru@gmail.com*

Maize (*Zea mays L.)*, the third most important cereal crop after rice and wheat in India. Globally, maize is known as queen of cereals because of its highest genetic yield potential. Besides serving as human food and animal feed, the importance of this crop also lies in its wide industrial applications. In addition, corn is fed to cows and chicken which produces milk and eggs respectively. There are various causes of low productivity of maize and severe weed infestation is one of the major constraints causing greatest damage to the crop by offering strong competition to the crop plants for the growth factors primarily nutrient, soil moisture and light, causing yield losses up to 40%. Weed infestation is the key detrimental factor causing huge grain yield losses, because of wide row spacing and slow initial crop growth. The extent of losses caused by weeds depends on the nature of crop, density of weeds, type of weed species and fertility status of soil. The predominant weed flora infesting maize are *Echinochloa colona* L., *Cyperus rotundus* L., and *Cynodon dactylon* L., among monocots and *Digera arvensis* L., *Amaranthus viridis* L., *Portulaca oleracea* L., *Alternenthera sessalis* L.,and *Trianthema* spp. among dicots. Integrated weed management (IWM) has been defined as a multidisciplinary approach to weed control, utilizing the application of numerous alternative control measures. The IWM involves a combination of cultural, mechanical, biological, genetic, and chemical methods for an effective and economical weed control that reduces weed interference with the crop while maintaining acceptable crop yields. None of the individual control measures can provide complete weed control. However, if various components of IWM are implemented in a systematic manner, significant advances in weed control technology can be achieved. Herbicides can suppress weed growth, but continuous application of similar herbicides of same group (s) may lead to development of resistance in weeds over the years making them difficult to control. The combination of herbicides with mechanical weeding is effective in controlling major weeds. Manual weeding is tedious, time consuming and expensive. Intercropping reduces weed problems but it depends on the crops, planting density, cultural operations, herbicide selectivity and residual toxicity. The herbicide controls weeds in-row, whereas mechanical weeding used to control weeds between the rows. Keeping in the view of these facts, it is necessary to develop integrated weed management practices including manual methods, intercropping and low rates of herbicides, which provide broad spectrum weed control in maize without any residual toxicity on the succeeding crop with low cost.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-70

Weed management with newer herbicide molecule imazethapyr + imazamox in soybean

P.C. Pagar*, V.S. Khawale, D.J. Jiotode, R.B. Kothikar and S.M. Deshkari
College of Agriculture, M.S. (Dr. PDKV, Akola) Nagpur, Maharashtra 440 001
**Email: pcpagar@rediffmail.com*

Soybean being a slow growing crop, during early growth stages faces severe competition from weeds, resulting in a loss of about 40-60% of the potential yield depending on the intensity, nature and duration of weed competition. It is therefore, essential to keep the crop weed free during initial stages of plant growth (30-40 DAS) to achieve optimum yield. Traditional method of weed control could not be performed in time due to erratic weather, unfavorable soil conditions and labour scarcity with high wages. The chemical method of weed control can be very effective in killing the weeds before their emergence as well as after emergence. Recently some newer molecules imazethapyr, imazethapyr+imazemox are being marketed with assurance of selective control of early post-emergent weeds in soybean. The use of herbicides or chemicals has consumed the great significance particularly in intensive agriculture due to their ability of providing quick, effective, selective and economical weed management in terms of time, money and labour. The experiment was laid out in randomized block design with ten treatments which were replicated thrice. The treatments comprised of weedy check, weed free, imazethapyr PoE75 g/ha at 20 DAS, pendimethalin PE1 kg/ha, imazethapyr+imazemox PoE75 g/ha at 20 DAS, imazethapyr+imazemox PoE 100 g/ha at 20 DAS and combination of chemical and mechanical weed management practices *i.e.,* imazethapyr PoE75 g/ha at 20 DAS + 1 hoeing at 35 DAS, pendimethalin PE 1.0 kg/ha + 1 hoeing at 35 DAS, imazethapyr+imazemox PoE 75 g/ha at 20 DAS + 1 hoeing at 35 DAS and imazethapyr+imazemox PoE100 g/ha at 20 DAS + 1 hoeing at 35 DAS. The findings of the investigation revealed that the highest weed control efficiency was recorded with weed free treatment due to meager crop-weed competition that produces less weed biomass. Amongst various herbicidal treatments, imazethapyr+imazemox PoE 100 g/ha at 20 DAS + 1 hoeing at 35 DAS recorded maximum weed control efficiency and lowest weed index as compared to other herbicidal treatments. This might be due to combine effect of herbicides and hoeing at 35 DAS have persistent effect on the weed population thereby reducing weed biomass and increasing the growth and yield of the soybean crop. The seed and straw yield of soybean was also significantly higher with weed free treatment as against all the herbicidal treatments. However, the combined treatments of herbicide and one hoeing at 35 DAS recorded highest seed and straw yield as compared to alone application of herbicides. As regards economics of soybean, highest GMR and NMR was observed with weed free treatment however, B: C ratio was maximum with the application of imazethapyr+imazemox PoE75-100 g/ha + 1 hoeing at 35 DAS. The GMR and NMR were also maximum with this treatment as compared to other herbicidal treatments which might be due to better weed control and improved growth and yield attributes thereby increasing yield of soybean and its economic returns.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-71

Response of succeeding soybean crop as affected by the residue of different herbicides applied in wheat

Vishal V. Singh, Tej Pratap, V. Pratap Singh and S.P. Singh
Department of Agronomy, G.B. Pant University of Agriculture and Technology
Pantnagar, Uttarakhand 263 145
**Email: 19vv.singh@gmail.com*

Soybean (*Glycine max* L. Merril) is the world's most important seed legume, which contributes 40 and 25% of the total oilseed and edible oil production of the country about two-third of the world's protein concentrate for livestock feeding and earns valuable foreign exchange by exporting soya meal. Soybean meal is a valuable ingredient in formulated feeds for poultry and fish. It has also been reported that the Indian continent is the secondary center for domestication of the crop after China. The contribution of India in the world soybean average is 10% but the contribution to total world soybean grain percentage only 4% indicating the poor levels of productivity of the crop in India (1.1 t/ha) as compared to other countries (world average 2.2 t/ha**).** Herbicide applied to soil or foliage tends to persist in the soil environment and enter into plant through root or foliage absorption and may be translocated to other part of the plant. Residual effect of elevenherbicidal treatment (RIL-066/F1 (48% EC) 960 g/ha, RIL-066/F1 (48% EC) 1200 g/ha, RIL-066/F1 (48% EC) 2400 g/ha, metribuzin (70% WP) 160 g/ha, metribuzin (70%WP) 175 g/ha, metribuzin (70%WP) 200 g/ha, metribuzin (70% WP) 210 g/ha, pendimethalin (30% EC) 800 ml/ha, pendimethalin (30% EC) 1000 ml/ha, pendimethalin (30% EC) 1260 ml/ha, pendimethalin (30% EC) 1500 ml/ha along with hand weeding (30 and 60 DAS) and Control (weedy check) applied in wheat (*Triticum aestivum* L.) and their residual effect on the succeeding soybean crop were investigated during *Kharif*season 2016 and 2017 in Tarai condition of Uttarakhand, India. Results of two years study revealed that plant population/m^2, pods/plant, grain/pod, 100 seed weight and grain yield were found not significant. This clearly indicated that the different herbicidal pre-emergence application against weeds in previous wheat crop during *Rabi* season has no residual effect on succeeding soybean crop during *Kharif* season. Phytotoxic symptoms (chlorosis/stunting/leaf tip injury/wilting/ vein clearing/epinasty and hyponasty) were also recorded at 20 days after sowing (DAS) and no phytotoxic symptoms were observed during growing season of soybean. Therefore, residual study show that application of tested herbicides in wheat is safe for germination and growth of the succeeding soybean crop and it could be suggested that wheat and soybean crop can be grown in rotation.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-72

Standardization of spacing and weed management for scented *Radhunipagal* rice in new alluvial zone of West Bengal

Ashish Kumar Pal, M. Ghosh, D. Mazumder, B.C. Patra and S. Banerjee*
Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya,
Mohanpur, Nadia, West Bengal 741 252
**Email: sibajee.bckv@gmail.com*

A field experiment was conducted to standardize the spacing and weed management for scented *Radhunipagal* rice at 'C' Block Farm, of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal during rainy (*Kharif*) season of 2013 and 2014. The experiment was laid out in a split plot design comprising 2 spacing (15 × 15 and 20 × 15 cm) in main plots and 6 weed control practices *viz.* [weedy check, 2 hand weedings (HW), butachlor 1.5 kg/ha + HW, butachlor + 2,4-D-sodium salt, HW + 2,4-D-sodium salt, mechanical weeding + HW) in sub-plots. Planting geometry and weed control methods had significant influences on growth attributes (plant height, tiller productions, dry matter accumulation and crop growth rate), weed density and grain yield of *Radhunipagal* rice in the study. Closer spacing (15 x 15 cm) of *Radhunipagal* rice resulted in significantly greater tiller production at 56 DAT (300.5/m^2) and dry matter accumulation (401.6 and 575.7/m^2 at 56 and 84D AT) due to more number of hills (44/m^2) than the wider spacing (20 x 15 cm). Mean number of total weeds in 1 m^2 of *Radhunipagal* rice field was 94.3 and 118.8 at 28 and 56 days after transplanting (DAT); and weed control efficiency varied among 5 weed management practices over weedy check as: 49.0-67.3% at 28 DAT and 56.5-72.8% at 56 DAT. Among 5 weed management practices, manual weeding twice towards the panicle production (270/m^2) and filled grains / panicle (127.5) closer planting (15 × 15 cm) resulted in 9.1% greater grain yield (2.27 *vs.* 2.08 t/ha) over wider spacing (20 cm × 15 cm). Six weed control methods based on grain yield could be arranged as manual weeding twice (2.51 t/ha)>butachlor + HW (2.23 t/ha)> mechanical weeding + hand pulling (2.19 t/ha)>Butachlor + 2,4-D- Na salt (2.16 t/ha)> HW + 2,4-D-sodium salt (2.10 t/ha > weedy check (1.88 t/ha). Manual weeding twice at 21 and 42 DAT could be adopted due to better weed control efficiency 67.3% (28 DAT) and 72.8% (56 DAT), grain yield (2.51 t/ha) and milling recovery (65.9%) of *Radhunipagal* rice in new alluvial zone of West Bengal.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-73

Bio-efficacy and phytotoxicity of new herbicide molecules on weed and crop growth and yield of maize

Kommireddy Poojitha*, M.T. Sanjay, K.N. Kalyana Murthy and G.N. Dhanapal
Department of Agronomy, College of Agriculture, UAS, GKVK, Bangalore, Karnataka 560 065
**Email: pujithareddy.71@gmail.com*

An experiment was conducted at the field unit of AICRP on weed management, Main Research Station, University of Agricultural Sciences, Hebbal, Bengaluru to evaluate new post-emergent herbicide molecules on bio-efficacy, weed suppression, phytotoxicity, crop growth and yield in maize during *Kharif* 2017. Treatments consisted of four new post-emergent herbicide molecules, *viz.* tembotrione, topramezone, dimethanamid and halosulfuron-methyl and 2,4-D sodium salt applied at 20 DAS, atrazine at 3 DAS, passing cycle weeder followed by hand weeding at 20 and 35 DAS and unweeded control replicated thrice in RCBD. Major weed flora observed in the experimental plots were *Cyperus rotundus* (sedge), *Cynodon dactylon, Dactyloctenium aegyptium, Digitaria marginata, Echinochloa colona*, *Eleusine indica* (among grasses), *Ageratum conyzoides, Borreria hispida, Commelina benghalensis,Euphorbia hirta, Alternanthera sessilis, Amaranthus viridis, Phyllanthus niruri, Portulaca oleracea* and *Legascea mollis* (among broad-leaved weeds). Among the weed species, the densities of *Cyperus rotundus, Cynodon dactylon*, *Dactyloctenium aegyptium*, *Ageratum conyzoides*, *Borreria hispida*, and *Commelina benghalensis* were more than the other weed species indicating their dominance and competitiveness with the maize crop. The weed density (48.7 and 102.7 m-2 at 45 DAS and at harvest, respectively) and weed dry weight (15.5 and 74.3 g m^{-2} at 45 DAS and at harvest, respectively) were significantly lower with application of topramezone 33.6% SC + dimethanamid-P 23.4% SC 570 g/ha at 20 DAS and was on par with passing cycle weeder followed by hand weeding at 20 and 35 DAS (26.7 and 91.0 m-2 at 45 DAS and at harvest, respectively and 2.63 and 68.9 g m-2 at 45 DAS and at harvest, respectively). Among the new herbicide molecules, a combination of topramezone 33.6% SC dimethanamid-P 23.4% SC 570 g/ha at 20 DAS recorded significantly higher crop growth parameters, *viz.* plant height (146.4 cm), number of leaves (13.67), leaf area (5679 cm^2/ plant), LAI (3.16) and total dry weight (255.54 g/plant), yield attributes like total number of kernels per cob (437.2), 100 kernel weight (28.97 g) and kernel yield (6397 kg/ha) and it was on par with passing cycle weeder followed by hand weeding at 20 and 35 DAS (149.4 cm, 13.80, 5812.1 cm^2/plant, 3.23, 259.94 g/plant, 442.4, 29.50 g and 6556 kg/ha, respectively). However, least crop growth parameters like plant height (104.6 cm), number of leaves (9.20), leaf area (3236.6 cm^2/plant), LAI (1.80) and total dry weight (122.77 g/plant), yield attributes like total number of kernels per cob (239.7) and 100 kernel weight (24.80) and kernel yield (2929 kg/ ha) was recorded under unweeded control. The new herbicide molecules used in present investigations did not cause any phytotoxic symptoms on maize crop.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-74

Effect of different weed management practices on yield attributes in transplanted rice

Arun. A*, K. Arivukkarasu[1]

Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu - 625 104

[1]Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu – 608 002

**Email: arunevin29@gmail.com*

Rice crop (*Oryza sativa* L.)is considered as the most staple food crop in all over the countries by serving as daily source of nutrition for more than 60% of world's population. In rice production, both biotic and abiotic factors are contributing for reduction of yield. On biotic factor, weeds considered as major yield limiting factor. Yield reduction in rice varies between 29 and 63%due to raising of competition between rice crop and weeds for various factors *viz*, light interception, uptake of moisture and nutrients from the soil. Traditional weed management practicehand weeding is not feasible to the farmers due to increasing labour cost and labour scarcity. By having this background information, the experiment was formulated and conducted at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamil Nadu to study the different weed management practices in transplanted rice during September, 2014 - January, 2015 in a randomized block design with seven treatments and three replications by using the rice variety *BPT 5204*.The treatments comprised of unweeded control, two hand weeding on 20 and 40 DAT, butachlor 1.5/kg (pre), pretilachlor0.75 kg/ha (pre), pyrazosulfuron-ethyl 20 g/ha (pre), pretilachlor + pyrazosulfuron-ethyl 0.492 kg/ha (pre), pretilachlor + pyrazosulfuron-ethyl 0.615 kg/ha (pre). The weed species such as *Ehinochloa colona, Leptochloa chinensis, Cyperus rotundus, Rotala desinflora, Bergia capensis, Eclipta alba* and *Marselia quadrifolia* were identified predominently during thecrop period. All the treatments were significantly influenced on yield attributes, *viz.* number of panicles/clump, number of filled grains/clump, thousand grains weight, grain yield and straw yield. Among the treatments, hand weeding on 20 and 40 DAT recorded the highest yield attributes and grain yield of rice, this was on par with (pretilachlor + pyrazosulfuron-ethyl) 0.615 kg/ha (pre). The highest grain yield of the treatments two hand weeding on 20 and 40 DAT and pretilachlor + pyrazosulfuron-ethyl) 0.615 kg/ha (pre) were 5.73 t/ha and 5.61 t/ha, respectively. These treatments were significantly superior to the rest of the treatments in reducing the weed infestation and ultimately increasing grain yield. Unweeded control recorded the highest weed population, weed biomass resulting in the least grain yield. Result of the experiment revealed that (pretilachlor + pyrazosulfuron-ethyl) 0.615 kg/ha (pre) is considered to be judicious recommendation to rice farmers in view of inadequate labour and higher weeding cost in transplanted rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-75

Effect of different genotypes of Indian mustard on smothering of weeds

Rajeev Bharat, Meenakshi Gupta* and B.R. Bazaya
AICRP on Rapeseed Mustard, Division of Agronomy, SKUAST- Jammu (J&K) 180009
**Email: meenakg13@gmail.com*

The field experiment was conducted during the *Rabi* 2010-11 and 2011-12 at the Research Farm, Chatha of the Sher-e-Kashmir University of Agricultural Sciences and Technology,Jammu. The soil of the experimental field was low in organic carbon (0.37%) and nitrogen (208 kg/ha), medium in available phosphorus (15.3 kg/ha) and potassium (128 kg/ha) and slightly alkaline in pH (7.1). The experiment consisted of twelve treatments which were laid down in factorial RBD replicated thrice, comprising of two factors namely six Indian mustard (*Brassica juncea* L.) varieties (*kranti, RL 1359, Navgold, NRCDR 2, CS 56 and RSPR 01*) as factor A and two levels of weed management as Factor B (weed free and weedy check). One additional cultivar of Indian mustard namely NRCDR 601 was included and one variety *CS 54* was replaced with a local cultivar namely *RSPR 03* during the second year of experimentationi.e. 2011-12 thus increasing the number of treatments to fourteen. In the weed free plots three hand weedings at 25-30 days interval were done to keep the field weed free throughout the crop season. All the standard package and practices of SKUAST-Jammu were followed for raising the crop. The data was analyzed and presented using standard formulas and statistical tools. The major weeds present in the experimental field were *Medicago denticulata, Euphorbia helioscopia, Ranunculus arvensis, Rumex retroflexus, Anagallis arvensis, Cirsium arvensis* and *Cannabis sativa.* Weedy check caused an average reduction in seed yield of Indian mustard (27.84%) ,which was significantly lower than weed free situation. Among the different Indian mustard cultivars *NRCDR 2* (1398 kg/ha) though at par with *Navgold* (1316 kg/ha) resulted in significant increase in the seed yield of Indian mustard than other cultivars in comparison during the first year of experiment. However, during the second year of experimentation, Indian mustard cultivar *NRCDR 601* (1298 kg/ha) proved to be equally competitive along with cultivars *NRCDR 2* (1368 kg/ha) and *Navgold* (1274 kg/ha) in increasing the seed yield of Indian mustard than other cultivars in comparison. This may be due to the lower weed density and weed suppression efficiency of newly developed cultivars such as *NRCDR 2, NRCDR 601* and *Navgold* thereby resulting in better utilization of nutrients, moisture, space and light, resulting in higher LAI of the said genotypes thus enhancing their weed suppressing ability over other genotypes during the early stages of crop growth. The lowest weed Index was recorded with cultivar *NRCDR 2* (4.77 and 7.88% respectively) during both the years of experimentation. Based on two years of experimentation it was concluded that new high yielding variety *NRCDR 2* recorded highest seed yield and was found to be most competitive cultivars of Indian mustard for suppression of weeds under sub tropical conditions of Jammu.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-76

Integrated weed management in maize under south eastern coastal plain zones of Odisha

B.Ghosh and R. Dash
AICRP on Weed Management, OUAT, Bhubaneswar, Odisha 751 003
Email: rabiratnadashouat@gmail.com

Maize is an important crop grown in the state and its popularity is increasing, looking to its production potential and high market demand. Weed poses a serious threat in realizing the optimum production potential more particularly in *Rabi* season. Considering these facts a field experiment was laid out taking 11 weed control treatments including one control at central research farm, OUAT at AICRP on weed management block.All the treatments were laid out with three replications under randomized block design. The test crop was sweet corn var. *SUGAR 75* of 110 days duration. The treatments were comprised of atrazine 1.0 kg/ha PE *fb* HW at 40 DAS, atrazine + pendimethaline (0.50 + 0.25 kg/ha) PE (tank mix), atrazine 1.0 kg/ha PE *fb* 2,4-D 1.0 kg/ha LPoE, atrazine + pendimethaline (0.50 + 0.25 kg/ha) PE *fb* 2,4-D 1.0 kg/ha LPoE, topramezone 25 g/ha EPoE, tembotrione 100 g/ha EPoE, topramezone 25 g/ha EPoE *fb* IC, tembotrione 100 g/ha EPoE *fb* IC, topramezone + atrazine (25 + 250 g/ha) EPoE *fb* IC, tembotrione + atrazine (100+ 250 g/ha) EPoE *fb* IC + HW at 30 DAS, IC + HW at 20 and 40 DAS, weedy checkwhich was imposed on an uniform plot size of (20 m^2). The floral composition at the experimental site was grasses (*Cyanodon dactylon, Digitaria sanguinalis, Eleusine indica*), BLW (*Cleome viscose, Celosia argentea*) sedges (*Cyperus iria, C. rotundus*). The observations of data after analysis revealed that the application of tembotrione + atrazine (100+ 250 g/ha) EPoE *fb* IC + HW at 30 DAS gave significantly higher fresh kernel yield, cob yield in comparison to other chemical treatments. This treatment was well comparable with interculture with hand weeding at 20 and 40 DAS. The benefit: cost ratio was also higher (3.26) with application of tembotrione + atrazine (100+ 250 g/ha) EPoE *fb* IC + HW at 30 DAS followed by topramezone + atrazine (25 + 250 g/ha) EPoE *fb* IC. At initial period of crop growth all the pre-emergence application of herbicides significantly controlled the weed population and the post-emergence herbicides controlled the subsequent emergence of weeds. However, ready-mix combination of tembotrione + atrazine applied at EPoE stage integrated with cultural management like interculture followed by hand weeding created a weed free environment for a wider window of a longer period resulting into higher yield. The studies on soil microbiological properties like beneficial microbial population was found to be lower with the herbicide treatments in comparison to IC + HW at 20 and 40 DAS, weedy check. However, the data showed at subsequent days of observation the population gradually built-up and maintained. The residue analysis revealed that the leftover residue of herbicides in the soil was below the detectable limit that is less than 0.001 ppm. Therefore the experiment concluded with the findings of application of tembotrione + atrazine (100+ 250 g/ha) EPoE *fb* IC + HW at 30 DAS proved to be the best treatment in controlling the complex weed flora of sweet corn at critical period of crop-weed competition thereby, resulting higher yield with B:C ratio.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-77

Management of major insect pests and weeds of soybean through insecticide-herbicide combinations

M.S. Dandge*, P.V. Mohod, S.S. Nichal, R.S. Ghawde and P.D. Peshattiwar
Regional Research Center (Dr. PDKV, Akola), Morshi Road, Amravati, Maharashtra 444 603
**Email: msdandge@rediffmail.com*

Soybean has already established as one of the substitute crop for major *Kharif* cash crop in Vidarbha. As the area under soybean cultivation is increasing day by day farmers now facing a problem of weed as well as pest management. In the month of June-July, due to heavy rainfall received, several weeds emerge and compete with the main crop. At the same time there is a heavy infestation of semi-looper and other pest. So, time its management becomes a very important issue to control both weed and pest in rainy season. Hence the present investigation undertaken, to manage weed and pest of soybean crop at the same time and increase soybean production and to find out suitable combination of insecticide-herbicide. The experiment was conducted in randomized block design with three replications consisting of twelve treatments, *viz.* -rynaxypyre 20 SC at 100 ml/ha, indoxacarb 14.5 SC at 300 ml/ha, quinalphos 25 EC at 1.5 l/ha, imazethapyr 10 SL at 1.0 l/ha, quizalofop-ethyl 5 EC at 1.0 l/ha alone and their insecticide-herbicide combinations. All the treatments were compared with untreated check. The variety was *JS 95-60*. At 15 DAS, the lowest weed count and dry matter accumulation was recorded in treatment imazathapyr 10 SL at 1.0 l/ha *fb* indoxacarb 14.5 SC at 300 ml/ha + imazethapyr 10 SL at 1.0 l/ha *i.e.* 4.87 and 4.91 in respect of weed count and 5.47 and 5.62 in respect of dry matter respectively. Whereas highest weed control efficiency was found in treatment imazethapyr 10 SL at 1.0 l/ha i.e. 19.20% both the treatments were found at par with each other. At 30 DAS same trend was observed but at 45 DAS, significantly lowest weed count and dry matter accumulation was found in treatment, indoxacarb 14.5 SC at 300 ml/ha + imazethapyr 10 SL at 1.0 l/ha *fb* treatment indoxacarb 14.5 SC at 300 ml/ha + quizalafop-ethyl 5 EC at 1.0 l/ha. The highest weed control efficiency was observed in indoxacarb 14.5 SC at 300 ml/ha+ imazethapyr 10 SL at 1.0 l/ha *i.e.* 30.28%. Significantly highest soybean seed yield was observed in treatment indoxacarb 14.5 SC at 300 ml/ha + imazathapyr 10 SL at 1.0 l/ha i. e. 1.86 t/ha but was found at par with indoxacarb 14.5 SC at 300 ml/ha + quizalafop-ethyl 5 EC at 1.0 l/ha and rynaxypyre 20 SC at 100 ml/ha + quizalafop-ethyl 5 EC at 1.0 l/ha. More or less similar trend was observed in respect of branches and pods per plant. Test weight was found to be non significant. The maximum COC was recorded in treatment rynaxypyre 20 SC at 100 ml/ha + imazethapyr 10 SL at 1.0 l/ha but highest net returns and B:C ratio was noticed in treatment indoxacarb 14.5 SC at 300 ml/ha + quizalafop--ethyl 5 EC at 1.0 l/ha.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-78

Weed management in dry direct-seeded rice

N.V. Kashid*, P.M. Choudhari, S.M. Kadam and T.J. Bhor
Agricultural Research Station, Vadgaon Maval, Pune, Maharashtra 412 106
**Email: kashidnv@gmail.com*

A field experiment was carried out during *Kharif* 2015, 2016 and 2017 for three years at Agricultural Research Station, Vadgaon Maval, Pune, Maharashtra. The experiment consisted of nine treatments comprising of unweeded check, weed free and weed control methods, *viz.* pendimethalin [1.0 kg/ha, pre-emergence (PE) application at 2-3 days after seeding (DAS)] followed by (*fb*) metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, post-emergence application (POE) at 25 DAS), pretilachlor (0.450 kg/ha, PE at 2-3 DAS) *fb* metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, POE at 25 DAS), oxyflourfen (0.150 kg/ ha,PE at 2-3 DAS) *fb* metsulfuron-methyl + chlorimuron-ethyl (0.004 kg/ha, POE at 25 DAS), pendimethalin (1.0 kg/ha, PE at 2-3 DAS) *fb* azimsulfuron (0.035 kg /ha, POE at 25 DAS), pretilachlor EC (0.450 kg/ha, PE at 2-3 DAS) *fb* azimsulfuron (0.035 kg /ha, POE at 25 DAS), oxyflourfen (0.150 kg/ha, PE at 2-3 DAS) *fb* azimsulfuron (0.035 kg /ha, POE at 25 DAS) and hand weeding (25 and 45 DAS). The experiment was laid out in randomized block design with three replications. The rice variety '*Phule Samruddhi*' was sown at 22.5 cm distance during *Kharif* 2015, 2016 and 2017. The crop was raised with recommended package of practices. All the herbicides were sprayed by using water 500 l/ha with the help of sprayer fitted with flat fan nozzle. The weed samples were taken out as per treatment were oven dried for about one week and weed biomass was recorded. All the other recommended package of practices except weed control was followed to raise the direct dry seeded crop. In the experimental plots dominant weed flora consisted of monocots as *Echinochloa colona* and *Cynodon dactylon* among grasses; *Cyperus iria* and *Cyperus defformis* among sedges while dicots like *Eclipta alba, Portulaca oleracea, Celosia argentea* and *Ludwigia parviflora* for three years. On the basis of this study, it can be recommended that the application of pretilachlor 0.450 kg/ha PE *fb* azimsulfuron 0.035 kg/ha POE at 25 DAS has effectively managed weeds in dry-DSR and gave the highest net returns (` 82777/ ha), higher B:C ratio (2.8) with lower weed index (2.78) and higher weed control efficiency (87.67%).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-79

Efficacy of different pre and post-emergence herbicides on weed control in maize

S.U. Kakade*, Joyti Jaybhaye, J.P. Deshmukh, M.S. Solanke and S.S. Thakare
Department of Agronomy Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharastra 444 104
**Email: snjykakade@gmail.com*

A field investigation entitled "Efficacy of different pre and post-emergence herbicides on weed control in maize (*Zea mays* L.)" was carried out at AICRP on weed management field of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the *Kharif* season of 2018-19.The investigation was carried out to study the relative efficacy of herbicides on weed control in maize as well as to study its effect on growth and yield of maize. The experiment was laid out in randomized block design with twelve treatment replicated thrice. The treatments comprised of Atrazine 1 kg/ha, pendimethalin1 kg/ha, metribuzin 0.35 kg/ha, atrazine 0.50 kg/ha + pendimethalin 0.50 kg/ha, 2,4-D sodium salt0.80 kg/ha, tembotrione 0.120 kg/ha, atrazine 0.50 kg/ha *fb* 2,4-D sodium salt 0.5kg/ha, atrazine 0.50 kg/ha *fb* tembotrione 0.120 kg/ha, topramezone 0.0252 kg/ha, halosulfuron-methyl 0.05 kg/ha, weed free and weedy check. The soil of the experimental field was characterized as clay loam in texture, having slightly alkaline pH (7.5), moderate organic carbon status (5.38%), low nitrogen content (219.33 kg/ha), medium available phosphorus content (15.30 kg/ha) and high available potassium (340.67 kg/ha). Maize hybrid (*Pioneer -3396*) was sown on 25th June 2018 at 60 × 20 cm spacing with 120:60:30 NPK kg/ha. The crop was harvested on 12th October 2018.In the experimental field, predominant weed flora were *Cyperus rotundus* L., *Cynodon dactylon, Commelina benghalensis, Cyanotis oxillaris, Denebra Arabica, Tridax procumbens* L., *Lagasca mollis, Euphorbia hirta* L., *Euphorbia geniculata, Parthenium hysterophorus* L., *Digera arvensis* L., *Phyllanthus niruri* L., *Celosia argentina* and *Acalyfa indica*. Weedy condition throughout the crop growth period caused 40 to 70% reduction in grain yield of maize. Among the herbicidal treatments, Atrazine 0.50 kg/ha *fb* tembotrione 0.120 kg/ha was found to be effective in controlling weeds across the crop growth period. Among the various treatments under study weed free treatment recorded significantly higher values of major parameters whereas, in herbicidal treatments, the maximum growth and yield attributes were recorded with treatment Atrazine 0.50 kg/ha *fb* tembotrione 0.120 kg/ha, which are at par with Atrazine 0.50 kg/ha *fb* 2,4-D sodium salt0.5kg/ha. The same treatment recorded better weed control efficiency and lowest weed index. The nutrient uptake by weeds was more in weedy condition. However, total nutrient uptake by crop was observed maximum with application of atrazine 0.50 kg/ha *fb* tembotrione 0.120 kg/ha. Atrazine 0.50 kg/ha *fb* tembotrione 0.120 kg/ha was found most economical with maximum value of GMR of Rs.75709/ha and B: C ratio of 3.34.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-80

Integrated weed management in mustard

Pratik Sanodiya
Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh 221 005
**Email: prsanodiya10@gmail.com*

Mustard is grown in large area of Bundelkhand region of Uttar Pradesh particularly in Jhansi District to fulfill the oil demand and reduce the water application for its cultivation. In *Rabi* season, mustard yield is affected due to infestation of weeds. Integrated weed management approach is very effective tool for controlling various kinds of weed flora. To reduce herbicide application, enhance grain yield and economics of mustard, one experiment was carried out in randomized block design with six treatments at the research farm of Rani Lakshmi Bai Central Agricultural University, Jhansi during *Rabi* season of 2018 to find out the effect of different treatments on weed density and dry weight, growth and yield of mustard, and economics. Pendimethalin was applied as pre-emergence 1.0 kg/ha while quizalofop as post-emergence 1.0 kg/ha at 15 DAS and pendimethalin 0.75 *fb* quizalofop 0.75 kg/ha in 400 liters of water by using knapsack sprayer. Mustard variety NRCHB-101 was sown by seed drill using seed rate of 5.0 kg/ha at row spacing of 45 cm. However, plant to plant spacing was maintained 15 cm after thinning and gap filling. Uniform dose of N, P_2O_5, K_2O and S was applied at the rate of 60, 40, 30 and 20 kg/ha, respectively. Data on weed density and dry weight of different weed species were recorded during various stages of crop growth. Similarly, observations on yield attributes, yield and economics were taken and data analyzed as per standard statistical procedure. Results showed that field was predominantly infested with four broad leaved weeds, *viz. Chichorium intybus*, *Coronopus didymus*, *Melilotus indica* and *Rumex dentatus* and miscellaneous weeds at different growth stages. At 60 DAS, it is apparent from the data that amongst integrated weed management treatments, pendimethalin 1.0 kg/ha + hand weeding at 30 DAS (6.70 g/m^2) and pendimethalin 0.75 kg/ha *fb* quizalofop 0.75 kg/ha (6.96 g/m^2) recorded lower total wed dry weight and both were statistically at par to each other. At 30, 60, 90 and 120 DAS, pendimethalin 1.0 kg/ha + hand weeding at 30 DAS recorded the highest weed control efficiency than rest of treatments except hand weeding at 20 and 40 DAS. Pendimethalin 1.0 kg/ha + hand weeding at 30 DAS (1.29 t/ha) and pendimethalin 0.75 kg/ha *fb* quizalofop 0.75 kg/ha (1.28 t/ha) enhanced seed yield at par with two hand weeding at 20 and 40 DAS (1.37 t/ha). However, pendimethalin 0.75 kg/ha *fb* quizalofop 0.75 kg/ha gave the lower cost of cultivation (31.5×10^3 /ha), higher net returns (22.4×10^3 /ha) and B: C ratio (1.7) in comparison to pendimethalin 1.0 kg/ha + hand weeding at 30 DAS. It may be concluded that amongst integrated weed management treatments, pendimethalin 0.75 kg/ha *fb* quizalofop 0.75 kg/ha is the best weed management practice in terms of economics in mustard.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-81

Integrated weed management in dry direct-seeded rice

P. Nagarjun, G.N. Dhanapal, M.T. Sanjay and S. Kamala Bai
Department of Agronomy, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka 560 065
**Email: nagarjunp009@gmail.com*

Rice is an important staple food crop in most of the Asian countries. It is one of the crop grown in different agro-ecosystems. Traditionally, rice is established by transplanting seedlings in puddled soils, which demands a huge amount of water and labour. The method of direct-seeding escapes the transplanting and puddling operations which is an attractive and sustainable alternative to traditional transplanting of rice. However, under the context of present water and labour scarcity globally, there is an urgent need to replace conventional transplanting method of rice by more resource saving crop establishment method of rice like direct-seeding of rice (DSR). However, in the recent years the area and production of the rice is decreasing in the major parts of the Asia mainly due to scarcity of labour and water since it is highly labour and water intensive crop. To overcome these two main problems especially that of human labours required in nursery preparation, puddling and transplanting operations, dry-direct seeding of rice was found to be one of the efficient method of crop establishment. In this method paddy seeds are sown directly in rows in unpuddled land. The weed flora of direct-seeded rice crop is entirely different from that of transplanted crop due to maintenance of saturation moisture at sowing and shallow depths of water up to 3 weeks after sowing. As weeds emerge almost at the same time as that of the crop in dry seeded rice and weed competition with rice crop is greater. However, weeds put upper hand over the paddy crop due the poor initial growth of paddy crop and lead to severe yield losses due to severe competition for all the growth components ultimately leads to sever reduction in yield. To manage the weeds it's very difficult by following a single weed management practice. Hence, there is a need for integrated weed management which included from preparation land for previous crop, selection of good previous crop which is having a good canopy cover and preferably a legume like cowpea, stale seed bed technique, application of weed decomposed manure, selection of good quality weed free seeds, application of fertilizers in rows instead of broadcasting, mechanical weeding by passing machines in between two rows of crop, mulching with live crop or any decomposable material, passing inter cultivation implements and combination of good pre-and post-emergence herbicides. Weeds in direct-seeded rice are difficult to manage by any single method it can be effectively managed only by integrated weed management practices.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-82

Tillage and weed management practices in soybean under *inceptisol*

J.P. Deshmukh*, S.U. Kakade, N.D. Parlawar and M.S. Solanke
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra 444 001
**Email: jpdagro@rediffmail.com*

A field investigation entitled was conducted at research farm of AICRP on Weed Management, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during the year 2018-19 on inceptisol soil. The experiment was laid out in strip plot design with three replications. There were twenty treatment combinations consisting four tillage and weed management practices,, *viz.* 1 ploughing + 2 harrowing by tyne cultivator + 1 harrowing by blade harrow; 1 harrowing by tyne cultivator + 1 rototill; 1 rototill; zero tillage and five levels of weed management, *i.e.* diclosulam 0.030 kg /ha PE, propaquizofop + imazythapyr 0.125 kg/ha PoE, diclosulam 0.030 kg/ha PE *fb* propaquizofop + imazythapyr 0.125 kg/ha PoE weed free weedy check. The sowing of soybean (PDKV Yellow Gold) was done on 22nd June, 2018 and harvested on 10th October 2018. The soil of experimental field characterized as clay loam in texture, having moderately alkaline pH, moderate organic carbon status, good electrical conductivity, low nitrogen content, medium available phosphorus content and high available potassium In the experimental field, predominant weed flora were *Cyperus rotundus, Cynodon dactylon, Commelina benghalensis, Denebra Arabica, Tridax procumbens, Lagasca mollis, Euphorbia hirta, Euphorbia geniculata, Parthenium hysterophorus, Digera arvensis, Phyllanthus niruri, Celosia argentea* and *Acalyfa indica*. Treatment conventional tillage was found to be effective in controlling weeds across the crop growth period. Among the weed management treatments, diclosulam 0.030kg/ha PE *fb* propaquizofop + imazythapyr 0.125 kg/ha POE was found to be effective in controlling weeds across the crop growth period and also recorded better weed control efficiency and lowest weed index. The values of plant growth, yield attributes and yield of soybean were significantly increased with tillage treatment of 1 ploughing + 2 harrowing by tyne cultivator + 1 harrowing by blade harrow as compared to other tillage treatments but was at par with 1 harrowing by tyne cultivator + 1 rototill. Among the weed management practices under study weed free recorded significantly higher values of major parameters whereas, in weed management treatments the maximum growth, yield attributes and yield were recorded with treatment diclosulam0.030 kg/ha PE *fb* propaquizofop + imazythapyr0.125 kg/ha POE. All the soil physical properties *i.e* mean weight diameter, porosity, hydraulic conductivity and rate of infiltration were significantly improved with tillage consisting of 1 ploughing + 2 harrowing by tyne cultivator + 1 harrowing by blade harrow. The next best treatment that improved physical properties of soil to some extent was 1 harrowing by tyne cultivator. While zero tillage and minimum tillage treatments were not shown any improvement in soil physical properties with bulk density and penetration resistance. The maximum benefit to cost ratio was obtained with conventional tillage treatment followed by reduced tillage. While among the weed management practices maximum benefit to cost ratio was obtained with treatment diclosulam 0.030 kg/ha PE *fb* propaquizofop + imazythapyr0.125 kg /ha POE.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-83

Performance of weed management practices on weed dynamics, growth and yield of sugarcane ratoon

R.M. Dixit, K.C. Ombase* and B.S. Raskar
Mahatma Phule Krishi Vidhyapeeth Rahuri MS, Satara, Maharashtra 413 705
**Email: sangramombase99@gmail.com*

A field experiment was conducted to evaluate the relative performance of weed management practices in sugarcane ratoon during 2006-07, 2007-08 and 2008-09 at Central Sugarcane Research Station, Padegaon. The pooled data revealed that the major weeds observed in the experimental plot were *Cyperus rotundus, Cynadon dactylon, Parthenium hysterophours, Commalina benghalensis, Echinochloa, Virudus, Acalypha indica, Convolvulus arvensis, Euphorbia Hyperccifolia, Panicum isachmi, Digitaria sanguinalis, etc.* The pooled data revealed that at 30, 60, 90 and 120 DAR, the treatment of trash mulching between all the rows recorded lower weed count (18, 16, 28 and 29 /m^2), dry weight (10, 13, 26 and 30 g/m^2) and maximum weed control efficiency (77.53, 69.44, 50.72 and 54.62%) respectively and it was followed by the treatment trash mulching in alternate rows + hoeing at 1st and 6th week after ratoon initiation. The maximum weed control efficiency was observed at 30 DAR in all the treatments. The data revealed that the significantly highest cane (98.00 t/ha) and CCS yield (15.50 t/ha) were recorded in treatment of trash mulching between all rows with recommended practice. However, the cane yield obtained in treatment of trash mulching in alternate rows + hoeing at 1st and 6th week after ratoon initiation, (95.28 t/ha) and in treatment of three hoeing (1st week, 4th week and 7th week after ratoon initiation), (93.99 t/ha) were at par with treatment of trash mulching between all rows with recommended practice. The significantly minimum sugarcane ratoon cane yield (66.64 t/ha) was observed in control (weed infested) plot. The treatment of trash mulching between all the rows recorded significantly higher stool count (49883/ha), millable height (218 cm) and cane girth (8.08 cm) and it was at par with trash mulching in alternate rows + two hoeing (48835/ha, 211 cm and 7.88 cm, respectively) and three hoeing (47778/ha, 211 cm and 7.86 cm respectively). Trash mulching between all the rows recorded significantly higher number of millable canes (90390/ha) and average weight per cane (1.09 kg) and it was at par with trash mulching in alternate rows + two hoeing (89510/ha and 1.06 kg, respectively), three hoeing (87510/ha and 1.06 kg, respectively) and metribuzin 1.0 kg/ha PE spray + one hoeing at 45 DARI (86680/ha and 1.05 kg, respectively) for millable cane and weight per cane. The treatment trash mulching between all rows also recorded significantly higher number of internodes per cane (21) than other treatments. The data on juice quality parameters revealed that the trash mulching between all the rows recorded significantly higher CCS% (14.76%). However, it was at par with trash mulching in alternate rows + two hoeing (14.58%), three hoeing (14.38%), metribuzin 1.0 kg/ha PE spray + 2.4 - D 1.0 kg/ha at 45 DARI (14.32%), metribuzin 1.0 kg/ha PE spray + one hoeing at 45 DARI (14.25%) and atrazine 2.0 kg/ha PE spray + 2, 4-D 1.0 kg/ha at 45 days after ratoon initiation (14.20%). The brix, sucrose and purity were not significantly, affected but numerically higher values were recorded by trash mulching between all the rows (21.86, 20.65% and 95.03%, respectively).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-84

Effect of weed managements on weed dynamics of suru sugarcane

K.C. Ombase*, P.M. Chaudhari and B.S. Raskar

Central Sugarcane Research Station Padegaon Tal Phaltan dist Satara, Maharashtra 413 705

**Email: kiranombase86@gmail.com*

A field experiment was conducted to assess the management of weeds in spring sugarcane var. '*CoM-0265*' during 2010-11 at Central Sugarcane Research Station, Padegaon. At 30 and 60 Days After Planting (DAP) the minimum weed flora (16 m^2 and 19 m^2) and biomass (09 g/m^2 and 09 g/m^2) were observed in the treatment Atrazine 2 kg/ha after 1st irrigation (PE) and hoeing followed by 2,4-D1 kg/ha at 75 DAP. As regards weed control efficiency (WCE) was also observed in same treatments (84.21% and 85.25%) followed by treatment Atrazine 2 kg/ha (PE) + almix 20 g/ha at 75 DAP (79.66% and 71.18%). At 90 and 120 DAP the minimum weed flora (31 m^2 and 29 m^2) and biomass (22 g/m^2 and 21 g/m^2) were observed in the treatment atrazine 2 kg/ha after 1st irrigation (PE) and hoeing followed by 2,4-D1 kg/ha at 75 DAP. The data revealed that the atrazine 2 kg/ha after 1st irrigation (PE) and hoeing followed by 2,4-D 1 kg/ha at 75 DAP recorded significantly higher germination (75.28%), tillering ratio (1.21), millable height (216 cm), girth (10.9 cm), number of internodes (27), millable cane (100430/ha) and average weight per cane (1.27 kg) than rest of treatments. The significantly higher cane and CCS (125.34 and 17.22 t/ha) yields were obtained in the treatment, Atrazine 2 kg/ha after 1st irrigation and hoeing followed by 2,4-D1 kg/ha at 75 DAP. However, it was at par with the treatments hoeing at 30, 60 and 90 DAP, atrazine 2 kg/ha (PE) followed by 2,4-D (1 kg/ha) at 60 DAP and Metribuzine 1.25 kg/ha (PE) followed by 2,4-D1 kg/ha at 75 DAP (118.60 and 16.21, 121.60 and 16.69 and 119.96 and 16.57 t/ha, respectively). The economic studies indicated that significantly higher gross monetary returns (` 229212/ha) were obtained in the treatment atrazine 2 kg/ha after 1st irrigation (PE) and hoeing followed by 2,4-D1 kg/ha at 75 DAP, However, it was at par with the treatments, Atrazine2 kg/ha (PE) followed by 2,4-D (1 kg/ha) at 60 DAP (` 218880/ha) and metribuzine 1.25 kg/ha (PE) followed by 2,4-D 1 kg/ha at 75 DAP (` 215928/ha) than rest of the weed management methods tried. The same treatment, recorded higher net profit (Rs.91061/ha) and B: C ratio (1.66). The weed management method of Atrazine 2 kg/ha after 1st irrigation (PE) and hoeing followed by 2,4-D 1kg/ha at 75 DAP, produced significantly higher cane and CCS yields (125.34 and 17.22 t/ha, respectively), gross monetary returns (` 229212/ha) and maximum weed control efficiency (72.33%). However, the cane, CCS yield and gross monetary return were on par with treatments, atrazine 2 kg/ha (PE) followed by 2,4-D (1 kg/ha) at 60 DAP, metribuzine1.25 kg/ha (PE) followed by 2,4-D 1kg/ha at 75 DAP. However, lowest economic returns (gross and net returns and B:C ratio) was recorded under weedy condition during both the years of investigation. The highest gross return, net return and benefit cost ratio was due to highest weed control efficiency and cane yield under these treatments in spring planted sugarcane.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-85

Effect of weed control practices and crop mulch against weeds in chickpea

Muni Pratap Sahu*, Mewa Lal Kewat, J.K. Sharma, A.K. Jha, Jitendra Patidar and Lalita Badole
Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
**Email: munipratapag@gmail.com*

A field experiment entitled "Effect of weed control practices alone and in combination with crop mulch on weed dynamics, yield and economics of chickpea" was conducted at Live Stock Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, and Jabalpur during *Rabi* 2018-2019 to find out the suitable interaction of pendimethalin and mulches on growth and yield of chickpea. The 16 treatments comprising of four weed control practices, *viz.* pendimethalin 38.7 CS1 kg/ha as PPI, hand Weeding at 30 DAS, hand hoeing at 30 DAS and control (no. weed control) as a main plot treatments and four crop mulch, *viz.* Wheat straw5 t/ha, Paddy straw 5 t/ha, Soybean straw 5 t/ha and control (no. mulch) were assigned in sub plot treatments and there were laid out in a split plot design with three replications. It is obvious from the data that the experimental field cropped with chickpea was infested with rampant weeds like *Cichorium intybus* (31.17%), *Medicago truncatulla* (27.27%) and *Melilotus indica* (20.00%). However, other weeds like, *Anagalis arvensis* and *Chenopodium album* were also present in less numbers (11.69 and 9.33%, respectively). The control plots receiving no weed control treatment had maximum weed density (172.67/m^2) and dry weight (179.50 g/m^2) of dicot weeds respectively. However, hand weeding at 30 DAS with paddy straw mulch5 t/ha and hand weeding at 30 DAS + wheat straw mulch 5 t/ha caused 89.09 per cent reduction in density and dry weight of dicot weeds followed by hand weeding at 30 DAS with wheat straw mulch and pendimethalin 38.7 CS1 kg/ha + paddy straw mulch 5 t/ha (82.31 WCE), pendimethalin 38.7 CS1 kg/ha + wheat straw mulch 5 t/ha (71.38% WCE) and hand weeding 30 DAS+soybean straw 5 t/ha (71.37% WCE). The zero reduction of weed in control plot (0% WCE) was noted followed by control + soybean straw mulch (17.07% WCE), control + wheat straw mulch 5 t/ha (37.18% WCE) and hand hoeing 30 DAS alone (43.19% WCE), respectively. The chickpea yield was minimum (0.75 t/ha) in the plots receiving no weed control measure and crop mulch. It was increased markedly under different weed control practices + crop mulches. Hand weeding at 30 DAS with paddy straw mulch 5 t/ha received higher seed yield (1.87 t/ha) being at par to hand weeding at 30 DAS+ wheat straw mulch 5 t/ha (1.72 t/ha) and pendimethalin 38.7 CS 1 kg/ha + paddy straw mulch (1.70 t/ha) over other weed control practices and crop mulches.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-86

Weed and nitrogen management in direct-seeded rice

T.U. Patel*, J.D. Thanki, D.D. Patel and H.H. Patel
Department of Agronomy, N. M. College of agriculture, Navsari Agricultural University, Navsari, Gujarat 396 450
**Email: tushagri.ank@nau.in*

Weed infestation in direct-seeded rice (DSR) fields remains the single largest constraint limiting their productivity. Aerobic edaphic situation under non-flooded conditions in DSR stimulate germination of diverse weed species and reduced the grain yield by 50 to 91%. Nowadays, use of herbicides is gaining popularity in rice culture due to their rapid effects and lower costs compared to traditional methods. Further, decrease in grain yield, however, be averted with the use of fertilizers as a source of plant nutrition. The shallow root and dense population of rice make them responsive to fertilizers. Management of weed along with fertilizers decreased crop weed competition and increased net income by reducing losses due to weed, increasing fertilizer and energy use efficiency and finally the grain yield. A field experiment was conducted at Navsari Agricultural University, Navsari during three consecutive years of 2014, 2015 and 2016 in *Kharif* seasons with an objective to assess the feasibility of weed and nitrogen management on energy requirement, yield and economics of direct-seeded rice. The soil of experimental site belongs to vertisol (pH - 7.7, EC- 0.80 dS/m, OC- 0.78%, available N (271 kg/ha), P_2O_5 (42 kg/ha), and K_2O (463 kg/ha). The experiment was laid out in a factorial RBD with eighteen treatment combinations including six weed management treatments, *viz*. pretilachlor, pendimethalin, pretilachlor followed by (*fb*) bispyribac-sodium, pendimethalin *fb* bispyribac-sodium, weed free and weedy check and three nitrogen (N) levels, *viz.* 80, 100 and 120 kg N/ha replicated thrice. Rice cultivar '*NAUR-1*' (50 kg/ha) were sown in second week of July with single row hand drill by maintaining 30 cm rows apart. Nitrogen fertilizer was applied through urea as per the treatments and phosphorus 30 kg P/ha through SSP. The composition of grasses, sedges and broad-leaf weeds in weedy check plot was 65.5, 2.0 and 32.5%, respectively, and caused 71.2% yield reduction of direct-seeded rice. Significantly lower weed biomass was recorded with weed free which [2 hand weedings (HW) at 20 and 40 days after seeding (DAS)] was at par with pendimethalin 1.0 kg/ha pre-emergence treatment (PE) *fb* bispyribac-sodium 0.04 kg/ha, post-emergence treatment (PoE). Similarly, the highest weed control efficiency (WCE, 73.0%) and the lowest weed index (WI) were also recorded with weed free treatment, next to pendimethalin 1.0 kg/ha *fb* bispyribac-sodium 0.04 kg/ha (WCE, 71.2%). Rice growth and yield attributes, *viz.* plant height, effective tillers, panicles length, grains/ panicle were improved significantly under combine application of PE and PoE herbicides either pendimethalin 1.0 kg/ha or pretilachlor 0.75 kg/ha (PE) *fb* bispyribac 0.04 kg/ha (PoE) and weed free [2 HW at 20 and 40 DAS]. Further, weed free treatment as well as pendimethalin 1.0 kg/ha *fb* bispyribac 0.04 kg/ha were found equally effective and recorded significantly higher rice grain and straw yield and nutrient use efficiency (NUE) with higher net returns and energy efficient compared to rest of treatments. Application of 120 kg N/ha significantly increased the plant height, effective tillers/plant, panicle length, grain/panicle, grain and straw yield, N content and NUE%, energy efficient over rest of the treatments. Further, 2 HW at 20 and 40 DAS or application of pendimethalin 1.0 kg/ha *fb* bispyribac-Na 0.04 kg/ha for weed control appeared to be a viable strategy along with 120 kg N/ha for achieving higher energy efficient and profitable yield of direct-seeded rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-87

Productivity of wheat and weeds under different land configuration and weed management

Shweta*, Meena Sewhag, and Samunder Singh
Chaudhary Charan Singh Haryana Agriculture University, Hisar, Haryana 125 004
**Email: malik.shweta54@gmail.com*

The experiment was conducted at Agronomy Research Farm, CCSHAU, Hisar, Haryana, India (29010'N Latitude, 75046'E longitude and at an altitude of 215 M above mean sea level) during 2016-17 with the objectives of evaluating the effect of planting and weed management practices on weed interference, and wheat crop productivity in mungbean- wheat cropping system. Soil of the experimental field was sandy loam in upper 30 cm layer. The experiment was conducted in split plot design with four replications. Three contrasting planting system, *viz.* bed planting (BP), zero tillage (ZT), and conventional planting (CP) were taken in the main plot. Four weed management, *viz.* pinoxaden 50 g/ha+ premix of metsulfuron and carfentrazone 25 g/ha, clodinafop 60 g/ha + metsulfuron 4 g/ha, weed free and weedy check. The effective tillers per meter 2 were significantly affected by planting methods and significantly higher value was recorded under conventional sowing, while significantly lower value was recorded under bed planting method. Tillers per meter 2 were significantly affected by weed management. Weed free treatment have significantly higher tillers per meter square and on par with pinoxaden 50 g/ha + premix of metsulfuron and carfentrazone 25 g/ha. Wheat plant height significantly affected due to weed management practices and higher plant height was observed under weedy plant and on par with clodinafop 60 g/ha + metsulfuron 4 g/ha. This might be due to more completion between plants and weeds. Significantly effect of sowing methods on grain and biological yield was recorded in the study. Conventional sowing provided significantly higher grain yield over bed planting and zero tillage. Conventional sowing recorded 17.40 and 22.15% higher grain yield. Biological yield was significantly affected by sowing methods as significantly lower biological yield was recorded under bed planting than to zero and conventional sowing, while biological yield under conventional and zero was at par. Weed free provided significantly higher grain yield (4191 kg/ha) which was similar to pinoxaden 50 g/ha+ premix of metsulfuron and carfentrazone 25 g/ha (4046 kg/ha) over to weedy and clodinafop 60 g/ha + metsulfuron 4 g/ha. Treatment W4 produced 19.42, 10.71 and 16.54% lower grain yield than feed free, clodinafop 60 g/ha + metsulfuron 4 g/ha, and pinoxaden 50 g/ha+ premix of metsulfuron and carfentrazone 25 g/ha, respectively. Planting methods have non-significant effect on physiological study, while weed management have significant effect on wheat physiological study, *viz.* LAI, CGR, RGR. The value of LAI was maximum under zero tillage and CGR value was higher under conventional sowing than to other planting methods. Weedy treatment has significantly lower value of LAI and CGR than to other weed management practices.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-88

Weed management for achieving higher productivity of pulses in Indian sub-continent

Anil Kumar*, R. Puniya, B. R. Bazaya, B. C. Sharma, Neetu Sharma, and Deepak Kumar
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu Division of Agronomy, FoA, SKUAST-J, Chatha, Jammu, J&K 180 009
**Email address: anillau@gmail.com*

Pulse crops are the major stay in fulfilling the protein requirements of bulk of the population in Indian subcontinent. The productivity of these crops is subject to numerous biotic and abiotic stresses besides the genetic erosivity of these crops thus leading to lower potential yields of available varieties and the resultant imports of pulses with accompanied huge spending of national exchequer. Weed infestation is one of the major limiting factors for low productivity of pulse crops and associated cropping systems across India. A large number and diverse range of weed species belonging to grasses, broad-leaved and sedges dominate different pulse cropping systems. The critical period for crop-weed competition in rainy season pulses varies from 15-70 days after sowing (DAS), while in winter season pulses it varies from 15-60 DAS. Depending on the kind of weed flora and intensity of crop-weed competition, crop losses may vary from 20-100%. Weeds in pulses are by and large managed by various preventive, cultural and mechanical methods as per their feasibility and local preference, while the use of chemical herbicides is limited in India. The preventive measures include the use of weed-free seed, use of well-decomposed weed-free farm yard manure or compost, proper cleaning of farm machinery and ensuring weed-free farm bunds and irrigation/drainage channels. Stale seedbed, appropriate crop rotations, optimum time of seeding, timely irrigation, inclusion of cover crops and intercropping that enhance the competitive ability of crops constitute important cultural practices for managing weeds. Mechanical methods including the use of hand-operated tools like hand hoe and wheel hoe are largely employed for weed management in small and medium land holding. For chemical weed management, a large number of pre-emergence herbicides like pendimethalin, oxyfluorfen, metolachlor, pendimethalin+imazethapyr, alachlor, oxadiargyl, linuron, oxadiazon, fluchloralin and trifluralin provide promising results, while post-emergence herbicides like imazethapyr, quizalofop-ethyl, imazethapyr + imazamox, fluazifop, fenoxaprop-p-ethyl and clodinafop-propargyl have proved to be good option for attaining economic weed management in specific crops and situations. In fact herbicidal options are limited for addressing post-emergence broad-leaved weed management particularly in crops like chickpea and lentil. This necessitate the need to adopt integrated weed management initiatives involving judicious combinations of preventive, chemical and non-chemical methods for achieving broad-spectrum weed management in pulses in diverse agro-ecological situations.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-89

Weed management studies in direct-seeded upland rice

V.T. Jadhav and N.S. Kute
Pulses Improvement Project, Mahatma Phule Krishi Vidyapeth, Rahuri.
Ahmednagar, Maharastra 413 722
**Email: vtj2009@rediffmail.com*

A field experiment was conducted under irrigated conditions at Agricultural Research Station, Karad during the three *Kharif* seasons. The soil was medium-deep with pH 7.9 and organic carbon 0.45%, available N 112.0 kg/ha, available P 13.5 kg/ha and available K 432.0 kg/ha. The experiment was laid out in randomized block design, replicated thrice. The treatment details are weedy check till maturity, hand weeding twice (20 and 40 DAS), anilofos (0.4 kg/ha) as pre-emergence, anilofos + 2,4-D (0.3+0.5 kg/ha) as pre-emergence, anilofos (0.4 kg/ha) as pre-emergence + one hand weeding (40 DAS), anilofos + 2,4-D (0.3+0.5 kg/ha) as pre-emergence +2,4-D (0.5 kg/ha) as post-emergence (25 DAS), anilofos + 2,4-D (0.3+0.5 kg/ha) as pre-emergence + one hand weeding (40 DAS), pendimethalin (1.0 kg/ha) as pre-emergence, pendimethalin + 2,4-D (1.0 + 0.5 kg/ha) as pre-emergence, pendimethalin (1.0 kg/ha) as pre-emergence + one hand weeding (40 DAS), pendimethalin + 2,4-D (0.75 + 0.5 kg/ha) pre-emergence + 2,4-D (0.5 kg/ha) as post-emergence (25 DAS), pendimethalin + 2,4-D (0.75 + 0.5 kg/ha) as pre-emergence + one hand weeding (HW) (40 DAS), weed free till maturity, three hand hoeing (20,40 and 60 DAS). Seeds of rice variety "*Basmati-370*" was sown in rows of 30 cm apart and 10 cm in between plant on 7th June, 10th June and 12th June using seed rate of 100 kg/ ha as upland direct-seeded rice. The crop received a uniform dose of NPK/ha as per recommendation through Urea, single super phosphate and muriate of potash. The nitrogen was applied in three split doses *i.e.* 40% at sowing, 40% at tillering and 20 percent at flowering stage of rice crop growth. The dry weight of weeds was taken at harvest from each treatment plot separately for calculation. The weedicides were applied as per the treatment. Irrigation was given as per requirement during the crop period. Among the various weed management practices under study, two hand weeding at 20 and 40 days after sowing (DAS) and pre-emergence application of pendimethalin + 2, 4-D at 0.75 + 0.5 kg/ha, respectively + one hand weeding at 40 DAS were at par with each other and they significantly increased the rice growth, yield attributes and yield, weed control efficiency and lower weed index after the weed free treatment. Similar trend was also noticed in case of economic study of the different integrated weed-management practices.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-90

Integrated weed management in mentha

Priyanka Suryavanshi *, Rajesh Kumar Verma, Dipender Kumar[1] and Saudan Singh

** Division of Agronomy and Soil Science, CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, Uttar Pradesh 226 015*

[1]CSIR-Central Institute of Medicinal and Aromatic Plants, Research centre, Pantnagar 263 149

**Email: priyankaagrios@gmail.com*

Menthol mint is a commercially important oil bearing herb, widely cultivated in semi temperate regions in Northern Indian plains. Among various mint growing species, Japanese mint accounts for nearly 86% of total mint area in India. It is commercially cultivated for its essential oil, which is the main source of natural menthol. India is the largest producer and exporter of mentha oil in the world. The development of improved agro-techniches for mentha cultiivation has helped to a great extent in its production, yet there are various problems which still needs serious attention. Out of these, weed management is a major area of concern. Delayed germination, initial slow growth and frequent irrigations provide congenial environment for germination and growth of both annual and perennial weeds in mentha. As mentha is grown in summer season, it requires frequent irrigation prior to onset of monsoon rain and also during rainy season weed growth is luxuriant. It takes about 10- 15 days for complete emergence and is very slow growing during initial stages which makes it a poor competitor with weeds. Both *Rabi* and *Kharif* season weeds emerge and compete with the crop. Researchers have reported that around 37 weed species infest mint crop. These weeds, if left uncontrolled during critical period of crop weed competition leads to around 80% reduction in fresh herb and essential oil yield. Weeds also deteriorate the quality of crop produce as separating out weed plants from crop produce during oil extraction is not possible. Weed problem in mentha can be effectively managed with the help of integrated approach using cultural, manual, mechanical, physical, chemical and biological means. Integration of weed control methods is very important for solving long term weed problems. Pre-emergence application of pendimethalin (Stomp 30 EC) 0.75 kg/ha or oxyflourfen (Goal 23.5 EC) at 0.22 kg/ha give effective control of annual grasses and broad-leaf weeds. Two hand hoeings at 30 and 60 days after sowing is effective in controlling perennial weeds like Motha (*Cyperus rotundus*), Baru (Sorghum halpense), doob (*Cyanodon dactylon*) *etc*. assosciated with mentha. Dependence on herbicides in mentha can be reduced with the adoption of some cultural techniques like Straw mulch. Its application can reduce weed density and weed biomass in menthe and significantly increase dry matter accumulation, fresh herbage and oil yield.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-91

Bio-efficacy of pinoxaden against the *Phalaris minor* and *Avena ludoviciana* in wheat crop

Amit Kuamr Jha
Department of Agronomy, JNKVV, Jabalpur, Madhya Pradesh 482 004
Email; amitagcrewa@rediffmail.com

Wheat is one of the most important staple food grains for human beings. It is the most commonly and widely grown crop in India including Madhya Pradesh under irrigated conditions. India is the second largest producer of wheat in the world, producing about 80.68 million tonnes per year. Madhya Pradesh contributes about 13.64% to the total area and 8.25% to the total production of wheat in the country. However, the productivity is quite low (1.72 t/ha) which is far below the national average (2.91 t/ha) of wheat in the country. Introduction of semi dwarf varieties of wheat coupled with increased use of fertilizers and irrigation provides congenial growth conditions for weeds. Slow initial growth of wheat and high fertilization during the successive growth period encourages the rapid growth of weeds, making the problem more serious and if weeds are not controlled in time, they cause substantial reduction in yield. Hand weeding is widely practiced to control weeds, but it is costly and time consuming. Hence, chemical weed control has become common practice since last two decades and the use of Sulfosulfuron in very common for control of *Phalaris minor* in wheat. But due to development of resistance in *Phalaris minor* against this herbicides and weed shift in the cropped area, there is an urgent need to find out alternate herbicides, which can take care off weed notoriety in wheat crop. Pinoxaden the new entrant in the herbicidal world to get rid of weeds in wheat. Keeping this fact in mind, the present investigation was under taken with the objective to evaluate the " Bio-efficacy of Pinoxaden against the *Phalaris minor* (Canary grass) *Avena ludoviciana* (Wild oat) in Wheat crop at Research Farm, JNKVV, Jabalpur during winter season of 2016-17 on clayey soil, having medium in available nitrogen and phosphorus, high in potassium and neutral in reaction (pH 7.3. Pinoxaden 800 ml/ha, pinoxaden 900 ml/ha , pinoxaden 1800 ml/ha, metsulfuron-methyl 4 g/ha clodinafop propargyl 15% WP 400g /ha, hand weeding – 15 and 30 Days of Sowing (DOS) and Control. The density of predominant weeds namely *Phalaris minor, Medicago denticulate, Cichorium intybus, Chenopodium album, Anagalis arvensis, Convolvulus arvensis and Avena ludoviciana* their dry weight were maximum under weedy check plots due to uninterupted growth of weeds from germination upto the end of critical period of crop-weed competition (*i.e.* 45 DAS). But the density of predominant and their dry weight reduced identically in plots receiving either herbicidal or mechanical weed control. The post-emergence application of pinoxaden 900 ml curbed the weed growth to that of significant reduction in broadleaf weed followed by metsulfuron-methyl 4 g/ha. Grain and straw yields of wheat varied significantly due to weed control treatment. The grain and straw yields were minimum under weedy check plots due to poor values of yield attributing traits. But both were increased in plots receiving either herbicidal and mechanical weed control. Post-emergence application of of pinoxaden 900 ml caused significant improved in grain and straw yields (56.36 and 85.32 q/ha) followed by metsulfuron-methyl 4 g/ha.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-92

The *Cuscuta* spp.; an emerging threat to soybean production in Maharashtra

B.A. Shinde* and K.S. Rathod
College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra 415 712
Email: banduashinde@gmail.com

The growing importance of oilseed cultivation in Maharashtra's agriculture is clear from the increasing trend in area under oilseeds. Among oilseeds, soybean is on its road to become the most important crop in the cropping pattern of Maharashtra. Maharashtra is a major soybean producing state and the productivity of soybean is higher than that of many other major soybean growing states including Madhya Pradesh. Maharashtra occupies around one third area under soybean and contributes 33 percent to the total soybean production of the country. In fact most of the crop is grown under rain fed conditions. The gap between demand and production of edible oil in India has increased sharply in recent years. Due to increasing demand and consumption of edible oils, India still is the world's top vegetable oil importer. This certainly highlights the need to increase the oilseed production. Furthermore, the reliability in production, competitiveness as compared to other *Kharif* season crops and more remuneration with lesser cost of cultivation makes soybean crop a better choice for the rainfed farmers. Hence sustaining its production would be beneficial not only for the farmers but also for the consumers and the agricultural sector as a whole. One of the major problems faced by the soybean cultivators in the recent years is the nuisance of weeds, specially the *Cuscuta spp.*; an emerging parasitic weed in soybean fields. It is an annual complete stem parasite belonging to family Cuscutaceae. It is been major problem in chillies, greengram/blackgram, niger, lentil, chickpea, tomato, alfalfa *etc*. in the many states of the country but now it has started to invade the soybean fields in Maharashtra. The yield reductions due to *Cuscuta* spp. are reported to the tune of 31-87% depending upon its intensity of infestation in host crops. The *Cuscuta* spp. can be controlled by using Cuscuta free crop seeds, harrowing in crop rows before it parasitizes the host, cultural practices like tillage, planting time, crop rotation and intercropping, and use of selective herbicides like pendimethalin, fluchloralin and imazethapyr. If the infestation is in patches, it can be easily controlled by spraying non-selective herbicides such as glyphosate and paraquat. In this paper, an attempt has been made to review the research work done on management of *Cuscuta* spp. in Maharashtra and India.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-93

Weed management in yellow mustard using herbicide and weed mulch in lateritic soil of West Bengal

Koushik Sar* and B. Duary
Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal 731 236
**Email: koushiksar1@gmail.com*

Yellow sarson is an important edible oilseed crop in India. Technological advancement in the production of yellow mustard has resulted in increased productivity. But biotic stresses like weeds may cause yield losses up to 45% in yellow sarson. Under this situation farmers need efficient weed management practices that offer a quick response to produce more. Recently herbicides are being used for timely and effective weed management in different crops and cropping system. But sole dependence of herbicide may lead to several problems. Alternative weed management practices like use of weed mulch as a component in integrated weed management may be effective for yellow sarson. Keeping the above in view, the present study was conducted during *Rabi* season of 2018-2019 at Agricultural Farm of the Institute of Agriculture, Visva- Bharati to study the effect of herbicide and weed mulch on weed dynamics and yield of yellow mustard. The experiment comprising of seven treatments *viz*. pendimethalin at 0.75 kg/ha, mulching with *Eichhornia crassipes* (water hyacinth), mulching with *Antigonon leptopus* (Coral vine), pendimethalin at 0.75 kg/ha followed by mulching with *Eichhornia crassipes* (water hyacinth), pendimethalin at 0.75 kg/ha followed by mulching with *Antigonon leptopus* (Coral vine), weedy check and weed free was laid out in a randomized block design with three replications. The yellow sarson variety 'B-9' was sown in the second week of November, 2018 and harvested in the end of February, 2019. Yellow sarson was infested with seven weed species out of which 3 were grasses, 3 broadleaved and one sedge. Experimental results revealed that yield reduction due to weeds in yellow mustard was 43.8%. Pendimethalin at 0.75 kg/ha followed by mulching with water hyacinth registered significantly lower density and biomass of grass, broad-leaved and total weeds, higher weed control efficiency at 45 DAS and was at par with pendimethalin at 0.75 kg/ha followed by mulching with *Antigonon* (T5) followed by mulching with water hyacinth alone, mulching with *Antigonon* alone, pendimethalin at 0.75 kg/ha alone. Among the weed management treatments pendimethalin at 0.75 kg/ha followed by mulching with water hyacinth also registered significantly higher seed yield (1250 kg/ha) over other treatments and was at par with pendimethalin at 0.75 kg/ha followed by mulching with *Antigonon* (1108 kg/ha). Thus integrated use of pre-emergence herbicide pendimethalin at 0.75 kg/ha followed by mulching with easily available weeds like water hyacinth or *Antigonon* appeared to be promising for effective weed management in yellow sarson in eastern India.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-94

Indian mustard weed flora and importance value index of weeds at farmers fields in Bharatpur

O.P. Premi and P.K. Rai

ICAR-Directorate of Rapeseed-Mustard Research, Sewar, Bharatpur, Rajasthan 321 303

Email: oppremidrmr@gmail.com

Weeds compete with crop for water, nutrients and light and have been a matter of great concern to mustard growers. The yield reduction was mainly depends on weed species and their densities. As the distribution and infestation intensity of each weed is different, so the extent of crop yield reduction will mainly depend on the number and kind of weeds present in the field. So the weed density, frequency, their distribution and infestation behavior are the prerequisite for any effective weed management programme. A survey of weeds of mustard fields from five selected villages of Kumher Tehsil, district Bharatpur under MGMG programme was carried out during 2014. A total of 50 quadrates of 1 square meter were thrown in the selected farmers fields at each village and average count of different weeds species were taken for calculating importance value index (IVI) of each species. Only the major weed species in competition with mustard crops were studied. Among different weed flora three important weeds including *Chenopodium murale*, *Chenopodium alba*, *Convalvulus arvesis* and *Cyperus rotundus* were found with highest importance value index of 22.4, 17.6, 15.8 and 15.6, respectively having highest densities as well in the mustard fields under irrigated conditions. While in rainfed conditions *Aspodelus tenuifolius* was the dominant weed.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-95

Weed management through different mulching practices in guava in Shahdol, Madhya Pradesh

Mrigendra Singh, Alpana Sharma, P.N. Tripathi, Deepak Chouhan and Bhagwat P. Pandre
JNKVV-Krishi Vigyan Kendra, Shahdol, Madhya Pradesh 484 001
**Email: kvkshahdol@rediffmail.com*

Fruit orchards owes is importance in farming business in Shahdol district of Madhya Pradesh with total area and production of 4002.3ha and 75185.3 tonnes, respectively (APC Booklet , 2018-19). But weeds are considered major problems in guava orchard. Abouziena and Haggag (2016) reported that losses caused by weeds exceeded the losses from any category of agricultural pests. The annual loss of agricultural produce due to weeds, insects, diseases and other pests are 45%, 30%, 20% and 5%, respectively Rao (2000). In orchards, the weeds can be managed by various methods such as chemical, mechanical, and by mulching etc. The chemical weed management is most effective but it has its own constraints like the residues in soil and water, toxicity to friendly pests. The mechanical management of weeds through manual method is very expensive and labour intensive. Mulching or covering the soil with organic or synthetic materials has been recorded as a safe method to control weeds in comparison to herbicides application. Thus, the experiment was conducted in the KVK Kalyanpur Farm to know the efficiency of different management practices like mulching (paddy straw mulching, white polythene mulching, black polythene mulching and sunn hemp green manuring) for managing weeds in guava orchard. To assess the performance of different management practices a control weedy plot was also kept for their comparative assessment. On various types of grassy as well as broad-leaf weeds, the result showed a significant effect. The result revealed that the black polythene mulch showed a complete check on weed infestation with a long durability for three years whereas the white polythene mulch showed a tear off in one season with a reduction in weed count of 72% as compared to control. Further, the paddy straw mulch exhibited quite promising results, with 68.3% reduction in weed. Also the treatment with green manuring with sunnhemp exhibits a reduction in 65% of weed population with also an additional source of income with the seed production of sunnhemp in between the spaces alongwith extra soil nutritional enhancement traits . Hence, the paddy straw mulch and the sunnhemp green manuring exhibited quite a high potential to manage weeds in guava orchard and could be recommended for management of weed menace in guava orchard.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-96

Integrated weed management in *Rabi* castor

V.M. Patel*, R.B. Ardeshna, V.A. Lodam and R.S. Bhakta

Pulses & Castor Research Station, Navsari Agricultural University, Navsari, Gujarat 396 450

Email : vinaypatel@nau.in

Gujarat is the leading castor growing state of our country. In the recent time, the area under this crop is increasing in south Gujarat reflecting its profitable cultivation. Weeds cause enormous crop losses and are one of the most important production constraints in south Gujarat due to high rainfall. Severe crop losses have been observed due to weeds in castor crop because of wider crop space and slow initial growth. Hand weeding and inter-culturing are effective, but not feasible due to poor soil physical condition and unavailability of labour. In this context, use of herbicides can play vital role in management of weeds. Hence, integrated weed management has gained importance. A field experiment was conducted during *Rabi* season of 2012-13 to 2014-15 on vertisols of Navsari, Gujarat, geographically located at 20° 57' N latitude and 72° 54' E longitude at an altitude of 10 meters above sea level. The soil of experimental site was low available nitrogen, medium in available phosphorus and fairly rich in potash. The grassy weeds were dominant as compared to broad-leaf weeds during the period of experimentation. Maintenance of weed free condition (three hand weedings at 20, 40 and 60 DAS) resulted in significant reduction in population of monocot, dicot and total weeds at 60 DAS. But, it remained at par with pre-emergence application of pendimenthalin 1.0 kg/ha *fb* two hand weedings at 40 and 60 DAS for density of monocots weeds. All weed management treatments recorded significantly lower weed dry matter at 120 DAS as compared to unweeded control and application of pendimenthalin 1.0 kg/ha as pre-emergence *fb* quizalofop-p-ethyl 0.05 kg/ha at 20 DAS as post-emergence. Similarly, significantly more number of branches, spikes and capsules/plant, spike length and seed yield were also recorded with pre-emergence application of pendimenthalin 1.0 kg/ha *fb* either two hand weedings at 40 and 60 DAS or one hand weedings at 40 DAS which remained statistically at par with weed free condition. The weed free condition (three hand weedings at 20, 40 and 60 DAS) accrued higher net returns (42.7 x 103/ha) and is closely followed by pendimethalin 1 kg/ha (pre-emergence) *fb* hand weedings at 40 and 60 DAS (42.2 x 103/ha) and pendimethalin 1 kg/ha (pre-emergence) *fb* hand weedings at 40 DAS (40.4 103/ha). While, higher benefit:cost was recorded with pendimethalin 1.0 kg/ha (pre-emergence) *fb* hand weedings at 40 DAS (2.41) followed by pendimethalin 1 kg/ha (PE) *fb* hand weedings at 40 and 60 DAS (2.33). No residual/carry over phytotoxicity of any herbicides was observed on succeeding greengram crop under bioassay study. Further, result of residue analysis of pendimethalin in soil and seed of castor at laboratory indicated the no residue of pendimethalin in seed of castor and 0.029 ppm in soil which was below than European commission approved maximum residue level (EU-MRL) *i.e.* 0.05 ppm. Pre-emergence application of pendimenthalin 1.0 kg/ha *fb* one hand weeding at 40 DAS has been proved economically feasible and viable weed management practice for irrigated *Rabi* castor considering the present condition of scarcity and high cost of labour under south Gujarat condition.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-97

Weed management in maize-based cropping system in Kymore Plateau in Madhya Pradesh

Jitendra Kumar Dubey, H.S. Kushwaha, and Amit Kumar Jha

Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna and JNKVV, Jabalpur, Madhya Pradesh 482 004

Research experiment will be conducted at Agriculture farm of, Department of Agronomy, JNKVV, Jabalpur (M.P.) during 2017-18 and 2018-19. The experiment will be laid out in randomized block design (RBD) for comparing two factors (2×6) (A) – two level for maize cultivars (composite and hybrid) and (B) for 6 levels of cropping systems (wheat, chickpea, mustard, field pea, barseem, lentil). There were 12 treatment combinations and each will be replicated Three times. Treatments will be arranged randomly in each replication. Maize is one of the most important cereal crop in the world agricultural economy used both as food for human beings and feed for animals. It has very high yield potential per hectare than other crops so it is called "Queen of cereals". The products include starch, oil, syrup and products offer mentation and distillation industries. It is also being recently used as bio fuel. The crop has tremendous genetic variability, which enables it to thrive in tropical, subtropical, and temperate climates .Global production of maize has grown at 3.4 per cent over the last ten years, from 717 m tons in2004-05 to 967 m tons in 2013-14.Maize production in India has grown at a CAGR of 5.5 per cent over the last ten years from 14 m tons in 2004-05 to 23 m tons in 2013-14.The area under maize cultivation in the period has increased at a CAGR of 2.5 per cent from 7.5 m hectare in 2004-05 to 9.4 m hectare in 2013-14, the remaining increase in production is due to increase in yield. Productivity of maize (yield) has increased at a CAGR of 2.9 per cent from 1.9 m tons/hectare in 2004-05 to 2.5m tons/hectare in 2013. Maize is the third most important cereal crop after rice and wheat ,which is widely grown in the world and used as a primary staple food 5% global supply in diet . Maize (*Zea mays* L), being a C4 plant, is one of the most vibrant food grain crops under diverse edaphological conditions In India, maize-wheat is by and large a predominant cropping system that is followed on a large scale, Weeds deplete 30-40% of applied nutrients from the soil. In India, the presence of weeds, in general reduces the maize yield by 27-60%, depending upon the growth and persistence of weed population in maize crop, hand Weeding (labour) and mechanical weed control are expensive, time consuming, labour intensive and many a times timely operations are not possible due to continuous rains in monsoon season. maize based cropping system to manage on the time of application of herbicides, *viz.* Pre-emergence herbicides, early post-emergence and post-emergence herbicides. find out the best promising herbicides combination to control all kinds of weeds in maize and their effect on succeeding wheat crop grown under sequential cropping.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-98

Studies on conservation tillage regimes and nutrient management strategies on weed and crop growth under rainfed *Alfisols*

Veeresh Hatti[1]*, B. K. Ramachandrappa[2], Mudalagiriyappa[3] and M. T. Sanjay[4]

[1]SDAU, Sardarkrushinagar, Gujarat 385 506

[23]AICRP on Dryland Agriculture, [4]Agronomist and Scheme Head, AICRP on Integrated Farming Systems, UAS, Bengaluru, Karnataka 560 065

**Email: veereshshatti@gmail.com*

Weeds are the major biotic threats for loss of yield in any cropping system. Weeds compete with crops for all the inputs and the total actual economic loss due to weeds in 10 major crops of India was estimated at US$ 11 billion. Hence managing weeds is critical in attaining higher productivity of crops with improved resources use efficiency, to meet the food and nutritional demands of increasing Indian population as well as increasing income of the farmers. Weeds continue to be a major problem as weeds are dynamic and their pressure varies with crops, cropping system, soil type, weed seed bank, cultivation practices *etc*. Especially in conservation tillage systems, it is a necessary requirement to maintain the weed population below their threshold levels to maximize grain yields. Thus, to study the effect of conservation tillage practices on weed dynamics, soil weed seed bank and their distribution, a field experiment was conducted under rainfed finger millet (*Eleusine coracana* (L.) Gaertn.) on *Alfisols* for two consecutive seasons during 2014 and 2015 at All India Coordinated Research Project on Dryland Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, India under split-plot design with three main plots (different tillages) and five sub-plots (different nutrient management). Conventional tillage has recorded significantly higher grain and straw yield of finger millet (3.04 and 4.69 t/ha, respectively) due to effective control of weeds as evidenced by lower total weed density and dry weight observed (13.7 no./m^2, 8.0 g/m^2 at 30 DAS and 23.9 no./m^2, 9.0 g/m^2 at 60 DAS) along with higher weed control efficiency 92.5-93.2% in 2014 and 93.3-93.8% in 2015) and lower weed index (7.6-10.3%) due to lower number of weed seeds observed during 2014 (12.3, 19.5 and 4.6/kg soil at 15, 30 and 60 days, respectively) and 2015 (11.3, 17.6 and 4.1/kg soil at 15, 30 and 60 days, respectively as compared to minimum tillage (2.60 and 4.03 t/ha, respectively). Whereas, zero tillage has recorded significantly lower grain and straw yield (2.09 and 3.24 t/ha, respectively) due to poor weed control as observed by higher soil weed seed bank. Due to higher grain and straw yield under conventional tillage, it has also witnessed higher rain water use efficiency, net energy returns resulting in higher net returns and B:C ratio (4.78 kg/ha-mm, 93991 MJ/ha, ` 54082/ha and 3.77, respectively) as compared to minimum and zero tillage. Among different nutrient management practices application of 100% recommended NPK + 7.5 t FYM/ha yielded significantly higher grain and straw yields (3.03 and 4.68 t/ha, respectively) resulting in higher rain water use efficiency, net energy returns, net returns and B:C ratio (4.76 kg/ha-mm, 92650 MJ/ha, ` 50228/ha and 3.14, respectively) as compared to other nutrient management practices. Wherein, the soil weed seed bank was not significantly influenced by nutrient management practices and their interactions with the tillage.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-99

Effect of crop establishment and weed management practices on productivity of wheat in north-west Rajasthan

H. Shivran*, R.S. Yadav, S.P. Singh, A. S. Godara, A.L. Bijarniya and S. Samota
Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan 334 006
**Email: hansrajshivran90@gmail.com*

A field experiment was carried out at SKRAU, Bikaner, Rajasthan, during *Rabi* seasons of 2016-17 and 2017-18 to investigate the effect of crop establishment and weed management practices on productivity of wheat (*Triticum aestivum*) in north- west Rajasthan. Amongst the crop establishment, adoption of stale seedbed (SSB) using glyphosate at 2.0 kg/ha resulted in higher of dry matter at harvest, effective tillers (101.77/ meter), maximum grain yield (3130 kg/ha) and biological yield (7191 kg/ha), which was superior over rest of treatments, as the same treatment caused significantly lowered weed density and dry matter. Among various weed management treatments metsulfuron at 4.0 g/ha + one hand hoeing significantly lowered the density and dry matter of all the weeds except *Cyperus rotundus* and *Cynodon dactylon* over all herbicidal treatments. In weed management, metsulfuron at 4.0 g/ha + one hand hoeing significantly increased the maximum grain yield (3354 kg/ha) and biological yield (7757 kg/ha), over other herbicidal treatments. Weeds substantially reduce the productivity and production of wheat. Looking to the scenario of stale seed bed technique with tillage and herbicides and its impact on weed, growth and yield attributes and productivity of wheat, there is a need to test this current practice in wheat. Deep tillage may also bury the weed seed deeper in the soil layer and minimize the weed seed bank in upper layer of soil. Supplementing these above mentioned practices, herbicides play an important role for weed control in close spaced crops like wheat, where manual or mechanical weeding is difficult. SSB using glyphosate at 2.0 kg/ha recorded significantly higher effective tillers, grain and biological yield than deep and conventional tillage but remained at par with SSB using shallow tillage. This might be due to significant improvement in dry matter accumulation and higher number of effective tillers was also due to less competition by weeds for nutrient uptake to wheat.

Theme 3

Herbicide use in India: Safety regulations and policies

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-100

Nano-herbicides in weed management: A review

Swati Mehta* and Ashiana Javed
Division of Agronomy, SKUAST, Jammu, Jammu & Kashmir 180 009
**Email: swatimehta1909.sm@gmail.com*

Weeds infest crop fields and adversely affect the growth and yield of crop plants. Eradication of weeds from agricultural lands is often labour-extensive and economically expensive. Recent approaches used to control weeds include physical, cultural, chemical and biological methods. Chemical control through herbicides is an instant and effective remedy for weed control. However, there are reports on development of herbicide resistance in weeds possibly due to restricted bioavailability of herbicides in plants. Further, the extensive usage of toxic chemicals contaminates the environment and poses health threats to humans and animals. Efforts to design suitable nanoparticles (NPs) carrying herbicides offer a promising hope in the control of unwanted plant species. Such approaches include synthesis of NPs, nano emulsions, nano encapsulation, etc. Nano-technology offers exciting ways for averting the herbicide overuse and also a safe and effectual delivery. The usage of nanostructured systems in agriculture has increased tremendously in the current era for the controlled release of agrochemicals as well for plant nutrients. The nanostructured herbicide could substantially reduce the herbicide consumption rate and promise increased crop productivity. This technology of exploiting nano materials guarantees to improve the current agricultural practices via the enrichment of management methods. Nano-herbicides are one of the new fangled strategies for combating the problems of conventional herbicides. These are being developed for addressing the issues in annual weed management and also for fatiguing the weed seed collection. The nanostructured formulation performs action through controlled release mechanism. The nano-herbicides comprise a wide range of entities such as polymeric and metallic nanoparticles. Nano-herbicides require a glance in order to place nanotechnology at the premier level. The high penetration efficiency of nano-herbicides helps in eliminating the weeds before resistance could develop. The nano carriers required for preparing nano-herbicides provide short and long residual herbicides based on the need by averting the lethal dose at which the plant could develop herbicide resistance. Nano-herbicides are being developed to address the problems in perennial weed management and exhausting weed seed bank. Remediation of environmental contamination of the industrial waste and agricultural chemicals like pesticides and herbicide residues are possible through metal nanoparticles. Nano-herbicides not only reduce the herbicide load on the environment but also help in eradication of weeds without leaving any major toxic residues in soils and environment. These herbicide-loaded 'nano-bullets' can effectively target the specific plant organ or tissue with a controlled herbicide release. This approach of weed control costs less and ensures minimum toxicological implications besides increasing the herbicide bioavailability into weeds. Thus, in the current scenario, the overuse of herbicides to boost the crop production has left the soil, ground water and food products polluted. Although increasing the agricultural products is vital, the indirect damage on the environment cannot be unnoticed. Nano-technology with promising results in the agricultural sector with its unique way of applying the pesticides, fertilizers etc., could enable the human population to finally visualize the dream of attaining sustainable and eco-friendly agricultural technology. This dream of exploiting the nano-technological methods in agriculture is still in nascent stage. Therefore, development of systems that would improve the release profile of herbicides without altering their characteristics and novel carriers with enriched activity without significant environmental damage is the focus areas that require further investigations.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-101

Efficacy of new herbicide mixture (penoxsulam + butachlor) on phytotoxicity, yield attributes and yield of transplanted rice

Abha Sharma*, Sandeep Manuja, S.S. Rana, B.S. Mankotia[1] and R.P. Sharma[2]

Department of Agronomy, Forages and Grassland Management CSK HPKV, Palampur 176 062

[1]CSKHPKV, Rice and Wheat Research Centre, Malan, Nagrota Bagwan, Himachal Pradesh 176 047

[2]Department of Soil Science CSK HPKV, Palampur, Himachal Pradesh 176 062

**Email: abhasharma22nov@gmail.com*

Rice (*Oryza sativa* L.) is most important staple food and key pillar of food security. The average productivity of rice in Himachal Pradesh state is abysmally low as compared to its productivity at the national level as well as those of the adjoining states. Weeds in rice are one of the most important biological hindrances to yield increase. Weed management has become an integral part of crop production and use of herbicides gaining popularity due to non availability of labour in time and increased labour wages. However, heavy reliance on single herbicide creates an environment favourable for weed resistance to herbicides and weed population shifts. Hence, keeping this in view experiment was conducted at the experimental farm of CSKHPKV, Rice and Wheat Research Centre, Malan during *Kharif* seasons of 2015 and 2016 with eight weed control treatments, *viz.* penoxsulam + butachlor 717.5 g/ha (7 days after transplanting DAT), penoxsulam + butachlor 820 g/ha (7 DAT), penoxsulam 25 g/ha (8-12 DAT), butachlor 1500 g/ha (1-3 DAT), bispyribac-Sodium 25 g/ha (20 DAT), weed free condition, hand weeding twice (25 and 45 DAT) and weedy check with three replications in randomized block design to evaluate the impact of new herbicide mixture containing two herbicides recommended for rice on phytotoxicity, yield attributes and yield of transplanted rice. Results of the study revealed that no phytotoxicity was observed by using any of the herbicides (penoxsulam + butachlor, penoxsulam, bispyribac-sodium and butachlor) on transplanted rice. The study also revealed that competition caused by weeds in weedy check treatment resulted in significantly lowest values of yield attributes (number of panicles, panicle length, grains per panicle, grain weight per panicle and 1000 grain weight) as well as grain yield of transplanted rice as compared to all other treatments. Amongst the herbicide treatments, application of this new herbicide combination product having penoxsulam + butachlor 717.5 g/ha resulted in significantly highest grain yield though it was at par with weed free treatment and all other herbicide treatments except butachlor 1500 g/ha which resulted in lower yield. Similar trend was also observed with respect to straw yield as new herbicide combination product having penoxsulam + butachlor 717.5 g/ha was the best treatment.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-102

Effect of different doses of pre mix herbicide mixture of penoxsulam + pendimethalin on wet direct-seeded rice

Nitish Tiwari* and Sunita Mehar
Indira Gandhi Krishi Vishwavidyalaya, Raipur, Raipur, Chhattisgarh 492 012
**Email: tiwarinitish@yahoo.co.in*

Direct-seeded rice fields are constrained by wide range of weed populations. This results in efficient weed management through different weed management strategies. Therefore, broad spectrum herbicides and mixtures are considered to be reasonable in prospect of saving time, labour cost to control the diverse weed flora. New herbicide mixture has been tested for its efficacy in controlling weeds. To study efficacy of a new pre-mixture herbicide penoxsulam + pendimethalin (1%+24% SE) for weed control in wet direct-seeded rice, an experiment was conducted at Indira Gandhi Krishi Vishwavidyalaya, Raipur, during *Kharif* seasons of 2014 and 2015 with test rice variety *'MTU-1010'*. It was laid out in RBD and replicated thrice with fourteen treatments, *viz*. new herbicide pre-mixture treatments penoxsulam + pendimethalin (1%+24% SE) at three different doses (2000, 2250 and 2500 ml/ha), standard post-emergence herbicide treatments, penoxsulam 24% SC at four different doses (83.33, 93.75, 93.75 and 104.17 ml/ha at 15 DAS), pre-emergent herbicide treatments, pendimethalin 30% EC at five different doses (1600, 1800, 3333.33 and 5000 ml/ha), one farmers' practice of hand weeding (twice) and one control (untreated check). The major weed flora observed in the experimental field were *Cyperus iria,* (among sedges); *Echinochloa colona,*(among grasses); *Spilenthes acmella, Cyanotis axillaris, Ludwigia parviflora* and *Eclipta alba* (among broadleaf). Other weeds noticed in lower density were *Ceasulia axillaris, Commelina benghalensis* while broad-leaf weeds dominated the flora. Grain yield of rice plots treated with new herbicide penoxsulam + pendimethalin (1% + 24% SE) at 2500 ml/ha (5.10 t/ha) gave significantly higher grain yield, however, this was comparable with its lower doses of 2250 ml/ha (5.0 t/ha), standard checks, penoxsulam 24% SC at 104.17 ml/ha (4.30 t/ha) and 93.75 ml/ha (3.90 t/ha) and pendimethalin 30% EC at 5000 ml/ha (4 t/ha) and 3333.33 ml/ha (3.85 t/ha) as well as hand weeding (4.65 t/ha). Hand weeding treatment except 15 DAS (as hand weeding was done at 20 and 40 DAS) registered significantly lowest weed dry matter accumulation at all observation days (30, 45, 60, 75 DAS and at harvest stages) among all treatments which was at par with penoxsulam + pendimethalin (1%+24% SE) at 2500 ml/ha where as at 15 DAS penoxsulam + pendimethalin (1%+24% SE) at 2500 ml/ha registered lowest weed dry matter accumulation (9.25 g/m^2). Weed control efficiency of new herbicide penoxsulam + pendimethalin (1% + 24% SE) recorded highest among all the treatments at 2500 ml/ha among all herbicide treated treatments (76.10%) while at 2500 ml/ha it controlled weeds efficiently with 74.85% and was superior than standard checks penoxsulam 24% SC and pendimethalin 30% EC as well as was at par to hand weeding twice. Hence, use of new herbicide penoxsulam + pendimethalin (1%+24% SE) 2250 ml/ha to 2500 ml/ha controlled weeds more efficiently, gave grain yield superior to standard herbicide, penoxsulam 24% SC and pendimethalin 30% EC and can be recommended for enhancing agricultural productivity.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-103

Evaluation of ethalfluralin 36% EC against weeds in soybean

Parita*, Suresh Kumar, S.S. Rana, Neelam Sharma and Tamanna Bhalla
Department of Agronomy, CSKHPKV, Palampur, Himachal Pradesh 176 062
**Email: skg_63@yahoo.com*

Soybean (*Glycine max* L.) is an important global legume crop that grows in the tropical, subtropical and temperate climates. It belongs to the botanical family leguminosae. Owing to its high yield potential, soybean plays an important role in boosting oilseed production in the country. It has emerged as a potential crop for changing the economical concern of the farmers in India. Weeds are one of the major limiting factors in soybean production throughout the world. Even with advanced technologies, producers suffer high crop yield losses due to competition by weeds. Weeds compete with crops for resources like water, light and nutrients. The competition is important mainly in the initial stages of crop development, due to possible losses in production. Use of herbicide for controlling the weeds at pre-emergence as well as post-emergence stage has been found to be of great importance in soybean cultivation. The effective control of weeds by using herbicides like alachlor, pendimathalin, quizalofop + chlorimuron-ethyl has been reported. However, new herbicide such as ethalfluralin, a dinitroaniline herbicide, also need to be assessed for weed control and thereby soybean productivity under mid hill conditions. A field experiment was conducted during *Kharif* season of 2018 at Research Farm of Department of Agronomy, CSK HPKV, Palampur in randomized block design with 9 treatments, replicated four times. The experimental soil was silty clay loam in texture, acidic in reaction, medium in available nitrogen, phosphorus and high in available potassium. The treatment consisted of five doses of ethalfluralin 540, 630, 720, 810, and 1440 g/ha, imazethapyr 100 g/ha, pendimethalin 1.0 l/ha, weed free treatment and unweeded check. The dominant weed flora of the experimental field was *Echinochloa colona, Panicum dicotomiflorum, Digitaria sanguinalis, Commelina benghalensis, Ageratum conyziodes, Gallinsoga parviflora, Cyperus* sp, *Aeschynomene indica, Bidens pilosa, Physalis minima* and *Polygonum alatum*. The data revealed that the yield attributes and yield of soybean were significantly influenced by different weed control treatments. Significantly highest plant height (81.4 cm), number of pods per plant, grain yield (2185 kg/ha), and straw yield (4643 kg/ha) were obtained in weed free treatment. However this treatment believed statistically alike with imazethapyar 100 g/ha and ethalfluralin 720, 810, and 1440 g/ha in this regard. Significantly lowest weed count, dry weight and higher weed count efficiency was recorded in weed free- treatment. Among different herbicides ethalfluralin 810 and 1440 were the best treatment and were next best in this regard. Thus it can be concluded that imazethapyar 100m l/ha and ethalfluralin 720, 810 and 1440 g/ha were found most effective for controlling weeds and increasing yield of soybean.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-104

Synthesis and characterization of nanoencapsulated sulfentrazone for season long weed management

Vikram Kannamreddy* and C.R. Chinnamuthu
Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003
**Email: vikramreddy2882@gmail.com*

A laboratory experiment was conducted in the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during 2019-2020 to prepare nanoencapsulated sulfentrazone herbicide using solvent evaporation method by the processes of polymerization, dissociation and dispersion. Sulfentrazone is a herbicidal molecule belongs to the family of phenyl triazolinone which controls the weeds by the process of proto porphyrinogen oxidase inhibition (membrane disruption), commonly referred to as PPO inhibition. It can be applied as pre-plant, Pre-emergence and post-emergence herbicide. Sulfentrazone has high Groundwater Ubiquity Score (GUS) of 6.75 which is far more than other broad spectrum herbicides like pendimethalin and glyphosate which are having GUS of 0.66 and 0.42 respectively. So as to achieve season long weed management and reducing the leaching potential of this herbicide solvent evaporation method has been chosen.The encapsulated sulfentrazone was prepared by mixing organic phase containing 1g of sulfentrazone (2.525 ml of commercial formulation) in 10 ml of ultrapure water and 2 ml of polyethylene glycol in 8 ml of dichloromethane and aqueous phase containing 4% starch (1:1 ratio of sulfentrazone commercial formulation and starch). The organic phase containing polymer with herbicide was added drop by drop to aqueous phase and stirred for 12 hours. Thus produced nanoencapsulated sulfentrazone herbicide was collected as such (liquid formulation) in a vial and characterized using Scanning Electron Microscope (SEM) with EDAX (Energy dispersive X-ray analysis) and Particle Size Analyzer (PSA) for size, shape and zeta potential.The SEM images were clearly showing the spherical shaped particles encapsulated by starch molecules. EDAX image was showing that presence of carbon and oxygen peak and also presence of little amounts of fluorine, sulphur and chlorine confirmed the presence of active ingredient of sulfentrazone in the encapsulated herbicide. The spherical nano-particles with smooth and shining surface was showing that herbicide was encapsulated with starch molecules. The average particle size of nanoencapsulated sulfentrazone and commercial formulation (normal sulfentrazone) were 186.9 and 626.9 nm respectively, which shows that the encapsulated herbicidal particle size was far less than normal herbicide. Zeta potential is a measure of surface charges present on the nano particles. Higher the surface charge lower will be the agglomeration. Zeta potential shows the stability of the colloids. It is influenced by the composition of the particle and medium in which it is dispersed. The suspension of nanoencapsulated sulfentrazone was found to be more stable with increased zeta potential (-38.1 mV) which is more than the minimum surface charge (+/-30 mV) required for stability of any solution.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-105

Effect of chemical weed control on relative density of weeds in maize

Monika Raghuwanshi*, Amit Kumar Jha and G. Sairam
Department of Agronomy, JNKVV, Jabalpur, Madhya Pradesh 482 004
**Email: monika5252raghu@gmail.com*

Weed management is a severe issue in forage crop production and weeds play a large piece in maize production. Worldwide yield losses in maize due to weeds are estimated to be around 37%. A field experiment was conducted at Research Farm, AICRP on Forage Crops, Department of Agronomy, JNKVV, Jabalpur (Madhya Pradesh) during *Kharif* season in 2019. The main objective of the experiment was to find out the effect of different treatments on weeds. The soil of the experimental field was neutral in reaction (pH 7.2), and low in organic carbon (0.53%) as well as with medium available nitrogen (255.00 kg/ha), medium available phosphorus (17.18 kg/ha) and high available potassium (315.00 kg/ha) contents with normal electrical conductivity (0.32 dS/m). Ten treatments consisted with Pre-emergence application of atrazine 1000 g/ha, pendimethalin 750 g/ha, combined application of atrazine 750 g/ha + pendimethalin 750 g/ha, post-emergence application of 2,4-D 500 g/ha, tembotrione 120 g/ha and topramezone 35 g/ha alone, combined application of tembotrione 120 g/ha + atrazine 250 g/ha, topramezone 35 g/ha + atrazine 250 g/ha, hand weeding twice at 20 and 40 DAS and weedy check were tested in a randomized block design with three replications. A uniform dose of 80 kg/ha N plus 40 kg P_2O_5 plus 20 kg K_2O/ha was applied in all plots. The N, P and K were given through urea, single super phosphate and murate of potash, respectively. Half quantity of N as per treatment along with full quantity of P and K fertilizers were given as basal application at the time of sowing and remaining N was top-dressed at 25 and 45 DAS. Various observations were recorded on weed parameters and crop parameters. The experimental field was infested with *Echinochloa crusgalli* and *Cynodon dactylon* among monocots; *Cyperus rotundus* among sedges; and *Amaranthus viridis*, *Digera arvensis*, *Portulaca oleracea*, *Alternenthera sessilis* and *Trianthema* spp. among dicots. The predominant weeds were *Echinochloa crusgalli* (17.93%) and *Cyperus rotundus* (16.39%) under monocot weeds and *Phyllanthus niruri* (17.14%), *Eclipta alba* (16.32%) and *Alternenthera* spp. (16.61%) among dicot weeds and many others minor weeds having small intensity (15.58%) were also present in maize ecosystem at 30 and 60 DAS stages, respectively. In weedy check treatments the total weed population was significantly higher than all the herbicidal treatments 2,4-D 500 g/ha, atrazine 1000 g/ha, tembotrione 120 g/ha, topramezone 35 g/ha, tembotrione 120 g/ha plus atrazine 250 g/ha, topramezone 35 g/ha plus atrazine 250 g/ha and weed free treatments. Post-emergence application topramezone 35 g/ha plus atrazine 250 g/ha and tembotrione 120 g/ha plus atrazine 250 g/ha significantly reduced the infestation of all associated weeds over weedy check and was found most effective in paralyzing the weed growth.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-106

Effect of pre and post-emergence herbicides on weed control in soybean

D.J. Jiotode, V.S. Khawale*, P.C. Pagar, R.B. Kothikar and Y.S. Sarode
College of Agriculture, (Dr. PDKV, Akola), Nagpur, Maharashtra 440 001
**Email: vskhawale@rediffmail.com*

Soybean crop grows slowly during the initial period which results in to vigorous growth and proliferation of weeds thereby, increasing crop-weed competition for soil moisture, nutrients, light and space. In *Kharif* season, the weed competition is one of the most important cause for reduction in yield of soybean to the extent of 31 to 84% depending upon weed species, their intensity and duration of crop-weed competition. Now a days, pre and post-emergence herbicides are becoming popular due to advantage over traditional method of weed control that are time consuming, costlier and having constraint during unfavorable soil and weather conditions. With these views a field investigation entitled “Effect of pre- and post-emergence herbicides on weed control in soybean” was carried out at Agronomy farm, College of Agriculture, Nagpur during *Kharif*, 2017.The experiment was laid out in randomized block design with eight treatments replicated thrice. The treatments comprised of weedy check, weed free, pendimethalin extra 38.7% PE 1.0 kg/ha, pendimethalin extra 38.7% PE 1.0 kg/ha *fb* imazethapyr PoE 100 g/ha at 20 DAS, pendimethalin extra 38.7% PE 1.0 kg/ha *fb* quizalofop-ethyl PoE 50 g/ha at 20 DAS, pendimethalin extra 38.7% PE 1.0 kg/ha *fb* imazethapyr PoE 100 g/ha and quizalofop-ethyl PoE 50 g/ha (tank mix) at 20 DAS, pendimethalin extra 38.7% PE 1.0 kg/ha *fb* imazethapyr + imazemox PoE 70 g/ha at 20 DAS (premix) and pendimethalin extra 38.7% PE 1.0 kg/ha *fb* quizalofop-ethyl PoE 50 g/ha and chlorimuron-ethyl PoE 9 g/ha (tank mix) at 20 DAS.The findings of the investigation revealed that, at all the growth stages highest weed control efficiency was recorded with the application of pendimethalin extra 38% PE 1.0 kg/ha *fb* imazethapyr + imazemox PoE 70 g/ha at 20 DAS (premix). This might be due to continued effect of controlling weed due to use of pre- and post-emergence herbicides. Similarly, weed index was also found lowest by the combination of these herbicides indicating increase in soybean yield due to effective weed control. Application of pendimethalin extra 38.7% PE 1.0 kg/ha *fb* imazethapyr + imazemox PoE 70 g/ha at 20 DAS (premix) improved the growth and yield attributes thereby, increasing the yield of soybean. Similarly, the monetary return (GMR- ` 71,895/ha and NMR- ` 47,177/ha) and B: C ratio (2.90) were found highest with the combined application of these herbicides.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-107

Nanoherbicide: A new strategy in agriculture towards weed management

Shahiba Khatoon* Suryaprakash Sharma and Anay Rawat
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
**Email: shahibakhan786@gmail.com*

In changing scenario of applied technology there is need to replace or upgrade old costly technologies especially in the field of agriculture. Farmers are using conventional practices for nutrients, weed, diseases and pest management are labour intensive, time consuming and costly hence directly affecting the object of doubling the farmer's income. Outcome of agricultural research are effective but continuous uses creating health and soil hazards. In view of above introduction to new approaches is urgently required. Word "Nano" simply means small things and Nanotechnology is a science which deals with control of materials at the nanoscale, at dimensions approximately 1 to 100 nm, where unique phenomena enable to have novel applications. Nanotechnology is a multidisciplinary approach in each area of research such as physics, chemical, and medical and also in agriculture. Nanotechnology seems to be effective and new proven technology which may be also applicable in the field of agriculture for management of nutrients, weeds, pest and diseases effectively and efficiently. Particularly in weed management approaches, nanoherbicide is very effective and less hazardous to environment. Major problems of present agricultural system like large uncultivable areas, shrinkage of cultivable lands, wastage of inputs like water, fertilizers, herbicides, pesticides etc can be addressed through various applications of nanotechnology. Nanoherbicides are encapsulated in the form of nanoparticles and requires in minute quantity for application and controls more than one flush of weeds can be controlled. They have the capacity of better penetration through cuticle, biodegradable and easy to handle and less risk of phytotoxicity where as traditional molecules requires in more quantity, have drift hazard, cannot control more flushes and also have residual effect on soil and environment. Size of molecule is very small hence nanoherbicide molecule will be able to blend with the soil, eradicate weeds in an eco-friendly way without leaving any toxic residues, and suppress the growth of weed species that have become resistant to conventional herbicides. It is also capable to destroy underground parts of perennial weeds like tubers, rhizomes, suckers, stolons and deep roots etc. Being very diversified in all type of agroclimatic zones and developing resistance due to frequent use of same herbicides and herbicides belong to same class, conventional practices are not sufficient to control weeds hence there is an urgent need for lateral approach and alternate methods to exhaust the weed seed bank in soil with new molecule and new methods of delivery. Developing new herbicide molecule with emerging technology, the nano science and technology, will be demand of research for controlling weeds and this paper reviews the new strategy to manage weeds below ETL level so that economic loss can be prevented and this will decrease cost of cultivation and provide more profit to farmers.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-108

Evaluation of efficacy and compatibility of herbicide mixtures for weed control in maize

Y. Lavanya and Dr. K. Srinivasan
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003
**E*mail: yenabalalavanya@gmail.com*

A field study was conducted, in Agricultural College & Research Institute at TNAU, Coimbatore-03, during *Kharif* season of 2018 and 2019 to evaluate the efficacy, selectivity and compatibility of atrazine 0.5 kg/ha in tank mix combination with pendimethalin 1 kg/ha against weeds of maize (*Zea mays*) compared with weed free (2 hand weeding at 20 & 40 days after sowing) and weedy check. Herbicide mixtures are widely recommended to manage herbicide resistance. Mixing of two or more herbicides is a useful practice that is extensively used in intensive agriculture aiming to broaden spectrum of weed control, to improve efficacy of the combined herbicides, to delay herbicide resistance development in weed populations, or to reduce herbicide rates and consequently to reduce the cost of weed control. In many cases, however, this practice may result in modified activity of the herbicides in the mixture due to interactions which often occur prior, during, or after application of the mixture. The type and the extent of interactions between companion herbicides depend primarily on properties of each herbicide in the mixture including chemical family, absorption, translocation, mechanism of action and pathway of metabolism as well as on weed or crop species involved. Generally, atrazine alone effected good to excellent control of broadleaved weeds (70-91%), while its effect on grasses was poor (18-23%). Whereas pendimethalin alone was more effective on control of grasses (62-77%) and depicted low activity against broad leaved weeds (31-40%). Tank mixtures of both herbicides revealed good to excellent control of both grasses (65-85%) and broadleaved weeds (79-99%). Herbicide treatments reduced weed ground cover and weed biomass compared to the un-weeded control. All tested herbicides had no visible phytotoxic symptoms on maize. Unrestricted weed competition significantly reduced crop growth as reflected in plant height, crop stand at harvest, yield and yield components. Unrestricted weed competition reduced maize grain yield by 43%. Herbicide treatments significantly improved crop growth and grain yield compared to the un-weeded control. It is concluded that atrazine can be tank mixed with pendimethalin for control of broadleaf and grass weeds without antagonism on the efficacy of either herbicide.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-109

Efficacy of broad spectrum herbicides for managing weeds in greengram

Roshan Choudhary*, Arvind Verma, S. K. Sharma, R.S. Choudhary and S.K. Yadav
Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan 313 004
Email: roshan6109@yahoo.co.in

Greengram [*Vigna radiata* (L.) Wilczek] is the most important and extensively cultivated pulse crop grown during the *Kharif* season in Rajasthan. Major constraints to the production of greengram are use of low genetic yield potential varieties, weed growth during the critical period, pre-harvest sprouting and yellow vein mosaic virus incidence. Weed infestation, particularly at early crop growth stages, poses a considerable threat to achieving the expected yields. The loss of yield due to weeds is quite high and ranges from 40- 68%. Critical period of crop-weed competition in greengram is about 20-40 days after sowing. Use of herbicide at critical stages plays a significant role in maintaining the productivity by decreasing weed interferences. A field experiment was conducted at Agronomy Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *Kharif* 2016-17 to study the efficacy of pre- and post- emergence herbicides in managing weeds in greengram. Thirteen weed control treatments were evaluated in greengram grown in three replications with randomized block design (RBD). The major grassy, broadleaf weeds and sedges in the experimental fields were *Echinochloa colona* (31.7%), *Commelina bengalensis* (20.0%), *Trianthama portalacastrum* (17.2%), *Digera arvensis* (6.7%), *Parthanium hysterophorus* (10.5%) and *Cyperus rotundus* (13.9%). Two hand weedings resulted in lowest weed density and weed biomass of broad-leaf, grassy and total weeds with maximum yield of greengram. Among herbicides, ready mix application of aciflurofen 16.5% + clodinofop 8% EC applied at 370 g/ha at 3-4 leaf stage recorded significantly lowest weed density and weed dry matter at harvest over weedy check and which was found at par with two hand weeding at 20 and 40 DAS. Maximum weed control efficiency of grassy weed at harvest was recorded by two hand weeding at 20 and 40 DAS (85.80%), whereas in herbicidal treatments weed control efficiency of broad-leaf (83.95%) and total weeds (82.35%) at harvest was found maximum with ready mix post-emergence application of aciflurofen + clodinafop 8% EC applied at 370 g/ha as post-emergence at 3-4 leaf stage and it reflected in terms of significant increase in growth and yield attributes which ultimately resulted into higher yield of crop. This treatment also resulted in the highest number of branches per plant, pods per plant, seeds per pod and seed and haulm yield compared to other treatments. The highest net return (` 48934/ha) and B C ratio (1.68) were realized with post-emergence application of ready mix combination of aciflourfen 16.5% + clodinafop 8% EC RM applied at 370 g/ha. Application of herbicides did not cause any phytotoxicity on crop.

Theme 4

Weed education, extension, socio-economic implications, adoption, and impact assessment

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-110

Impact analysis of weed management and economics of different rice ecosystem in Central India

Santosh Kumar*, P.K. Singh, V.K. Choudhary, Yogita Gharde, Chetan C.R. and S.K. Parey
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: santosh.ageco@gmail.com*

Rice (*Oryza sativa* L.) a member of Poaceae family is relished as staple food and source of nourishment of more than half of the world population. It is an important target to provide food security and livelihoods for millions. India is the second largest producer of rice after China. It occupies highest area among all the crops grown in the country. Mostly, rice is grown by manual transplanting of seedlings into puddled soil but it to be shifted from manual transplanting to direct-seeded rice (DSR) system because it creates a hard pan below the plough layer and reduces soil permeability, deteriorates soil and high cost of cultivation as well as puddling and transplanting operations consume a significant quantity of water. However, weeds are one of the most biological constraint and major threat to the production and adoption of DSR system and can cause rice yield losses up to 50% and the risk of yield loss is greater than transplanted rice. Therefore, for sustaining food grain production to feed every increasing population and ensuring food security, higher productivity to be harvested. Weeds are major production constraints; hence effective weed management is very essential. The goal of this paper is to analyse the impact of weed management and its economics of DSR *vis-a vis* transplanted rice cultivation. This study conducted during 2017-18 at Jabalpur district by ICAR-Directorate of Weed Research, Jabalpur under the On-farm Research cum demonstration on weed management for higher productivity and income. The data were analyzed using descriptive statistics to estimate cost of cultivation. Result shows that, the overall average yield of rice recorded was 4.88 t/ha under transplanted rice over the DSR (4.05 t/ha) applying bispyribac-Na 25 g/ha with recommended dose of fertilizer (RDF) 120:60:40 N, P_2O_5, K_2O kg/ha. The lowest weed population and weed dry weight was obtained in transplanted rice than the DSR. Overall total cost of production was found (` 21360/ha) which was considerably lower in DSR over transplanted rice cultivation (` 31360/ha). Transplanted rice estimated net return of ` 54005/ha than the DSR (` 49428/ha). The benefit cost ratio was obtained 3.31 in DSR than the transplanted rice (2.72), mainly due to higher production cost associated with irrigation requirement and manual transplanting. As per the results, it can be concluded that thought gross and net-returns was more in TPR, but DSR provide more return per rupees of investment and sustainable yield.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-111

HerbCal: A Mobile app for herbicide calculations, terms used and precautions in herbicide application

Sandeep Dhagat*, V.K. Choudhary, Yogita Gharde, P.K. Singh and Daud Raza Khan
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: dhagatsandeep@gmail.com*

Today, technology is present in all parts of our lives, and it is widely available to everyone. The main forms of technology in industry, farming and household are communication and mobile technology. The best way to deliver information and services to the clients is certainly the use of apps. Mobile applications allow the developers to reach a wider audience, in a more cost effective and personalized manner *i.e.* in retail, banking or healthcare, the mobility has transformed each and every sector, and now is marching towards the agricultural sector as well. Now a day, each and every person in this world has a smart-phone in his pocket. Smart-phones combining a range of functions such as media players, camera and GPS with advanced computing abilities and touch screens are enjoying ever-increasing popularity. Smart-phones help us to achieve a range of tasks through something known as applications or Apps in short. Agriculture based mobile apps and technologies help farmers in many ways such as by spreading agricultural related information to farmers. One of the benefits of such connectivity and information flow is that it helps farmers to make better decisions in their agricultural operations. Uniformly applying chemicals at proper rates is essential for effective weed management. A slight variation in the application rate with some chemicals may result in poor control or injury to the crop or environment, causing lost time, effort and money. Herbicide rates may be given in terms of active ingredient or acid equivalent per acre and or hectare treated or volume of commercial product per acre and or hectare. Active ingredient indicates the amount of non-acid herbicide in a formulation. Acid equivalent indicates the amount of an acid herbicide in a formulation. Herbicides may be applied broadcast (uniformly over the entire field surface) or in bands (narrow strips of herbicide centered over the row, with the area between rows left untreated). Looking to above problem a mobile app namely '*HerbCal*' was developed at ICAR–Directorate of Weed Research, Jabalpur. It is working over Android mobile devices for herbicide calculations, terms used and precautions in herbicide application. This mobile app providing herbicide application related information to the farmers, agriculture department officials, students, other stakeholders and Industry professionals. This app allows users to scout crop name and identify common dominated weeds of that particular crops with their control measures.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-112

On farm demonstration for evaluation of post-emergence herbicide in zero tillage maize in red loamy soils of North coastal zone

Y. Sandhya Rani*, K. Lakshmana, U. Triveni and T.S.S.K. Patro

Agricultural Research Station, Vizianagaram, DAATT Centre, Vizianagaram, Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh 522 034

**Email: sandhyarani33756@gmail.com*

Maize is a major predominant crop during *Rabi* season in Vizianagaram district of North Coastal Zone, cultivated in an area of 16632 hectares. As an alternative to the traditional method of sowing in maize, zero tillage technology was introduced among the farmers to save the residual moisture and reduce the cost of cultivation. Zero tillage maize is essentially taken up by the farmers in paddy fields in *Rabi* season without any field preparation and tillage after the harvest of paddy crop. In order to exploit the residual moisture in the paddy fields, under zero tillage conditions, maize seeds are recommended to be dibbled as soon as possible after the harvesting of paddy. In conventional method of maize cultivation, yields are being reduced as the crop is subjected to terminal moisture stress as the crop is sown behind the plough after 2-3 ploughings. By adoption of zero tillage maize the crop can be sown 20-25 days earlier than the conventional method and escape from the terminal moisture stress. In this practice farmers can save the cost of two ploughings and two irrigations which accounts for Rs.0.0025 million per acre. Weed management under zero tillage condition is one of the major set backs for the wide spread adoption of this technology. About 15 percent of cost of inputs was incurred on hand weeding to control the weeds and prevent emergence of rice stubbles. In this concern an On Farm Demonstration was conducted in 12 locations in farmers fields to evaluate the use of post-emergence weedicide in zero tillage conditions under the supervision of DAATT Centre, Vizianagaram for two seasons during *Rabi* 2017-18 and 2018-19. Post-emergence herbicide tembotrione with tax mix formulation of 100 gm/ ha is applied at 15-20 DAS for the control of both type of weed flora (grasses and broad-leaf) in zero tillage maize crop in comparison with hand weeding which is followed by most of the farmers of North Coastal Zone. The results revealed that post-emergence herbicide tembotrione with tank mix formulation of 100 gm/ha at 15-20 DAS in the demonstration plot have recorded 73.40% weed control efficiency, 10.20% increase in grain yield and 0.60 difference of B: C when compared to the farmers practice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-113

Weed risk assessment (WRA)-A tool to curtail the alien invasive weeds species

V.R.G.R. Naidu and D. Damodar Reddy
Krishi Vigyan Kendra (East Godavari), ICAR-Central Tobacco Research Institute, Rajahmundry, Andhra Pradesh 533 105
Email: naidudwsr@gmail.com

Invasive alien weed species signify a major distraction for all managed and unmanaged ecosystems. They tend to cause losses to ecosystem productivity and biodiversity. Foretelling the impacts of alien plant species is a challenging task but need of the hour to avert the risk of invasion. Risk assessment is the technical and objective process of appraising the biological and economic evidence to identify potentially invasive alien species and to determine the level of risk associated with an invasive species or invasion pathway. The increasing world-wide concern with weed invasion has generated growing international demand for weed risk assessment (WRA) systems, both as quarantine protocols and as prioritizing tools for existing weeds. Weed Risk Assessment is the use of standard, technical criteria to determine relative weed threats posed by different plant species. It compares the invasiveness, or the ability of a plant species to invade an area, with the likely impacts an invasion. Weed risk assessment is a question based scoring system, containing variable questions about the species under study. The questions include details of the plant's spatial and temporal attributes, dispersal methods and reproduction. A minimum number of questions must be answered before an assessment is made. The weed risk assessment uses answers to the questions to generate a numerical score that is positively correlated with weedy character of a plant. An acceptable weed risk assessment system should fulfil a number of requirements. It should be calibrated and validated against a large number of plants already present in country and against the plants that are likely to be encountered as imports into that country. It must differentiate weeds and non-weeds, such that the majority of weeds are not accepted, non-weeds are not rejected, and the proportion of plants requiring further evaluation is kept to a minimum. Finally the system must be cost effective. WRA is also applied to the prioritization of control programmes for existing weed species, and to reduce spread of economic species with known weed potential. The Weed Risk Assessment System with precise scoring of different attributes is a useful tool for detecting potentially invasive weeds present outside India and can be used in Indian in Plant Quarantine process to assess the plants before issue of the Import Permit.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-114

User accessibility of Indian Journal of Weed Science through CeRA consortium at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur

Siddarth Nayak, Pramod Kumar Gupta, Anay Rawat and Prashant Shrivastava
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
Email: c_lib@rediffmail.com

Indian Journal of Weed Science is an esteemed publication of Indian Society of Weed Science (ISWS) is being published from 1969 (http://isws.org.in/About.aspx) Journal is a publication made for professionals of specific subject and it is of great importance for its audience. Journals provide experimental results which are supported by references of past work. Journals are also essential for authors as journals provide a platform for authors to establish themselves as subject matter specialist at global levels. Indian Journal of Weed Science is pioneer journal in disseminating all issues related to weed. A vast majority of work and teaching related to weeds are carried out at Agricultural Universities which also includes Master's and Doctoral research programmes. Indian Journal of Weed Science is an open access journal and is available at http://isws.org.in/IJWSn/Journal.aspx. It is also accessible through CeRA consortium at https://jgateplus.com/. Scientists, academicians post graduate students and doctoral research scholars often access Indian Journal of Weed Science to gain knowledge and support their experimental research findings. The present study is based on the accessibility of Indian Journal of Weed Science through CeRA consortium at constituents units of Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), during May 2015 to April 2019. The main aim of the study was to see how Indian Journal of Weed Science is being accessed at JNKVV. The study shows that users accessed the online journal in two formats either *i.e.* abstracts and full texts. Highest number of abstracts (173) was accessed during May 2018 to April 2019 and July 2018 was the most productive month with 79 abstracts accessed. The results of full text show an opposite picture highest number of full texts *i.e.* 89 was accessed during May 2015 to April 2016 and the most productive month was April were a total of 38 full texts were accessed. Inference can be drawn that there is a shift from full text reading to abstract glance. Many journals publish abstracts in advance and also online first articles, it is in the interest of the journals to follow this process. This helps in increasing the readability of the journals. Enabling table of content (TOC) alert through is also a welcome step in this regard. Advance publication of abstracts will surely increase the citations and h-index of authors and journal. It can be further concluded that the result of this study will be useful for journal editors to identify the readers need and requirement; it will also be helpful for librarians in their collection development.

Theme 5

Weed biology, ecology and climate change

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-115

Damage potential of Mexican beetle *Zygogramma bicolorata* on invasive weed Parthenium under the regime of climate change

Sushilkumar
ICAR- Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: sknrcws@gmail.com*

Parthenium weed has become one of the most problematic weeds in India, Australia and many other countries. It has infested large area in non-cropped, forest and cropped land in India. This weed is responsible to cause severe allergy in men and animals besides causing loss to biodiversity. Climate change is happening at a fast leap around the world and significantly impacting the plant growth and ecosystem dynamics besides causing global warming. Carbon dioxide and temperature have a direct effect on plants, which change the plant's biochemical cycle. Parthenium weed is likely to show enlarged growth rate in a climate enriched with CO_2 and increased temperatures. The bioagent, *Zygogramma bicolorata* Pallister (Coleptera: Chrysomelidae) has been considered as a potential bioagent to suppress, Parthenium. It's adult and grubs feed on the leaves and cause heavy damage to the plant. The experiments were conducted in open top chambers (OTC) to see the effect of elevated CO_2 and temperature on biology, population dynamics and damage potential of *Z. bicolorata* on growth of Parthenium weed as well. Reduction of leaf nitrogen in Parthenium foliage with increased carbon and C: N at elevated CO_2 over ambient CO_2 indicated the dilution of biochemical constituents in host plant. Elevated CO_2 and temperature resulted longer growth duration of eggs, grubs and pupa of *Z. bicolorata*, but with high consumption of Parthenium foliage by them in comparison to ambient conditions. Significant effect of elevated CO_2 and temperature on *Z. bicolorata* was observed, such as longer growth duration of eggs, grubs and pupa with high consumption of Parthenium foliage by *Z. bicolorata* grubs and adults under elevated CO_2 and temperature compared with ambient conditions. Elevated CO_2 and temperature also had a significant effect on the intrinsic rate of increase (R), finite rate of increase (ë), net reproductive rate (R0) and gross reproductive rate (GRR). The growth of Parthenium was found increased under elevated CO_2 and temperature. This was inferred that reproduction efficiency of *Z. bicolorata* is likely to be reduced, but consumption rate of beetle will be increased due to less nitrogen in Parthenium leaves in future climate change scenarios.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-116

Effect of microwave treatment on the distribution of weed seed bank in conservation agriculture

Sachin Kumar*, S.S. Rana and Neelam Sharma

Department of Agronomy, Forages and Grassland Management CSK HPKV, Palampur, Himachal Pradesh 176 062

**Email: schnagri@gmail.com*

Conservation agriculture (CA) has been identified as an effective tool for sustaining crop productivity but increasing weed infestation is the most challenging issue. Due to the reduction in tillage operations in CA, weed seed bank composition and dynamics change compared to the conventional tillage. Soil weed seed bank determines the species composition. The effect of different tillage and weed management treatments on population, distribution and germination of weed seed bank was evaluated under fully controlled glasshouse conditions in soil from fifteen treatment comprised of five tillage *viz*. CT-CT, CT-ZT, ZT-ZT, ZT-ZTR and ZTR-ZTR (CT, conventional; ZT, zero and ZTR, conservation) and 3 weed management methods *viz*. H-H, IWM-IWM and HW-HW; (H, herbicide; IWM, integrated weed management; HW, hand weeding). The soil samples for weed seedlings estimation were drawn from 0-5 cm and 5-10 cm soil depth after the harvest of wheat during June, 2018-19. The soil seed bank was assessed by standard seedling-emergence method. The soil was placed in petri-pots. Microwave treatment having frequency range of 300 MHz < f <300 GHz, wavelength range of 1 mm < ë < 1 m and temperature range of 80-100^{0}C of 0-5 cm soil was done for 10 minutes in borosil glassware. Microwave treatment increased the temperature linearly with heating time. The treated and untreated soil samples were placed under controlled conditions with proper moisture to facilitate weed seed germination. Under microwave treatment, ZT-ZT had 7.2, 14.4 and 43.3 weed seedlings/m^2 of *Commelina benghalensis*, *Cyperus* sp. and *Echinochloa colona*, respectively, whereas, complete reduction in the germination capacity of *Digiteria sanguinalis* and *Ageratum conyzoides* was recorded. The results showed that intensive microwave treatment was effective in inhibiting seedlings emergence of weed species particularly for those species having high seed dispersal abilities because of their rapid recolonization potential from neighboring areas. Under untreated conditions, the ZT-ZT system had the largest portion *i.e.* 25 and 24.6% of the seed bank in the 0-5 cm layer and ZT-ZTR have 31.6 and 38.2% during August and September, 2019, respectively. Herbicide (H)-Herbicide (H) resulted in minimum weed seed bank *i.e.* 30.7 and 27.5% in 0-5 and 5-10 cm, respectively during August and September, 2019. Conventional tillage (CT)-CT had 23.1% and 14.2% of the seedlings at the 0-5 and 5-10 cm depths, respectively. During December 2019, ZT-ZTR had lowest weed seedling amongst tillage treatments *i.e.* 7.4 and 10.0% at 0-5 and 5-10 cm depth, respectively. However, H-H had minimum weed seed bank at both the depths. The vertical distribution of the weed seed bank differed with tillage type. Present study concluded that higher number of weed seedlings (78.7%) were present at 0-5 cm followed by 5-10 cm (21.3%).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-117

Adaptations for persistence- the case of *Sacciolepis interrupta* in rice

Pujari Shobha Rani* and Meera V. Menon
College of Horticulture, Kerala Agricultural University, Thrissur, Kerala 680 656
**Email: pshobharani1990@gmail.com*

Sacciolepis interrupta is a new weed that has been found with increasing frequency in semi dry rice sowing areas of Kerala. Earlier the weed was confined to dry sown areas of rice but now it is reported in wet seeded rice too. The biology and germination ecology of *S. interrupta* and its seeds was studied and experiments were conducted to determine the different methods of propagation, effects of temperature, light and burial, on the development mechanisms and survival strategy of this weed in major rice tracts of Kerala. *Sacciolepis interrupta* is a C_3 plant, with annual to perennial, erect or creeping or geniculate habit with rooting at lower nodes and nodes are glabrous in nature. Inflorescence is an erect panicle with monosexual to bisexual flowers and seed production capacity is, on an average, 454 seeds per plant. *Sacciolepis* showed different ways of survival through seeds, culm cuttings and root clumps which were on par in germination rate and regeneration capacity. *Sacciolepis interrupta* seeds showed complex physiological dormancy during off-season period, but the seeds were found to be viable and showed seed longevity up to depth of 8 cm. During crop season, *Sacciolepis* exhibited germination in aerobic and even in anoxic conditions, and peak period of germination was 3rd week of June. Germination was strongly influenced by temperature (minimum around 30^0C; optimal 35-38^0C) and light (phytochrome dependent). There was an increase of seed germination in light and highest germination percentage was recorded under continuous light of 14 days at a temperature of 38^0C. Seed burial also strongly inhibited germination and emergence of the weed, at 5 cm seed burial only 12% of seedlings emerged, while at the 0 cm depth 72% of seeds germinated. Varied propagation methods and ability to germinate at different soil moisture levels ensured survival of the weed in an unpredictable environment and contributed to its weedy nature. Adaptation mechanisms of this weed may be by production of large numbers of small, easily dispersed seeds per plant, possession of seed dormancy, rapid development by varied propagation methods, ability to flower under higher temperatures, and relative resistance of mature plants to herbicide sprays making the weed persistent in the rice fields. Rising temperatures and CO_2 concentrations and changing rainfall pattern are favourable for *Sacciolepis* growth, its reproductive output and therefore its future spread and infestation. The combined effect of enhanced weed competition and drought stress could severely harm crop yield, and therefore, it is important to control such weeds in the early stages of the crop and prevent it from becoming invasive.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-118

Seasanal variation of critical period for crop-weed competition in groundnut (*Arachis hypogaea*) under mid altitude of Meghalaya

Santosh Korav*,Vishram Ram[1] and N. Premaradhya[1]
CCS Haryana Agricultural University, Hisar, Haryana 125 004
[1]Central Agricultural University, Imphal Manipur 795 004
**Email:-santoshkorav@gmail.com*

Groundnut is an important oilseed crop in India which grows almost all agro climatic situations of India. It supplies food, fodder and industrial raw materials. The ICGS-76 groundnut variety developed by ICRISAT, Hyderabad which is most suitable for rainfed situations due to mid season drought tolerance, photo insensitive and early duration in nature. Weeds are major problem in rainfed groundnut due to more water availability and which competes with crop to resources for their development and suppresses the crop growth. A field experiment was carried out during *Kharif* and *Rabi* seasons of 2016-17 at the experimental farm of the College of Post Graduate Studies (CAU, Imphal), Umiam, Meghalaya, India. The experiment was conducted in a randomized block design, replicated thrice with twelve treatments *viz.,* weeds until 15, 30, 45, 60, 75 days after emergence (DAE), weedy check and weed free until 15, 30, 45, 60, 75, weed free check. Critical period for crop-weed competition under 5 and 10% relative yield loss were determined through Logistic and Gompertz equations. The results clearly showed that the weed dry matter tended to decrease with increasing weeds free condition up to harvest. It was observed that the lowest weed dry matter associated with weed free check treatment. While, weedy check treatment resulted in the highest weed dynamics. The highest values of yield and yield attributes were higher with weed free check treatment, and lowest with weedy check treatment. The critical period for weed competition under 5% RYL at *Kharif* was 16 to 66 and *Rabi* was 15 to 63 DAE. The estimated critical period for groundnut at 10% RYL were 22 to 62 and 21 to 61 DAE in *Kharif* and *Rabi* seasons, respectively. The accumulated heat units of *Kharif* and *Rabi* seasons followed linear and quadratic trend might be the reasons for variations in the competitive period of seasons. The present study was concluded that early groundnut stage up to 15-16 DAE is more sensitive for crop weed competition to cause significant yield loss. And early stages *Rabi* groundnut was more susceptible for competition than *Kharif* as compare to later stage.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-119

Influence of potassium nitrate on germination of *Chloris barbata*

R. Narmadha, T. Selvakumar*, C.R. Chinnamuthu and S. Srinivasan
Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003
**Email: selvakumart@tnau.ac.in*

Soil is the resting place of weed seeds and main source for annual and some perennial weed species for future weed populations those reproduce through sexually *viz.,* seeds. Dormancy is a common attribute of many weed seed population, due to the presence of dormancy in weed seeds exploitation of weed seed bank study is difficult at present situation, since weed seed load is usually studied through the germination method. The knowledge about the germination behaviour of the particular weed seed helps to manage the weed seed population. *Chloris barbata* (purple top chloris) is one of the annual or short-lived perennial species propagated through seeds which is an important weed in many tropical and subtropical regions. Due to its dormancy the weeds seed thrive in soil over a long period of time and pose threat on crop production. A Laboratory experiment was conducted at the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, during 2019 to study the effect of Potassium nitrate on the germination of *Chloris barbata*. The treatments of the experiment consisted of different concentration of KNO_3 (2%, 4% and 6%) and water (control) with different time of soaking (5 min, 12 hrs, 24 hrs, 48 hrs and 72 hrs). The experiment was replicated thrice under room temperature. Seeds were soaked in respective concentration and after the stipulated time the seeds were transferred to the petri plate contain germination paper. In each petri plate twenty five seeds were placed to observe germination. The germination were observed from day one to day seven. The petri plate were maintained under moist condition with distilled water. It is evident from the present investigation that, the overall performance of germination behaviour of *Chloris barbata* is higher (>70%) with the KNO_3 treatment compared to control *ie*. water soaking (4 to 50 per cent). Among the various concentration of KNO_3 the higher germination was recorded in 4% KNO_3 and among the different time of soaking the seeds soaked for 24 hrs recorded higher germination percentage. The highest germination per cent of 90 was recorded in the combination of treating the seeds with 4% KNO3 and soaked for 24 hrs. It may be due to the presence of nitrate (NO_3-) in KNO3 provided exogenously which acts as a signal molecule that favours the germination of *Chloris barbata* by involving in the gibberellin pathway.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-120

Impact of climate change on crop-weed dynamics

Manila Bhatia, Surendra Singh, Saurabh Pagare, and Bhumesh Kumar[1]*
Department of P.G. Studies and Research in Biological Science, R.D. University, Jabalpur, Madhya Pradesh 482 001
[1]ICAR-Indian Institute of Wheat and Barley Research (IIWBR), Karnal, Haryana 132 001
**Email:kumarbhumesh@yahoo.com*

Climate changes are likely to exacerbate the problem of future food security by exerting pressure on agriculture. Changes in temperature and CO_2 are likely to have significant direct and indirect effects on biology of crops and weeds including growth, reproduction, competitive ability, responses to environmental stresses. Climate change also influences weeds indirectly by enforcing adaptations of farming methods such as choice of crop, sowing time, harvesting date, and other agronomical practices to these alterations, and may facilitate expansion of domains of weeds into new ecosystems. Due to changes in climatic factors, it is likely to trigger differential growth in crops and weeds and may have more implications on weed management in crops and cropping systems. Weeds are likely to possess many pre-adaptations at the molecular, biochemical or whole plant level to respond more positively to climatic change, including elevated CO_2 and increased temperature, than crop plant. Evidences, however limited, indicate that weeds may show a strong response to changes in climate. The present study was conducted in winter maize along with dominated weed in Open Top Chambers (OTCs) at ICAR-DWR, Jabalpur. Mixed population of crop and weed (winter maize + *Chenopodium album*) were grown in OTCs. Crop and weed were subjected to long-term exposure to ambient conditions, elevated CO_2 (550 ± 50 ppm), elevated temperature (ambient + 2°C) and combination of these two (elevated CO_2 and elevated temperature). For comparison, ambient conditions treated as control treatment. Morpho-physiological, phenological, biochemical, and molecular observations were recorded periodically. In general, enrichment of atmospheric CO_2 had a positive effect on overall growth of crops as well as weeds; however, elevated temperature alone or in combination of elevated CO_2 had adverse effect on phenology, growth and development of the crops. Differential regulation as well as induction of new iso-forms in response to elevated CO_2 and elevated temperature and combination of these two was evident in species-specific manner. Overall, weeds exhibited stronger antioxidant defence as compared to crop counterpart. Expression of genes involved in photosynthesis and defence pathways was found to be altered in species-specific and treatment-specific manner. In conclusion, elevated CO_2 and rising temperature are the important aspects of changing climate with pronounced impacts on agriculture ecosystems in general and weed species specifically. In this study, it is revealed that both crops and weeds respond to changing climate scenario, however, weeds flourish more due to better adaptation strategies.

Theme 6

Weed management in fruits, vegetable, medicinal, spices, floriculture horticultural crops and problematic weeds

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-121

Impact of different weed control measures on soil health and tree growth in a newly planted mango orchard

K.K. Barman*, Mohammad Rasid Khan, V.P. Singh and M.S. Raghuvanshi
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradersh 482 004
**Email: barmankk@gmail.com*

An investigation was undertaken to study the impact of cultural, chemical and mechanical weed management practices on soil health indicators in a newly planted mango orchard. The experiment consisted of two cultural practices, *viz.* growing (i) cowpea-pea-cowpea and (ii) blackgram-pea-greengram intercrops during *Kharif*, *Rabi* and summer seasons, two integrated weed management practices, *viz.* growing the above mentioned intercrops in combination with the application of pendimethalin (1.0 kg/ha PE), two chemical weed control measures, *viz.* application of (i) metribuzin (0.5 kg/ha PE) and (ii) glyphosate (2 kg/ha Post) in each season, one mechanical weed control measure (operating rotavator twice in each season), and a weedy check as control. The experiment was laid out by following randomized block design with 4 replications. In each experimental plot (8 m x 17 m), there were two mango plants along the axis in such a way that each mango plant was at a distance of 4.5 m from the centre and 4.0 m from the adjoining borders of the plot. Each mango plant received 5 kg FYM and 100 g DAP in its basin of 1 m diameter in the beginning of each *Kharif* season. Each intercrop received the basal application of 18 kg N/ha and 46 kg P_2O_5/ha through DAP. No fertilizer was applied to the non-intercropped plots. Sprinkler irrigation was given as and when needed. The results showed that managing weeds in the newly establishing mango orchard favoured the trees to achieve better growth compared to control plots. The penetration resistance of the surface soil was relatively higher in the control plots as compared to the other treatments tested. The mechanical (repeated rotavator operation) and sole chemical (application of metribuzin and glyphosate) weeding measures hampered the development of soil physical quality in terms of infiltration rate. The sole chemical treatments also hampered the development of soil biological health in terms of soil microbial biomass carbon. Growing legume intercrops in the orchard, with recommended doses of N and P, improved soil physical health in terms of infiltration rate and penetration resistance. These treatments also maintained good soil biological health in terms of soil microbial biomass carbon, and improved soil available P status. Thus, it was concluded that the intercropping treatments were better than the sole mechanical and chemical weed control treatments in terms of overall soil health and tree growth in the newly establishing mango orchard.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-122

Weed management in garlic under organic production system

Rameshwar*, G.D. Sharma and Sangeeta
Department of Organic Agriculture and Natural Farming, COA, CSKHPKV, Palampur, Himachal Pradesh 176 061
**Email: drrameshwar@gmail.com*

Organic farming has attained a greater attraction and significance in the present set up of agriculture due to increasing awareness about chemical free farming. Under organic conditions, in addition to nutrient and insect pest management, the management of weeds is also one of the main challenge. Garlic (*Allium sativum* L.) is a world's favorite, versatile horticultural commodity consumed for medicinal, antimicrobial and culinary purposes. It is a popular ingredient in many dishes and has a history of several thousand years of human consumption and use. It is one of the best selling herbal remedies and is also commonly used for treating various health problems. It is being cultivated for 5000 years. In India, garlic occupies an area of about 301 thousand hectare with a production of around 1717.9 thousand metric tonnes and average productivity of 5.69 tonnes/ha. In Himachal Pradesh, it occupies an area of 4.4 thousand ha with a total production of 7.7 thousand metric tonnes. Demand of chemical free commodities is increasing day by day and there is ample scope of growing garlic under organic conditions. A field experiment was conducted during *Rabi* season of 2018-19 in the Model Organic Farm of Department of Organic Agriculture and Natural Farming, CSKHPKV, Palampur, India to study the effect of different hand weeding intervals and mulching on garlic (Var. *GHC-1*) production. Seven treatments were tested consisting of one hand weeding 30 days after transplanting (DAP), two hand weedings (30 and 60 DAP), three hand weedings (30, 60 and 90 DAP), four hand weedings (30, 60, 90 and 120 DAP), five hand weedings (30, 60, 90, 120 and 150 DAP), mulch + one hand weeding (30 DAP) and no hand weeding. The experiment was sown on 27.10.2018 with spacing of 30 x 10 cm, having plot size of 12 m^2 in randomized block design with three replications. Significant differences for all the traits were observed. Among the complex weed flora in garlic, *Phalaris minor, Avena ludoviciana, Lolium temulentum, Anagallis arvensis, Vicia sativa, Spergula arvensis, Ranunculus arvesis* and *Euphorbia* sp. were the dominant weed species. In all the treatments, significantly higher bulb yield varying from 55.8 to 128.5% was recorded as compared to control treatment. Weed dry matter was significantly higher (280.4 g/m^2) in weedy check treatment whereas lowest (20.1 g/m^2) was recorded with five hand weedings treatment. Weed density also followed the same pattern that is highest in weedy check and the lowest under five hand weedings treatment. Significantly higher bulb yield (22.24 t/ha) recorded with five hand weedings which was statistically at par with hand weedings thrice or four hand weedings treatments. Mulching along with one hand weeding at 30 DAP produced 203.3 q/ha bulb yield which was statistically at par with three hand weedings. Even one hand weeding at 30 DAP produced 55.8% higher bulb yield as compared to weedy check. Therefore, three hand weedings at 30, 60 & 90 DAP or one hand weeding at 30 DAP along with mulching were the suitable option for effective weed management under organic onion crop production.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-123

Weed management in root and tuber crops: A review

N.V. Mhaskar*, M. Nedunchezhiyan, S.B. Bhagat, Deo Shankar and P.M. Haldankar
AICRP on IFS, Regional Agricultural Research Station, Karjat, Raigad
Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra 410 201
**Email: namdev_mhaskar@rediffmail.com*

Root and tuber crops have played significant role as a survival food because of their high nutritive value and high energy production. Major tropical tuber crops, *viz.* Cassava, Sweet potato, Yams (Lesser yam, greater yam, aerial yam and white yam), Aroids (Taro, Xanthosoma and elephant foot yam) are widely grown in India for use as secondary staple food, animal feed and as raw material for industries. Weeds as an average cause 37% of total crop loss, besides deteriorating quality of the produce and creating favourable conditions for attack of insect-pests and diseases. Cassava tuber yield losses due to weeds may go up to 95%. Among the different weed species *Cyperus rotundus*, *Cynodon dactylon*, *Panicum repens* were the dominant weed species recorded at different locations. Suppression of weed growth during initial growth period is important for cassava production. The four hand weeding at 1, 2, 3 and 4 MAP were reported the highest tuber yield as well as highest WCE and low weed index. The extent of sweet potato loss depends on weed intensity, composition, duration of weed – crop competition and fertility of soil. Weed growth beyond 45 days significantly reduces sweet potato yield. The weed species belonging to families Amaranthaceae, Asteraceae, Capparidaceae, Cyperaceae, Euphorbiaceae, Poaceae appeared immediately after planting of sweet potato. The most dominant species in large numbers are *Celosia argetia*, *Digitaria sanguinalis*, *Cleame viscosa*, *Ageratum conizoides* and *Cyperus rotundus* in sweet potato. Weeding and earthing up at 15th and 30 DAP recorded highest tuber yield in sweet potato. Weeds are one of the major constraints for the growth of yams and frequent and effective weeding is essential for yam cultivation. Yield reduction was greater (77%) in unstaked yams than in staked yams (36%). Broad leaved weeds dominated grasses and sedges while large number of weeds belonging to Poaceae, Cyperaceae and Papilionaceae. Application of pre–emergence herbicide like diuron 3.0 – 3.5 kg/ha effectively controlled weeds. Three hand weedings were recorded the highest tuber yield in lesser yam. Aroids are also grown as intercrops in tropical plantations such as coconut and rubber. Newly planted aroids are most susceptible to weed competition during initial 3 to 4 months. Initial slow growth and development of aroids coupled with wider spacing make conditions favourable for early establishment of weeds in the field. The critical period of weed – crop competition is between 4 to 7 months. Black polythene or paddy straw mulching has been practiced to control weeds and conserve moisture in taro while in Xanthosoma, a linuron or simazine or ametryn + paraquat or glyphosate were recommended in different situations. In Elephant foot yam, straw mulch at the time of planting and application of herbicides (Pedimethalin, Roundup, oxyfluorfen1.0 kg/ha) could effectively reduce weed population as well as dry weed mass as compared to control at different locations.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-124

Influence of different weed management practices on weed indices and yield of fenugreek

B.D. Malunjkar*, Arvind Verma G.R. Mali, Roshan Choudhari and S.L. Mundra
Department of Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan 313 001
**Email: malunjkar_bharat@rediffmail.com*

Fenugreek is one of the important seed spice of arid and semi arid regions of India. Among the states, Rajasthan is the largest fenugreek producing one which contributes 56.39% of total production and occupies an area of 129712 hectare with the production of 157934 tonnes during 2016-17. The average yield of this crop is very less than its potential, which may be due to many factors but among these weed infestation appears to be the most important because it causes indirect losses in crop yield (37%) due to there interference. weeds offered maximum competition up to 30 days of sowing resulting in drastic reduction in seed yield. Manual weeding or hoeing at right stage is difficult because of its time consuming, expensive and labour intensive nature. Under such conditions use of herbicide with suitable dose remains the pertinent choice for controlling the weeds. Sometimes only herbicides alone are not able to control weeds effectively. There use can be made more effective, if supplemented with hand hoeing. Integration of chemical and cultural method of weed control would not only reduce the expenditure on herbicide, but would benefit the crop by providing aeration and conservation of moisture. Therefore, field experiment on fenugreek was conducted at RCA, MPUAT, Udaipur during *Rabi* 2016-17 and 2017-18 to study the effect of different weed management practices on weed control and seed yield of fenugreek. The experiment consisted of thirteen weed management treatments comprising imazethapyr (70 g/ha, 70 g/ha *fb* hoeing at 40 DAS),imazethapye 50 g/ha at 2-4 leaf stage of weeds, imazethapyr + imazamox 50 and 60 g/ha at 2-4 leaf stage of weeds, pendimethalin 750 g/ha PE, oxyfluorfen (120, 150 g/ha and 120 g/ha *fb* hoeing at harvest, oxadiargyl (100 g/ha and 100 g/ha *fb* hoeing at 40 DAS) including weed free and weedy check in main plot treatments and levels of vermicompost, *viz.* control and 5 t/ha in sub plot treatments. The experiment was laid out in split plot design with three replications. Fenugreek variety RMT-305 was sown at 30 cm distance with 25 kg/ha seed rate and fertilize with recommended dose of fertilizers. Pre-emergence application of oxadiargyl 100 g/ha followed by hoeing at 40 DAS recorded significantly lower weed density (15.00 m^2) and weed dry matter (54.20 g/m^2), higher weed control efficiency (86.29%), crop resistance index (10.20), weed persistence index (1.79%) and lowest weed index (3.03%). Also the same treatment recorded higher growth, yield attributes and seed yield (2820 kg/ha) of fenugreek, however this treatment was remained at par with weed free check.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-125

Integrated weed management in fenugreek

Isha*, S.S. Punia, Todarmal and Garima Dahiya
Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email : isha3214@gmail.com*

A field experiment was conducted at Agronomy Research Farm, CCS Haryana Agricultural University, Hisar during *Rabi* 2018-19 to study the effect of different herbicides on growth and yield of fenugreek. The major weeds which infested the experimental field were *Rumex dentatus, Medicago denticulata, Melilotus indica, Convolvulus arvensis, Lathyrus aphaca* and *Phalaris minor.* Fenugreek is grown on an extensive scale in Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh, Maharashtra, and Punjab. It is an important condiment crop during winter season in north-western part of the country. It occupies third and fourth place in area and production, respectively among all the minor spices grown in India. Growth of fenugreek is slow in the initial stages and it does not form a canopy that can suppress the weed growth. The crop faces severe competition from weeds causing reduction in yields.The treatments were 2 pre-emergence herbicides *viz.*, imazethapyr at 80 g/ha, pendimethalin at 1000 g/ha, four pre-emergence herbicides mixture *viz.*,imazethapyr + imazamox (RM) at 70 g/ha, pendimethalin + imazethapyr (RM) at 1000 g/ha, pendimethalin + imazethapyr (RM) at 1250 g/ha, pendimethalin + imazethapyr (RM) at 1500 g/ha, two post-emergence herbicides *viz.*, imazethapyr at 80 g/ha at 3-4 leaf stage, imazethapyr + imazamox (RM) at 70 g/ha at 3-4 leaf stage, four pre-emergence herbicides with one hoeing *viz.*, imazethapyr at 80 g/ha + one hoeing at 3-4 leaf stage, imazethapyr + imazamox (RM) at 70 g/ha + one hoeing at 3-4 leaf stage, pendimethalin at 1000 g/ha + one hoeing at 3-4 leaf stage, pendimethalin + imazethapyr (RM) at 1500 g/ha + one hoeing at 3-4 leaf stage and two hoeing at 30 and 60 DAS were compared with weedy check and weed free. To optimize the dose and time of application of different herbicides against weeds in fenugreek, an experiment was laid out in randomised block design with fifteen treatments each replicated thrice.Among pre-emergence herbicide treatments the lowest weed density, dry weight of weeds and higher weed control efficiency was obtained in case of pendimethalin + imazethapyr (RM) at 1500 g/ha at 45, 75 DAS and at harvest. While the lowest growth attributes and yield were recorded in case of pre-emergence application of pendimethalin at 1000 g/ha. But pre-emergence herbicides with one hoeing gave better results than sole pre-emergence herbicides *i.e.* pendimethalin + imazethapyr (RM) at 1500 g/ha + one hoeing at 3-4 leaf stage. Application of pendimethalin + imazethapyr (RM) at 1500 g/ha + one hoeing at 3-4 leaf stage recorded significantly higher yield which was on par with two hoeing at 30 and 60 DAS.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-126

Impact of cropping system complexity on population dynamics of southern crabgrass in organic vegetable production

Manish Bhan
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
**Email: bhan.manish@gmail.com*

Weeds have been recognized as a major constraint for suppressing yield in organic production. Their increase cause an impact on soil seed bank thereby increase in abundance. A holistic approachis needed for its control in organic agriculture however requires a thorough understanding of dynamics of weed populations. Two field experiments were established from summer 2006 - 2008 in north-central Florida, USA to compare the effects of cropping system that comprise of integrating cover crops, living mulches, and intercropping on dynamics of southern crabgrass (*Digitaria ciliaris* (Retz.) Koel) population. Treatments consisted of seven organic cropping systems with a summer fallow followed by fall and spring vegetables.One experiment utilized fall yellow squash and spring bell pepper and fall broccoli and spring sweet corn were used in the other experiment. Cropping systems were arranged in a randomized complete block design. The simple cropping system was a weedy summer fallow prior to vegetable monoculture. Four intermediate cropping systems utilized cover crops of pearl millet (PM), sorghum-sudangrass (SS), sunn hemp (SH), or velvet bean (VB) planted prior to vegetable monoculture. Two complex systems included either pearl millet-sunn hemp (PMSH) or sorghum sudangrass-velvet bean (SSVB) mixtures. In the complex systems, row middles of fall squash and broccoli were planted with rye-hairy vetch and crimson clover as living mulches, and bush bean intercrops were used in both the spring vegetables. Southern crabgrass population were monitored from soil samples prior to beginning of the experiments, one year after, and at the end of the experiment, and seedlings collected from both the cover crops and vegetables experiments. Model for evaluating population trends, emergence and mortality rates was generated and later simulated using Python software for various systems. No significant relationship was observed between emergence and mortality rates with both the maximum ($P>0.2$; $P>0.29$) and minimum ($P>0.06$; $P>0.12$) temperatures, and rainfall ($P>0.37$; $P> 0.75$) parameters. Seven simulations representing seven cropping systems were simulated run for 128 weeks. The simulated results predicted that the effect of various cultural practices were not sufficient to decrease weed seedlings however many germinated seedlings were destroyed by tillage. The result also suggest that the living cover crops suppress weed seedling populations than simple system in the field with seed population was higher in the upper 0-5 cm soil layer among all the cropping systems, except intermediate SH system. Models are difficult to validate because of the scarcity of long-term data series. There is a need to include other management strategies to increase seedling mortality in organic vegetable systems.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-127

Bio-efficacy of herbicides on growth and yield of onion

M.M. Mishra, J.K. Nayak, K.C. Barik* and S.K. Mohanty*
Orissa University of Agriculture and Technology, Bhubaneswar, Odisha 751 003
**Email: mishramm2012@gmail.com*

Onion is one of the important commercial vegetable crops grown in India. Due to its slow growing, shallow rooted, narrow and upright leaves; onion crop is severely affected by weed competition at initial period of the crop growth. Though some pre-emergence herbicides can able to control the weeds at initial period of crop growth, there is a very limited options available to control the successive flushes of weeds in onion. The conventional methods of manual weeding are very laborious, expensive and cumbersome. Hence, using good herbicide at right time is one of the suitable options not only to manage the weed problems in onion in an effective and economic manner but also helps in utilizing those labours in a more productive alternate ways for profit optimization. Considering these facts an attempt has been made to manage weeds by using some new molecules in onion. A field experiment was conducted at Central farm, Orissa University of Agriculture and Technology, in onion with 7 weed control treatments in a randomized block design with three replications during *Kharif* seasons of 2016. The geo spatial position of the site was located at 200 15' N latitudes and 850 52' E longitudes with an elevation of 25.9 m above MSL. The climate is hot and humid with mean annual rainfall of 1467 mm. The soil of experimental field was sandy loam with pH 6.5, organic carbon 0.41%, available N 175 kg/ ha, P_2O_5 26 kg/ha and K_2O 215 kg/ha. The variety 'Dark Red' of onion, was transplanted in the month of September during 2016 at a spacing of 30 cm × 10 cm. Pendimethalin (33%) was applied 2 days after transplanting as pre-emergence (PE), quizalofop-p-ethyl(4%) +oxyfluorfen(6%) (RM) was applied 15 days after transplanting as early post-emergence (EPoE), while oxyfluorfen (23.5%), quizalofop-p-ethyl (5%), propaquizafop (10%) were applied 25 days after transplanting as post-emergence (PoE) when weeds were at 3-4 leaf stages as per the treatments. The manual weeding was done at 20 and 40 DAT. Weed density and dry weight of weeds were recorded at 30, 60 and 90 days after transplanting (DAT) by using a quadrat of 0.5 m × 0.5 m randomly from three places in each plot. The floral composition of different weed species of the experimental sites were *Ludwigia parviflora*, *Celosia argentea, Cleome viscose, Physalis minima* among major broad leaved weeds, *Cynodon dactylon, Eluesine indica, Digitaria sanguinalis* among grasses and *Cyperus rotundus* was only sedge present. Basing on the result analysis, it was concluded that application of ready mix combination of oxyfluorfen + quizalofop-p-ethyl (RM)100 g/ha is the most effective herbicide in controlling the complex weed flora in onion with WCE (78%), resulting in higher bulb yield (20.6 t/ha) with maximum benefit cost ratio (2.37).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-128

Evaluation of herbicide mixtures on control of weeds in tomato

S.B. Yogananda*, P. Thimmegowda[1], G.K. Shruthi and S.S. Prakash[2]
Department of Agronomy, College of Agriculture, V. C. Farm, Mandya, Karnataka 571 405
[1]Zonal Agricultural Research Station, V. C. Farm, Mandya, Karnataka 571 405
[2]Department of Soil Science and Agricultural Chemistry, College of Agriculture, V.C. Farm, Mandya, Karnataka 571 405
University of Agricultural Sciences, Bangalore 560 065
**Email: sbyogananda@gmail.com*

Tomato (*Lycopersicon esculentum*) is one of the most important vegetable crops grown all over the world. It is warm season crop, resistant to heat, drought and grows on wide range of soil and climatic conditions. India is the second largest producer of tomato in the world. It covers an area of 809 thousand hectares with a production and productivity of 19.7 lakh million tonnes and 24.3 t/ha during 2016-17, respectively. Weed is the major constraint limiting the crop production and has most deleterious effect and ultimately causing the yield reduction of tomato by 53-67%. A field experiment was conducted during *Kharif* season of 2018 at the College of Agriculture, V. C. Farm, Mandya to evaluate the bio-efficacy of herbicide mixtures on control of weeds in tomato under Cauvery command area of Karnataka. The farm is geographically situated between 110 30' to 130 05' N latitude and 760 05 to 770 45' East longitude with an altitude of 697 meters above MSL. The soil of experimental site is red sandy loam. The treatments consisted of pre-mergence application of metribuzin 11.25% + pendimethalin 29.75% ZC at 1500 ml/ha, metribuzin 11.25% + pendimethalin 29.75% ZC at 2000 ml/ha and metribuzin 11.25% + pendimethalin 29.75% ZC at 2500 ml/ha, pendimethalin 38.7% CS at 1750 ml/ha and pre-plant incorporation of metribuzin 70% WP at 750 g/ha. These treatments were compared with weedy and two hand weeding (at 20 and 40 DAT) checks. These treatments were replicated thrice in a complete randomized block design. The major weeds associated with tomato cultivation were *Echinochloa colonum, Digitaria sanguinalis, Cynodon dactylon, Dactyloctenium aegyptium, Panicum repens,* among the grasses; *Parthenium hysterophorus, Potulaca oleracea, Commelina benghalensis, Trianthema portulacastrum, Convolvulus arvensis, Euphorbia hirta, Corchorus trilocularis, Mollugo stricta, Phyllanthus niruri, Stachytarpheta indica* and *Leucas aspera* among the broad leaved weeds and *Cyperus rotundus* and *Fimbristylis miliacea* among the sedges. The data revealed that pre-emergence application of metribuzin 11.25% + pendimethalin 29.75% ZC at 2500 ml/ha found effective in the control of all types of weeds and recorded significantly lower total weed population (14.13/m^2) and weed dry weight (7.27 g/m^2) at 30 DAT and recorded 90.74% weed control efficiency. As a result of effective weed control the same treatment recorded significantly higher fruit weight (29.12 t/ha). However, it was at par with pre-emergence application of metribuzin 11.25% + pendimethalin 29.75% ZC at 2000 ml/ha on the basis of profit per rupee invested. While, uncontrolled weed growth throughout the cropping season reduced the tomato fruit weight to an extent of 67%. It was concluded that pre-emergence application of metribuzin 11.25% + pendimethalin 29.75% ZC at 2000 ml/ha is economically viable in the control of weeds in tomato.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-129

Weed dynamics in sweet potato grown in Alfisol under rainfed conditions of Konkan

T.N. Thorat, U.E. Thakare*, R.S. Shinde, R.T.Thokal, P.S. Gudadhe and P.S. Bodake
Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra 415 712
**Email: tnt161975@gmail.com*

Sweet potato is generally cultivated as rainfed crop in Konkan region of Maharashtra hence weed infestation during the early crop growth stages leads to heavy yield losses due to weed interference. Several workers reported that the critical period for crop-weed competition in sweet potato was 30 to 45 days after planting. A weed free period of 45 days reduced the weed dry weight by 80%. Yield reduction of 91% was found in sweet potato due to weed competition. The investigation was carried out in *Kharif* 2017 at AICRP on Tuber Crops, Central Experiment Station, Wakawali, to study the weed dynamics in sweet potato (*Ipomoea batatas* L.). The results revealed that, in sweet potato crop, the BLWs observed were *Alternanthera sessilis, Borreria pusilla, Amaranthus viridis, Desmodium triflorum, Urena lobata, Urena sinuate, Euphorbia hirta, Ludwigia parviflora, Commelina benghalensis, Commelina diffusa, Murdannia nudiflora, Mimosa pudica, Mitracarpus villosus, Mollugo nudicaulis, Mollugo pentaphylla, Phyllanthus niruri, Phyllanthus urinaria, Stellaria* media. Amongst these *Phylanthus niruri, Mollugo pentaphylla* and *Mollugo nudicaulis* were the predominant BLWs. The different grasses and sedges noticed were *Eleusine indica, Eragrostis minor, Echinochloa colona, Echinochloa crusgalli, Cynodon dactilon, Brachiaria erusiformis, Brachiaria ramose, Digitaria sanguinalis, Eriocaulonsie boldianum, Isachaemum globosa, Cyperus rotundus, Cyperus brevifolius* and *Cyperus compressus*. Among grasses *Eleusine indica, Echinochloa colona, Eragrostis minor* were more rampant while in sedges *Cyperus rotundus* was predominant. Among the different planting times, the total weed density (12.6/m^2) and biomass (6.27 g/m^2) was found significantly highest under early planting (24th Met. Week) as compared to late plantings at 30 days after planting. Numerically, higher values of weed density and biomass were found in higher nitrogen level (100 kg N/ ha) and full basal dressing of nitrogen as compared to lower nitrogen levels (75 and 50 kg N/ha) and split application of nitrogen as 50% basal and 50% top dressing at 30 days after planting. Hence, it can be concluded that, in Konkan region under rainfed conditions, the sweet potato crop was mainly associated with BLW like *Phylanthus niruri*, grasses like *Eleusine indica, Echinichloa colona, Eragrostis minor* and *Cyperus rotundus* amongst sedges in early planting with higher dose of nitrogen as basal application.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-130

Effect of different weed management practices on onion growth attributes

S.K. Verma*, G. Sharma, Shani Raj and R.K. Bisen
BTC College of Agriculture and Research Station, IGKV, Bilaspur, Chhattisgarh 495 001
**Email- Sanjayvermatcb@gmail.com*

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops grown all over the world. It is native of Central Asia and Mediterranean region. It belongs to family Alliaceae and the plant is either biennial or perennial. Its semi-cylindrical leaves emerge from a subterranean bulb, which bears fascicled, short and scarcely branched roots. The stem is erect and an umbel-like inflorescence composed of white or greenish-white small flowers grow at the tip of the stem. The fruit is capsule, which contain black flat seeds. The edible bulb is composed of several overlapping layers on a central core. Onion possess as culinary, dietary and medicinal importance in daily life of people in the whole world, it is also a major vegetable crop to gain foreign currency. In Chhattisgarh, it is being grown on an area of 20.06 (¹000 ha) with a production of 308.10 (¹000) mt and the productivity is 15.36 ton/ha (NHRDF, Nashik). The maximum cultivated area and production of onion is Mahasamund followed by Durg, Kanker, and Raipur district (Anon, 2013). Onion is very rich in various nutrients and vitamins like vitamin "A" thiamine, riboflavin, niacin and ascorbic acid and rest are the carbohydrates which make up the dry matter of the bulb. Under such circumstances application of herbicides offer a suitable method for weed control by producing maximum sized bulbs and higher yield. The conventional method of weed control (hoeing and manual weeding) is very labourious, expensive and insufficient. Weed infestation is the important constraint in onion production, which causes reduction in bulb and seed yield to the tune of 40 to 80%. Onion is slow growing, shallow rooted crop with narrow upright leaves and non-branching habit. Due to this type of growing habit, it cannot compete well with weeds. In addition to this, frequent irrigation and fertilizer application allows for successive flushes of weeds in onion. The field experiment was conducted during *Rabi* season of 2016-17 at the Horticulture Research cum Instructional farm, BTC CARS, Bilaspur (C.G.). The treatments consisted of ten combination of different agro input management practices, *viz.* control weedy check, weed free, pendimethalin1.75 kg/ha pre-emergence, oxyfluorfen1 kg/ha pre-emergence, quizalofop-ethyl 1.0 kg/ha post-emergence, pendimethalin 1.750 kg/ha pre-emergence + quizalofop-ethyl 1.0 kg/ha post-emergence, oxyfluorfen 1.0 kg/ha pre-emergence + quizalofop-ethyl 1.0 kg/ha post-emergence, two hand weeding at 25 and 45 DAT), black polythene mulch, organic mulch with paddy straw 2.0 t/ha). The plant height, number of leaves/ plant, fresh weight, dry weight were found higher with treatments T_7 (oxyfluorfen 1 kg/ha (pre-emergence) + quizalofop-ethyl 1 kg/ha (post-emergence).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-131

Weed management stratigies in mango and cashew orchards through agronomic interventions in Konkan region of Maharashtra

V.A. Rajemahadik, P.S. Bodake, S.S. Pinjari, U.V.Mahadker, V.G. More, V.G. Chavan and M.J. Mane and M.S. Jadhav

Dr.Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dapoli, Maharashtra 415 712

Email: agronomy56@gmail.com

Konkan region is geographically hilly zone of Maharashtra located on west coast having narrow strip of 720 km distance. This region covers of two agro climatic zones i. e. South Konkan Coastal Zone and North Konkan Coastal. It receives annual rainfall from 2500 to 4500 mm during monsoon *i.e.* (June to September) but irrigated area is only about 5 per cent. Horticultural crops especially mango, cashewnut, coconut and *kokum* are dominant crops in south Konkan coastal zone. Konkan region is having a huge potential in respect of horticulture, industry, tourism, fruit processing, minerals, fisheries, agro-based industries, etc. It is strategically located between Mumbai, the commercial capital of India and Goa, the tourism destination. Rain fed fruit crops specifically mango and cashew nut are being grown in different states of our country. While mango is grown in almost all states of our country, cashew nut cultivation is mainly concentrated in regions with low altitudinal situations Productivity of Indian orchards can be increased only when all aspects of sustainable production technology including weed management are given due consideration at the level of individual farmer as weeds in general, are responsible for yield losses of 20 to 50 per cent or even more due to which 70 per cent of labour input in orchard management is generally diverted towards weeding alone. India being a large country, diverse agroclimatic conditions prevail which provide great scope for cultivation of diverse types of tree fruits and bush fruit crops and accordingly numerous weed species are found to grow in orchards depending upon local agroclimatic conditions, season and packages being followed for a given fruit crop. India being a large country, diverse agroclimatic conditions prevail which provide great scope for cultivation of diverse types of tree fruits and bush fruit crops and accordingly numerous weed species are found to grow in orchards depending upon local agroclimatic conditions, season and packages being followed for a given fruit crop. In *Konkan* region despite control of perennials in interplant spaces, seasonal grasses mainly *T. quadrivolus* grow naturally to the height 0.75 to 1.5 m on large scale with underneath growth of many other grasses like *O. burmanii, O. compositus* etc. In orchards situated on plain areas in *Konkan,* incidence of *Coix lacryma jobi* and *I. rugosum* and such other weeds is common. Growth of these grasses during monsoon season is beneficial as fodder for milch and draft cattles besides the fact that such growth of grasses in interplant spaces of orchards acts as effective live mulch to avoid direct impact of intense rains besides soil binding action through their fibrous roots. However, such grassy vegetation needs to be harvested immediately during post monsoon period from October to December as it proves hindrance to plant protection measures, harvesting and picking fallen cashew nuts. animal grazing was found to be the effective, economical and eco-friendly way of controlling grass weeds in mango orchards.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-132

Management of *Cuscuta reflexa* by different herbicides and its impact on yield of berseem fodder crop

D.S. Sasode, Varsha Gupta, B.S. Kasana, Ekta Joshi, Y.K. Singh and V.P.S. Bhadauria
RVSKVV, Gwalior Madhya Pradesh, Gwalior, Madhya Pradesh
Email: dsingh.jnkvv@rediffmail.com

Cuscuta (*Cuscuta reflexa*) well known as '*Amar bail*' or 'dodder' has hard-coated seed that can remain dormant in the soil for more than 20 years. It is an annual parasitic weed with stem holoparasitic.It grows only by penetrating tissues of host plants to obtain water and nutrients. Berseem is an important *Rabi* fodder for milch cattle. It is widely adopted because of multicut test regeneration, high fodder yield and nutritional value. Due to frequent irrigation coupled with suitable temperature and better nutrient availability, it provides favourable environment for growth of *Cuscuta reflexa* and other weeds to appear simultaneously with crop plants and rob the essential nutrients, light, moisture and space thus causing substantial reduction in green forage yield. Besides this, seed quality is also impaired due to mixing of weed seeds. Keeping this in view field experiment was conducted at the research farm, RVSKVV, Gwalior during *Rabi* 2018-19 to see the impact of different herbicides for controlling the *Cuscuta reflexa*. The soil of the experimental field was sandy clay loam in texture with organic carbon 0.3% and having pH 7.8, low in available nitrogen (237 kg/ha), medium in available phosphorus (19.7 kg/ha) and potash (277.1 kg/ha). Seven treatments consisting of pre-emergence application of pendimethalin (1000 g/ha), pendimethalin (1000 g/ha) at 10 DAS, pre- emergence application of oxyfluorfen (250 g/ha), imazethapyr 40 g/ha after first cutting of berseem, imazethapyr 40 g/ha after last cutting of berseem, imazethapyr 40 g/ha after first cutting and again 40 g/ha after last cutting of berseem and control plot (no herbicide application) were laid out in the randomized block design with three replications. Berseem was sown on 21 November 2018 with 30 kg/ha seed rate. Basal dose 20, 80 and 20 kg/ha N, P_2O_5 and K_2O through urea, single super phosphate and muriate of potash was applied respectively. Weed population and their dry weight were recorded at 20, 45, 70, 90 and 110 DAS whereas green fodder yield was taken at 45, 70 and 90 DAS during the experimental year 2018-19. The yield thus obtained in three cuttings was summed up to get the total green forage yield under each treatment. After three cuttings, the crop was left for seed under each treatment. Economic analysis of each treatment was done on the basis of prevailing price of inputs used and output obtained under each treatment. Application of pendimethalin 1000 g/ha applied as early post-emergence at 10 DAS produced higher fodder yield (86 t/ha) with total three cuts and seed yield (273 kg/ha) and application of imazethapyr 40 g/ha after first cut + same dose applied again after last cut were also found effective to control the *Cuscutta reflexa* and other weeds and getting fodder yield 74 t/ha with seed yield 248 kg/ha. The profitability was also higher with the use of pendimethalin 1000 g/ha applied as early post-emergence at 10 DAS.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-133

Biology and management of Parthenium weed

Sintu Malik and Samunder Singh
Department of Agronomy, CCSHAU, Hisar, Haryana 125 001
Email- sintumalik01@gmail.com

The effect of various environmental factors and growth behavior of weed is important in understanding its competition with other species of plants. The knowledge of weed biology and weed ecology is therefore, essential to maximize the effectiveness of agronomic practices in the management strategy. Parthenium (*Parthenium hysterophorus* L.), a native weed of Tropical North and South America (Mexico, USA) was accidentally introduced in India with grains imported from Mexico. Plant complete one generation within 15 to 18 weeks and may complete 4 to 5 overlapping generations in a year. However, with the right conditions (rain, available moisture, mild soil and air temperatures), Parthenium weed can grow and produce flowers at any time of the year. There is no seed dormancy in Parthenium. A recent survey of summer and winter crops of Haryana State, India, revealed that Parthenium has moved from roadsides to adjoining fields of sugarcane, rice, wheat, cotton, vegetable crops and orchards. An experiment was conducted in screen house of Department of Agronomy, CCS HAU Hisar during the *Kharif* season of 2016 and 2017 to study the effect of seeding depth, flooding, competition with three weeds and two crops, herbicides on emergence, plant height and dry weight of Parthenium. Parthenium seeds germinated only upto 4 cm depth. No seedlings of Parthenium emerged from 8 cm depth. Maximum emergence (%) was reported at soil surface (82%) and controlled flooding (75%), whereas nil at 8 cm depth and 16 days of flooding. Parthenium can survive 15 days of flooding and can create weedy problem even after 15 days of flooding. Germination of Parthenium reduced with increase in flooding durations.All the three weed species (*Helianthus annus*, *Chenopodium* sp. and *Amaranthus hybridus*) and two crops (Pearl millet and Sorghum) reduced the germination of Parthenium. Interaction of plant ratio and weed species was significant on plant height of Parthenium. Dry weight of Parthenium increase with increase in plant height *i.e.* maximum in pure stand and minimum in single plant ratio. Glyphosate (NH_4 salt) was found to have highest mortality (91%) whereas, Lanfida had lowest mortality (40%) at 2 WAS. It was found that glyphosate (IPA and NH_4 salt), glyphosate (NH_4) + 2,4-D amine, glyphosate (NH_4) +2,4-D ester, glyphosate (NH_4)+metribuzin showed 100% mortality at 4 WAS but Lanfida had least mortality of 63%. Maximum dry weight of 6.50 g was obtained in no herbicide application treatment followed by Lanfida (2.53 g), glyphosate (IPA)+Lanfida (2.14 g), glyphosate (IPA)+atrazine (2.00 g) and glyphosate+Lanfida (1.90 g) whereas, minimum dry matter of 0.70 g in glyphosate (NH_4) treatment. Efficacy of all herbicides was more as there was optimum moisture in pots and spray was made at rosette stage, whereas under field conditions, these are major constraints for obtaining 100% control.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-134

Diclosulam herbicide management in summer groundnut in the lower Gangetic Plains of West Bengal

Anannya Ghosh*, Ananya Chakraborty, Dibyendu Mondal, Sritama Biswas, Pintoo Bandopadhyay and Ratikanta Ghosh

Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741 252

**Email: anannya1508@gmail.com*

The oilseed sector pose serious concern in the post-reforms period when India became one of the largest importers of edible oils in the world, importing about half of domestic requirement in the 1990s, despite India occupying the second position in area. Among the biotic stresses weeds pose the maximum challenge. Groundnut is a profiteering, low water requiring crop having better economics over summer rice which is a major spoiler as it contributes to arsenic pollution in the food basket of eastern India. Residual toxicity of herbicides related issue leads us to explore advanced and low volume herbicides in our quest for sustainability.Weeds are a major problem in summer groundnut in the lower Gangetic Plains of West Bengal which contribute to yield losses significantly.This study was undertaken to evaluate the efficacy and effective dose of Dicosulam 84 WDG against the weeds of groundnut and to determine the residual effect on succeeding crop maize. A field experiment was conducted in the sub humid tropics of C-Block farm of Bidhan Chandra Krishi Viswavidyalaya in the summer season 2015-16 and 2016-17 having bearing of 22°56' N latitude, 88°32' E longitude and at an altitude of 9.75 m. The experimental soil had sand 49.4, slit 30.4, clay 20.2, pH 6.75, organic carbon (%) 0.66. The available N: P_2O_5: K_2O content in the experimental soil were 167 kg/ha, 27 kg/ha and 140 kg/ha respectively. The plot size was 5 x 4 m. Recommended fertilizer doses N: P_2O_5: K_2O 20:60:40 kg/ha and variety was TAG-24. There were seven treatments including untreated control and hand weeding treatment replicated thrice. The major weeds in the experimental field were *Echinochloa* sp., *Cyperus* sp. *Portulaca oleracea*. Dicosulam 84 WDG at 18, 22 and 26 g/ha were evaluated in comparison with standards, *viz*. pendimethalin 30 EC at 1000 g/ha, oxyfluorfen 23.5% EC at 150 g/ha and all these treatments were compared with untreated control. Weed population and dry matter were all significantly the lowest with herbicide treatments in all doses of dicosulam and weed control efficiency was corresponding maximum and significant for the treatments. Highest pod yield was recorded in dicosulam at 26 g/ha, which was at par with dicosulam at 22 g/ha and hand weeding treatments at 30 and 45 DAS. There was no residual effect in the succeeding maize plots with germination count and yield having no significant variation across the treatments. The microbial count before experiment (2015) total number per gram of dry soil were bacteria 4.7 x 10^6, fungi 7.5 x 10^3 actinomycetes 6.5 x 10^3 and the corresponding count all improved after the experiment in both the years.The experiment concluded with the findings It is also evident from the present investigation that dicosulam at 26 g/ha was the best effective dose for controlling all type ofweeds and at par with dicosulam at 22 g/ha and it has noadverse effect in the succeeding crops of the groundnut *i.e.* maize.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-135

Study on translocation pattern of foliage applied herbicide with nano composite in *in-vitro* established *Cyperus rotundus*

Srimathi K* and C.R. Chinnamuthu
Department of Agronomy, TNAU, Coimbatore Tamil Nadu 641 003
**Email: srimathiraj95@gmail.com*

Cyperus rotundus L. (Purple nutsedge) is one of the world's worst weeds based on its occurrence in 52 crops in 92 countries and its capacity to cause substantial yield losses. It is an erect, glabrous, grass-like herb with fibrous root system, grows 7-40 cm tall and reproduces extensively by rhizomes and tubers. The rhizomes are initially white and fleshy with scaly leaves and then become fibrous, wiry and very dark brown with age. The tuberization begins within 17 days after shoot emergence. Even if the aerial parts of the weeds die, the underground parts may continue to live and put forth fresh shoots.The tubers contain inert buds and function like the seeds of annuals, acting as the primary dispersal units. The sprouting bud forms one to two upwardly growing rhizomes that produce the basal bulb under the influence of light. The shoots can reach a height of 10 to 90 cm. After a few weeks, lateral rhizomes will grow from this basal bulb that will grow and elongate up to 1 m. The lateral rhizomes will give rise to the formation of secondary sprouts that will form tertiary sprouts, and so on. The formation of the lateral rhizomes from the basal bulb starts 4 to 6 weeks after the appearance of the first aboveground shoots. The abundantly produced tubers present an efficient means of dispersal and reproduction. Complete control of these weeds is not possible because of their growing nature. Temporary control can be possible by the application of chemicals. But the success of this method mainly depends on the nature of chemical compounds, uptake pattern and ability of weeds. However, the dosages mentioned are too high to comply with current and future regulations. The *Cyperus rotundus* leaves have waxy surface and the mesophyll is composed of compactly arranged with thin wall. Vacuoles are absent in both stem and leaf. Single bulliform cells were present in the upper epidermis of nutsedge leaf. In stem, the epidermis consists of rounded compact cells and vascular cells are numerous, scattered in ground tissues. The epicuticular wax amount and composition on old leaves would likely have a greater effect on herbicide than young leaves. Glyphosate is highly hydrophilic, therefore, it is more likely to be absorbed less in older leaves than young leaves. The addition of more surfactants to the spray solutions applied improves the glyphosate activity. But the success of this weed control is mainly depends on the behaviour of sprouting, formation of rhizome, bulb, tuber and nature of chemical compounds, uptake pattern and ability of weeds.Based on these circumstances the study is conducted to establish *Cyperus rotundus* under *in vitro* condition by using different media and nutrient composition and induce tubers. The in-vitro grown plants and tubers will be used for translocation pattern of foliage applied herbicide with nano composites in primary and secondary tubers of *Cyperus rotundus*.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-136

Bio-efficacy of indaziflam for weed management in tea

Suresh Kumar*, S.S. Rana, Neelam Sharma, Navdeep Singh and Tamanna Bhalla
Department of Agronomy, Forages and Grassland Management CSKHPKV, Palampur, Himachal Pradesh 176 062
Email: skg_63@yahoo.com

An experiment to evaluate the bio efficacy of indaziflam 500 SC, a new herbicide product from Bayer Crop Science for managing weeds in tea, was conducted during the spring and monsoon seasons of 2017 at farmer's field at two location *i.e.* Holta and Palampur. The experiment was laid out in randomized block design with three replications. The dominant weed flora in the experimental area was *Ageratum* sp, *Rubia cardiflolia*, *Veronica* sp, *Stephania cephalantha*, *Galium spurium*, *Leptochloa chinensis*, *Bidens pilosa*, *Ipomoea* sp., *Pennisetum polystachion*. Eleven weed control treatments were indaziflam 500 SC 37.5, 50, 62.5 and 125 g/ha, oxyfluorfen 23.5% EC 250 g/ha, glufosinate ammonium 13.5% W/W SL 500 g/ha, glyphosate 1500 g/ha, hand weeding (30, 60, 90 and 120 days after start of experiment), indaziflam 62.5g/ha + glufosinate ammonium 13.5% W/W SL 500 g/ha, indaziflam 500 SC125 g/ha + glufosinate ammonium 13.5% W/W SL 1000 g/ha and weedy check. The major weeds were *Bidens pilosa* and *Ageratum* sp. constituting 8.9 and 21.1%, respectively, of total weed population during spring season and 25.4 and 19.5%, respectively during monsoon season. Hand weeding treatment recorded maximum weed control efficiency, followed by combination of indaziflam 125 g/ha + glufosinate ammonium 1000 g/ha. The results further revealed that girth of tea bush was significantly higher when combination of indaziflam 125 g/ha + glufosinate ammonium 1000 g/ha was applied and followed by indaziflam 125 g/ha. Fresh whereas dry weight of green leaves, green leaf yield and made tea yield were significantly higher with the application of indaziflam 125 g/ha + glufosinate ammonium 500 g/ha. However, this treatment was at par with combined application of indaziflam 125 g/ha and glufosinate ammonium 1000 g/ha and hand weeding over others. Weedy check reduced the green leaf yield and made tea yield by 36.5 and 37.1%, respectively. The combined application of indaziflam 62.5 g /ha and glufosinate ammonium 500 g/ha proved to be most profitable with highest net returns (Rs 2,14,870/ha/annum) and net returns per rupee invested (1.74). No adverse effect in terms of phytotoxicity were observed on tea with the application all the herbicides *i.e.* indaziflam, oxyfluorfen, glufosinate ammonium and glyphosate or the combination of indaziflam and glufosinate ammonium. Higher yields obtained without any phytotoxic effect with the application of herbicide combination product (indaziflam + glufosinate ammonium) indicates the superiority of this product in managing weeds in tea. Since this new herbicide combination contains two different herbicides indaziflam and glufosinate ammonium, as combination product they were effective in controlling all types of weeds due to synergistic effect between them.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-137

Bio-efficacy of glyphosate potassium salt 46% SL in non-crop area and residual effect on succeeding crop

Todar Mal*, S.S. Punia, Sushil Kumar Singh and Manjeet
CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: todarmal.poonia6@gmail.com*

Glyphosate, often referred to as Roundup, a broad-spectrum herbicide widely used to effectively kill or suppress all types of plants (including grasses, perennials, vines, shrubs and trees) when applied to green foliage in agriculture and nonagricultural landscapes. In agriculture it can be used during the non-crop growth period or with some protection in cropped areas only with the specific recommendations. In conventional agriculture, glyphosate-based herbicides are applied before crops are sown to kill weeds to facilitate crop establishment. They are also used in no-till farming to clear the land of weeds and previous crops to as an alternative to tillage/ cultivation. So keeping this in view, a field experiment was conducted at Agronomy Research Farm, CCS Haryana Agricultural University, Hisar to study the bio-efficacy of glyphosate potassium salt in non-crop area and its residual effect on succeeding mustard crop. The experiment was conducted in randomized block design and replicated three times. Herbicide treatments were applied as per treatments in non-crop area during *Kharif* 2017 and 2018. The mustard variety RH-749 and RH-725 was sown in undisturbed layout of original plan to study the effect of treatment application on succeeding crop during both the seasons. The main weed species recorded in the plots were *Digera arvensis, Cyperus rotundus, Echinochloa colona, Convolvulus arvensis, Celosia argentea* and *Dactyloctenium aegyptium*. Application of glyphosate potassium salt 46% SL8000 ae/ha resulted in significantly lower weed dry matter accumulation as compared to other treatments, but at par with glyphosate potassium salt 46% SL4000 ae/ha during both years at different days after treatments (DAT). Recommended university practice *i.e.* 1.5% glyphosate application (product basis) also resulted into lower weed dry matter accumulation which was at par with glyphosate potassium salt 46% SL8000 ae/ha at different days after treatment in 2017 but it was significantly inferior during 2018. However, university recommended practice was at par with glyphosate potassium salt 46% SL2000 a.e./ha during both the years. Weed control efficiency (WCE) was varied with different herbicide treatments during both the years of experimentation. Application of glyphosate potassium salt 46% SL8000 ae/ha resulted in higher WCE (%) as compared to other herbicide treatments. Recommended university practice resulted in higher WCE (%) than glyphosate potassium salt 46% SL750 and 1250 ae/ha during 2017 and 2018 at different intervals. The results showed that there was no significant difference in the plant height, fresh weight/plant, number of silique/plant and seed yield due to different herbicides treatments. Hence, there was no residual effect of application of different treatments of glyphosate in non-cropped area with different formulations and at different doses on the succeeding Indian mustard crop during both the year of experimentation.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-138

Allelopathic effect of oscimum based cropping systems on weed diversity and changing weed dynamics

Sanjeet K. Verma, Pragya Trivedi, Rajesh Kumar Verma* and Priyanka Suryavanshi
Division of Agronomy and Soil Science, CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, Uttar Pradesh 226 015
**Email: rajeshcimap@rediffmail.com*

Field experiment was carried out during 2012-2014 to study the allelopathic activity of *Ocimum* residues on weed diversity and changing weed dynamics. *Ocimum* crop was grown during *Kharif* season while mustard, chickpea and barley crops were grown during *Rabi* season. The experiment was laid out in split-split plot design. Two *Ocimum* spp. (*O. basilicum* and *O. sanctum*) were taken as main plot factors, type of residue amendments (No residue addition, Solid distillation waste from whole plant biomass, Only root exudates after removing above and below plant biomass, Roots retention and Leaves retention) as sub plot factors and three succeeding crops (mustard, chickpea and barley) as sub-sub plot factors. Weed observation was done at early developmental stage of crops to avoid the shade effect of standing crops on weeds. All weeds were identified and their population was counted manually to analyse abundance, diversity and biomass of weeds. *C. rotundus* was found to be the most abundant species with the highest values of density, frequency, dominance and Importance Value Index. It was significantly reduced by both *Ocimum* species (*O. basilicum* and *O. sanctum*). The T5 (leaf retention as mulch) treatment showed the most deleterious effect on all kind of weeds including *C. rotundus*. In the studied cropping systems, *Gnaphalium indicum* L. dominated over other annual weed species during *Rabi* season. *Cyperus rotundus* showed antagonistic relationship with *G. indicum*. However, the population and composition of weeds varied among different cropping systems. Among all the cropping systems *Ocimum*-barley system was found to be the most effective in weed management. Results also revealed that *Ocimum* based cropping system shifts the dominance of weeds from perennial (*C. rotundus*) to annual (*G. indicum*) with a sharp decrease in the abundance of perennial weed *C. rotundus* and increase in abundance and diversity of annual and seed propagated weeds. *O. sanctum* has a more prominent effect on all kind of weeds including *C. rotundus* than *O. basilicum*. Thus, the present results suggest that application of oscimum residues as mulch or its adoption in rotational sequence could effectively bring down weed population and farmers can use allelopathic residues of *Ocimum* as potential bioherbicides to control problematic perennial weeds like *C. rotundus*.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-139

Chemical and cultural method of weed control in ginger

S. Kamala Bai*, G.N. Dhanapal, Prathiba and K.K. Sindhu

AICRP on Weed Management, University of Agricultural Sciences(B.), MRS, Hebbal, Bengaluru, Karnataka 560 024

**Email: skamalabai@yahoo.co.in*

Ginger (*Zingiber officinale* Roscoe) is grown in tropical and subtropical regions of the world for its spice and medicinal values. The emergence and early growth of ginger is inherently slow and weed growth can impact on yield. It has slow initial growth rate and shallow root system results in emergence of a variety of weeds.An experiment was carried out to study the efficacy of some herbicides on major weed flora, nutrient uptake and soil microbial count on yield and yield parameters in ginger. The experiment was conducted during *Kharif* 2016-17 and 2017-18 at AICRP on Weed Management, UAS, Bengaluru The experiment was laid out in a Randomized Complete Block Design having 11 treatments replicated thrice. In this experiment, the herbicide treatments, *viz.* PE herbicides (metribuzin at 0.7 kg/ha, pendimethalin at 1.0 kg/ha, oxyfluorfen at 0.20 kg/ha) were applied at 3 days after planting (DAP). Further, to get an integrated effect, PE herbicides was followed by different POE (fenoxaprop at 67 g/ha + metsulfuron at 4 g/ha, quizalofop-p-ethyl at 37.5 g/ha + metsulfuron at 4 g/ha) and also by HW twice at 45 and 75 DAP. Passing cycle weeder at 25 DAP and hand weeding at 45 and 75 DAP and one unweeded control treatment was included to have a clear picture of mechanical method of weed control and to compare with chemical treatment with integrated methods.The predominant weed flora in the experimental field were *Cyanodon dactylon, Eleusine indica, Dactyloctenium aegyptium* and the major broad-leaf weeds like *Acanthospermum hispidum, Borreria hispida, Commelina benghalensis, Alternentera sessilis, Mimosa pudica, Tridax procumbens, Spillanthus acmella, Ageratum conyzoides, Euphorbia hirta, Euphorbia geniculata, Emilia sanchifolia* and *Amaranthus viridis*.The results clearly indicated that there was an increase in yield of rhizome with the reduction of weed density and weed biomass with all the treatments other than the control (unweeded) plot. Among all the treatments, passing cycle weeder at 25 DAP and hand weeding, 45 and 75 DAP recorded higher plant height (20.8 cm), number of leaves (13.1), number of tillers/clump (1.9), leaf area (467.5 cm^2), nutrient uptake (181.4:43.5:27.7 NPK kg/ha) rhizome yield (24.6 t/ha) and significantly higher microbial count of bacteria, fungus and actinomycetes (7.43, 6.46, and 5.31, respectively) however, it was on par with application of PE metribuzin at 0.7 kg/ha *fb* hand weeding on 45 DAP recorded (21.13 cm plant height, 13.27 number of leaves, number of tillers 1.93 per clumps) growth parameters, (180.83:43.37:276.15 NPK) nutrient uptake, higher rhizome yield (23.3 t/ha) and soil microbial count was (6.59,4.46 and 3.69, respectively) followed by PE pendimethalin at 1.0 kg/ha *fb* HW twice at 45 and 75 DAP recorded (20.45 cm, 12.73 and 1.87) growth parameters, (174.72:41.91:266.82 NPK) nutrient uptake, rhizome yield (22.4 t/ha) and soil microbial count was (6.22,4.09 and 2.90, respectively) and PE oxyfluorfen at 0.20 kg/ha *fb* HW twice at 45 and 75 DAP (23.11t/ha). Least rhizome yield was recorded in unweeded control (5.7 t/ha).

Theme 7

Non-chemical weed management including biological control and weed utilization

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-140

Microbial dynamics in soil under different weed control practices adopted in organic farming

Tapas Chowdhury*, M.C. Bhambri, Srikant Chitley and Nitish tiwari
Department of Agricultural Microbiology, College of Agriculture, IGKV, Raipur, Chhattisgarh 492 012
**Email: tapas_mb@rediffmail.com*

A field study was conducted during *Kharif* 2017 in Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) in Inceptisol with rainy season in scented rice to find out the effect of different weed management practices on soil microbial activities under an organic farming system. Three different types of organic manures *i.e.* FYM, poultry manure and vermicompost were mixed in different combinations and applied in field with two different types of biofertilizers (*Azospirillum* and phosphate solubilizing bacteria) to fulfill the crop nutrients' requirement. The organic manures and biofertilizers were applied in main plots. In sub plots different non–chemical weed management techniques were applied to find out the most suitable weed management method which can minimize the weed infestation and simultaneously keep the soil healthy. For comparison of the efficiency of non-chemical versus chemical method of weed control, one chemical herbicidal treatment was also incorporated. The results of the experiment revealed that different weed management practices significantly affected the microbiological properties of soil. Minimum dehydrogenises activity (DHA), microbial biomass carbon content (MBC) and basal soil respiration rate (BSR) of soil was quantified in chemical herbicide treated plots and maximum in treatment where green manure was incorporated at 30 DAS, followed by use of manual paddy weeder twice during crop growth. Different nutrient management treatments varied significantly with respect to microbiological properties. Maximum DHA, MBC and BSR of soil was found due to use of 50% N through FYM + 50% N by poultry manure + PSB and *Azospirillum*, and the treatment was found significantly better over treatment of 50% N through FYM + 50% N by vermicompost + PSB and *Azospirillum*. Significant difference in grain yield of scented rice was found under different nutrient management practices. Application of 50% N (FYM) + 50% N (poultry manure) + *Azospirilium* + PSB produced significantly higher grain yield over 50% N (FYM) + 50% N (vermicompost) + *Azospirilium* + PSB. However, in weed management practices maximum grain yield was found under application of chemical weed control method *i.e.* oxadiargyl 80 g/ha *fb* bispyribac Na 25 g/ha, which was found significantly superior to rest of the treatments. In case of non-chemical method of weed management, hand weeding twice and motorized weeder (single row type) twice were equally effective and recorded comparable yield. It is concluded that application of 50% N (FYM) + 50% N (poultry manure) + *Azospirilium* + PSB was the best organic manures and biofertilizer combination to produce highest rice grain yield and shown maximum microbial activities under organic farming practice. In case of weed management, hand weeding twice was found the best method to control the weeds in organic rice and produced the maximum yield. However, this method was found at par with the method of green manure incorporation for control of weeds with respect to soil microbial properties.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-141

Weed management in sweet corn in maize based non-chemical cropping system

Varsha Gupta*, Deep Singh Sasode, Ekta Joshi, B.S. Kasana, Y.K. Singh and V.P.S. Bhadauria[1]
Scientists, Rajmata Vijayaraje Scindia Krishi Vishwa Vidhyalaya,
Gwalior, Madhya Pradesh 474 002
[1]Scientific Advisor and Convener Agra-Chapter at Foundation for Innovative Research, Sustainable Technologies and Intellectual Property
**Email: drvarshagupta11@gmail.com*

The experiment was conducted during *Kharif* 2018 and 2019 at Research Farm, College of Agriculture, Gwalior (M.P.) to find out the best weed management practice for sweet corn cultivation under maize based chemical and non-chemical cropping system. The soil was sandy clay loam in texture, low in available nitrogen (237 kg/ha), medium in phosphorus (19.7 kg/ha) and potash (277.1 kg/ha). The 8 treatments as black plastic mulch, soil solarization followed by plastic mulch, soil solarization followed by one hand weeding at 40 DAS, intercrop (sweetcorn+green gram), stale seed bed followed by one hand weeding at 40 DAS, hoeing at 20 and 40 DAS, weedy check and RDF+ recommended herbicide (atrazine 750 g/ha PoE) replicated thrice in a completely RBD. The sweet corn variety "sugar-75" was sown in the month of July both years, keeping row to row spacing 60 cm and plant to plant 20 cm with seed rate 12 kg/ha. Seed was treated with Azotobacter (35 g/kg seed) for 30 minutes to control soil and seed born diseases. FYM 10 t/ha and vermicompost 10 t/ha were applied. Full dose of FYM and half dose of vermicompost were applied at the time of field preparation and rest dose of vermicompost was applied just before sowing during second ploughing of the field. Neem cake 250 kg/ ha was applied in the soil to control termite. Recommended dose of fertilizer of N:P:K (120:60:40) was applied. Herbicide atrazine 750 g/ha was sprayed after 25 days of sowing of crop. Crop was harvested in October both the years. The major weed flora observed at experimental site during both the years were *Setaria glauca*, *Acrachne racemosa*, *Echinochloa crus-galli*, and *Celosia argentea,* as narrow leaved weeds (NLW's) and *Commelina benghalensis* and *Digera arvensis* were observed as major broad-leaved weeds (BLW's). The sedge *Cyperus rotundus* was the most problematic weed in the experimental site during both the years of study. Based on two years experimentation it was concluded that the population of narrow and broad leaved weeds were less where soil solarization was done with one hand weeding. The weed control efficiency (84%) was also high with this treatment *fb* soil solarisation with plastic mulch (80.55%). Among all the non-chemical weed management practices the intercropping (maize+greengram) gave maximum yield of cobs (6.39 t/ ha) *fb* the application of soil solarization with one hand weeding (6.09 t/ha) and soil solarization with plastic mulch (5.46 t/ha). However the yield of recommended dose of fertilizers + recommended herbicide (atrazine 750 g/ha PoE) was recorded 5.74 t/ha. Therefore, among non-chemical weed management practices intercropping (maize + greengram) application, can contribute to increase productivity and profitability of sweet corn in maize based cropping system.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-142

Non-chemical weed management including biological control

Ashiana Javeed* and Swati Mehta
Division of Agronomy, Sher-e-Kashmir Unversity of Agricultural Sciences and Technology, Jammu, J&K 180 009
**Email: parihar1492@gmail.com*

Weeds can be seen everywhere during the growth of the crop, it fiercely battles with crops for water and nutrients, strongly disturbing the normal growth of the crop and resulting in severe yield loss and quality reduction. Weed management is one of the dominant challenges in agriculture cropping systems, because all crops become colonized by many different species of weeds. In extreme but rare cases, long term failure to manage weeds can result in complete crop loss. Farmer's interest in managing weeds is reflected in herbicide sales, which accounts for 33% of all sales. Yet in order to restore long-term soil fertility and ecosystem services needed in farming, as well as environmental and human health, there is a clear need to reduce and eventually eliminate herbicides and other pesticides. The solution is to invest in sustainable agricultural systems that can reverse the damage caused by herbicides and pesticides and create an ecologically and economically viable agricultural production model. Weeds differ from most pests and diseases in that killing or removing them by direct physical means is a practical option. The problem is in removing the weeds selectively without injuring the crop. Solarization is a method of heating moist soil by covering it for around 6 weeks with plastic sheeting to trap solar radiation. Unlike steam sterilisation, solarization does not sterilise the soil and create a biological vacuum, but there is some control of soil pathogens. A living mulch consists of a dense stand of low growing species established prior to or after the crop. The undersowing of cereals with clover and grass could be seen as forming living mulch.Rotating crops with ones that kill weeds by choking them out such as hemp, *Mucuna pruriens*, and other crops can be a very effective method of weed control. It is a way to avoid the use of herbicides, and to gain the benefits of crop rotation. Bioherbicide is a biologically based control agent for weeds. Bioherbicides are the compounds derived from microbes such as fungi, bacteria, viruses, or protozoa or phytotoxic plant residues extracts or single compounds derived from other plant species. Almost every agricultural pest has at least one naturally occurring enemy that will reduce its population. Bioherbicides utilize such naturally occurring enemies, rather than depending on man-made chemicals. Biological control would appear to be the perfect solution for pest, disease and weed control in organic and conventional agriculture. In its widest sense it has been taken to include such basic practices as crop rotation but the term biological control is now usually restricted to the deliberate application of some natural control agent. There is considerable potential for encouraging the use of native biocontrol agents against weeds. Within the broadening perceptions of biological control, allelopathy can be legitimately regarded as a component of biological control. Allelopathy refers to the direct or indirect chemical effects of one plant on the germination, growth, or development of neighbouring plants. The effect is exerted through the release of allelochemicals by the growing plant or its residues. Micro-organisms may also play a role in the production of these chemical inhibitors. Allelopathy has been considered a defence mechanism in plants.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-143

Non - chemical weed management in brinjal

Rajiv K. Sathe* and B. S. Raskar
Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra 413 722
**Email: rajivsathe510@gmail.com*

Brinjal (*Solanum melongena* L.) is one of the most common tropical vegetables grown in India. It is a perennial but grown commercially as an annual crop. It is an important vegetable due to its nutritive value, consisting of minerals like iron, phosphorus, calcium and vitamins like A, B and C. In world, brinjal occupies an area of 1.87 million ha with a production of 49.42 million tonnes with average productivity of 26.43 t/ha. In India, brinjal is grown throughout the year in almost all parts of country except at higher altitude. Among various factors responsible for the low productivity of brinjal, weed menace are considered to be major ones. Weeds can be considered a significant problem because they tend to decrease crop growth and yields by increasing competition for soil moisture, sunlight, space and nutrients while serving as host plants for pests and diseases. Among the various kinds of pests, the yield reduction in brinjal due to weed alone range from 49 to 90%.Weed management in organic vegetable production system must involve the use of many techniques and strategies, all with the goal of achieving economically acceptable weed control and crop yields. Hence effective non-chemical weed management needs to give special attention with regard to increasing the brinjal production under organic scenario. Stale seedbed technique, crop rotation, use of green manures and cover crops, forages, mulches, intercropping, use of highly competitive crops, crop cultivars, use of the allelopathic crops and other physical methods are commonly followed weed management practices in organic system. Weeds are considered the biggest problem facing organic farming, where weed control is more expensive compared to synthetic herbicides whose use is prohibited in clean agriculture. Most organic crop growers rely on cultivation/tillage, hoeing and hand weeding as a safe and available method for controlling weeds, but these tools can add significantly to production costs. In addition, frequent tillage can reduce soil health and quality and cause additional weed flushes. Controlling weeds without herbicides takes a lot of time and is very costly. Soil coverage with organic mulches is one of the natural methods of preventing weed infestation. It can be achieved by using plant mulches and mulches from straw left after cereal grain harvest. A number of studies have documented that straw mulch is a good means of decreasing weed emergence and growth, reduce erosion and increase the biological activity of soil.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-144

Effect of weed management practices on yield of direct-seeded rice under organic production system

***Rohini Naganagouda Meti, Satyanarayana Rao, B.K. Desai, B.G. Koppalkar, Pramod Katti and S.N. Bhat**

University Agricultural Sciences, Raichur, Karnataka 584 104

**Email: rohinimeti5080@gmail.com*

Field experiment was conducted at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur, during *Kharif* 2017 and 2018 to identify the eco-friendly weed management practice in direct-seeded rice under organic production system. The soil of the experimental site was clayin texture with bulk density of 1.16 g/cc, pH of 7.43 with organic carbon content of 0.46%. The soil had 286.2 kg/ha nitrogen, 25.4 kg/ha phosphorus and 440.1 kg/ha potassium in medium range available nutrients. The experiment was laid out on fixed site in two consecutive years in split plot design consisted of two main plot treatments. Each main plot was further divided in to five sub plots. Along with main and subplot treatments, recommended weed management practice as outside uneven control were kept for comparison. The predominant weed flora observed in the experimental field included grasses like, *Chloris barbata*, *Cynadon dactylon*, *Dactyloctenium aegyptium*, *Echinochloa colona*, *Elusine indica* and *Panicum repens*. Among broad leaved weeds, *Ageratum conyzoides*, *Celosia argentia*, *Commelina benghalensis*, *Parthenium hysterophorus*, *Phyllanthus niruri*, *Portulaca oleraceae*, *Tridax procumbens* and among sedges, *Cyperus rotundus* were noticed. Among the weed species, the densities of *Cyperus rotundus*, *Cynodon dactylon*, *Echinochloa colona*, *Ageratum conyzoides*, *Commelina benghalensis* and *Portulaca oleraceae* were more than other weed species indicating their dominance and competitiveness with the direct-seeded organic rice. The results of weed management practices under organic production system, 25% higher population with the seed rate of 25 kg/ha (4.10 t/ha) recorded significantly higher grain yield over normal population with the seed rate of 20 kg/ha (3.94 t/ha). Among different weed management practices, one IC at 20 DAS and two HW at 25 and 50 DAS (4.74 t/ha) and rice bran at 2 t /ha + HW (4.69 t/ha) recorded significantly higher grain yield over unweeded check (2.22 t/ha). 25% higher population with the seed rate of 25 kg/ha with one IC and two HW (4.91 t/ha) improved the productivity of rice and it was on par with 25% higher population with the seed rate of 25 kg/ha with rice bran at 2 t/ha + HW (4.81 t/ha).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-145

Non - chemical weed management in organic rice production system – A review

Pinki Mehra*, R.P. Sahu, Muni Pratap Sahu, Priya Kochale and Badal Verma, Shahiba Khatoon and Aparna Sharma

Department of Agronomy College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004

**Email: pinkimehra04@gmail.com*

Rice (*Oryza sativa* L.) is the world's staple food crop and accounting for 90% of the world's production and consumption of rice. Weeds are the major biological constraint in organic rice production system and it is most severe constrains in organic rice and timely weed management is crucial to increase the rice productivity. Organic rice farmers face weed as the most significant production problem they encounter and total crop losses from weeds can occur under organic rice production system. Chemical methods are not permitted for weed control purposes in organic rice systems and lack of research on non-chemical options for weed management has made weeds a serious problem in organic farming. Perennial weeds increase under organic husbandry. Strategies on weed management in organic rice production system depend on critical period of weed control, weed flora and method to be adopted for weed management. Chemical intervention is not permitted for weed control purposes in organic production system because chemical pose serious hazards to human health and the environment. Therefore non-chemical methods that is less hazardous and less laborious should be considered for sustainable production. The recent upsurge in environment awareness of public interest in organic food production and some problems with herbicide use has led to a range of technique and machines being developed for non- chemical weed control. Mechanical, cultural and biological technique are reviewed for organic rice production system however; cultural control method has been one of the most widely used weed control options for production of organic rice. Cultural weed control options include crop rotation, plant population adjustment, flooding, inclusion of green manure and cover crops and intercropping. Mechanical methods are also useful in organic rice production system. It involves tillage as well as the cutting and pulling of weeds and is probably the oldest weed management tool. In organic rice production, two to three hand weeding up to the age of 45 days is commonly followed but it is time consuming because labour is becoming scare and unavailable. Mulching is important practice under organic rice production system and it can reduce weed problems by preventing weed seed germination or by suppressing the growth of emerging seedlings. Growing of green manures, puddling and efficient water management practices reduce the occurrence of weeds under transplanted condition. When FYM or other organic source are applied, two hand weedings (one at 20-25 days and another at 40-45 days after transplanting) or two mechanical weedings with cono weeder are applied. The main aim of the weed management in organic rice is to reduce the direct control inputs and to bring substantial yield improvement of the crop.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-146

Weed management techniques in organic agriculture system

Hasamuddin Hasam* and Simerjeet Kaur

Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab 141 001

**Email: hasam-agr@pau.edu*

Organic agriculture has grown out of the conscious efforts by inspired people to create the best possible relationship between the earth and men. Area under organic certification in India is 3.56 mha. Weeds are often recognized as the most serious threat to organic crop production and fear of ineffective weed control is often perceived by farmers as one of the major obstacles to conversion from conventional to organic farming. Banded flaming followed by cultivation applied twice in the season provided the best weed control and crop yields, suggesting that flaming and cultivation can be a very effective tool for managing weeds in organic maize. It was observed that flame-cultivation in maize conducted two times during the early part of the season did not have any negative impact on maize yield, when used after pre-emergence rotary hoeing or broadcast flaming. Stale seedbed coupled with one hand weeding (60 DAS), and hand weeding twice (30 and 60 DAS) were the best treatments for eûective control of weeds and for realizing higher yield of organic garden pea. The intercropping could be useful for weed suppression in organic row-crops such as maize and cotton. Maize-legume intercropping greatly aûected weed density and biomass and intercrops resulted in higher soil canopy cover than with the sole crops. The highest weed density and dry matter were measured in sole crops. Moreover, weed suppression by crops was greater on the intercropping of cereals with legumes. Growing one or two rows of soybean (*Glycine max* L.) as an intercrop in maize signiûcantly reduced weed density and weight and increased maize yield. Sowing two rows of soybean was more effective than one row, with maize at a constant sowing density. Increasing seeding rates significantly improved yield with no interaction of the seeding rate on weed management systems in the same three environments. Vigorous living cover crop will suppress weeds growing at the same time as the cover crop for example the spring-sown subterranean or white clover cover crop in white cabbage suppressed weeds by 50%. Intercropping maize and legumes considerably reduced the weed density in the intercrop compared with the maize pure stand. Weed suppression by crops was also greater on a low-productivity site than on a high productivity site. It has been observed that improved weed management (seen in the organic system but not in the conventional system) does not entirely account for the increased yield response seen in both organic and conventional systems.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-147

Impact of diversification of rice-wheat cropping system on weed dynamics under irrigated condition of eastern Uttar Pradesh

Tej Ram Banjara, J.S. Bohra and M.K. Singh*
Department of Agronomy, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi, Uttar Pradesh 221 005
**Email: mksingh194.in@gmail.com*

Effects of ten diversified rice based cropping sequence on weed dynamics were evaluated at Institute of Agricultural Sciences, BHU, Varanasi (U.P.) in different season during 2016-17 and 2017-18. The results revealed that density of *Cyperus* spp., *Cynodon dactylon* and *Digitaria sanguinalis* were significantly lowest in rice-potato-green gram sequence but it remained statistically comparable with rice-berseem-cowpea (F), rice-cabbage-cowpea (F) and rice-potato-cowpea (F) during second year of experimentation in rainy season. Similarly, dry weight of most of the weed species were found non significant under different cropping sequence except dry weight of *Digitaria sanguinalis* which was significantly lowest under rice-potato-green gram sequence though remained statistically similar with rice-wheat-cowpea (F), rice-cabbage-cowpea (F), rice-berseem-cowpea (F), rice-mustard-cowpea (F) and rice-cabbage-cowpea (F). During winter season significantly lower density and dry matter production of *Medicago denticulate*, *Chenopodium album* as well as total weeds were recorded in mustard (R-Mus-Cp) though it was found similar with mustard (R-Mus-Sg), potato (R-P-Gg amd R-P-Cp) and wheat (R-W, R-W-Gg and R-P-Gg), whereas, density of *Cynodon dactylon* was markedly lower in wheat (R-W). However, it was also statistically comparable with mustard (R-Mus-Sg), potato (R-P-Gg, R-P-Cp) and wheat (R-W-Gg, R-W-Cp) proved distinct superiority over cabbage grown in (R-Cab-Cp) during both the years of experimentation. During summer season, cowpea grown in rice-cabbage-cowpea (F) recorded significantly lower density as well as dry weight of *Cyperus rotundus*, *Cynodon dactylon* as well as total weeds but it were found at par with cowpea (rice-berseem-cowpea fodder) and maize (rice-berseem-maize fodder) during both the years. Rice-wheat cropping system is one of the world's largest agricultural production systems, covering an area of 26 M ha extend over the Indo-Gangetic Plains (IGP) in South Asia. The development of high yielding varieties in both the crops (rice and wheat) during green revolution period facilitated and triggered its area expansion. More than 85% of the rice-wheat system practiced in South Asia is located in the Indo-Gangetic Plains. In India, IGP cover about 20% of the total geographical area (329 M ha) and about 27% of the net cultivated area, and produce almost 50% of the total food consumed in the country.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-148

Bio-herbicides for weed control

Prostuti Borah*, J.K. Choudhary and Sontara Kalita
Assam Agricultural University, Jorhat, Assam 785 013
Email: prostuti33@gmail.com

Bio-herbicides may be compounds and secondary metabolites derived from microbes such as fungi, bacteria or protozoa or phytotoxic plant residues, plant extracts *etc.* These have been identified as significant component of the ecological or organic weed management. Bio-herbicides have many advantages such as these are target specific, have no side effects on beneficial plants or human, there are no pesticide residue build-up in the environment and for control of some herbicide resistant weed biotypes, bio-herbicides are found to be effective. More importantly, it has been demonstrated that mixtures of some bio-herbicides and synthetic herbicides can be more effective. In 1980, the commercial form of a bio-herbicide was first introduced in the USA, Canada, Ukraine, and Europe. The microbial agents such as *Alternaria, Bacillus, Chondrostereum, Colletotrichum, Curvularia, Dactylaria, Diaporthe, Drechslera, Enterobacter, Epicoccum, Exserohilum, Fusarium, Gloeocercospora, Microsphaeropsis, Mycoleptodiscus, Myrothecium, Phoma, Phomopsis, Plectosporium, Pseudolagarobasidium, Pseudomonas, Puccinia, Pyricularia, Pythium, Sclerotinia, Serratia, Stagonospora, Streptomycetes, Trichoderma, Verticillium*, and *Xanthomonas* species and also several plant extracts have been recorded as bio-herbicides. Even though numerous plant products and microbes have been successfully showing the positive results against weeds in field trials, only a few of them are commercially available in the market at present. Some particular rhizobacteria have potential to inhibit weed growth in crop field. Some aromatic plants produce monoterpenes which have the potential to control weed in field. Bio-herbicides resulted into high weed control efficiency in different stage of crop growth as these have adverse effect on weed biomass as well as in regeneration of weed. Moreover, bio-herbicide can be integrated with other weed management practices which increase efficiency the weed management practices. More research on these areas is important in order to fully understand the interactions of microorganisms and plants (crops and weeds) and to discover new microorganisms or plant products useful as bio-herbicides.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-149

Effect of different adjutants on mycoherbicidal efficacy of *C. dematium* FGCN#54 against Parthenium

Jaya Singh* and Sushilkumar

ICAR - Directorate of Weed Research, Maharajpur, Jabalpur, Madhya Pradesh 482 004
**Email: dr.jayasingh@yahoo.com*

Adjutants are the compound used to modify and facilitate the effectiveness of mycoherbicides. Fungi used as mycoherbicides are sensitive to environmental extremes, therefore, appropriate formulation and methods of application may prolong their viability, virulence and infectivity under field conditions. Thus, studies were carried out *in vitro* to evaluate compatibility of various adjuvants with *Colletotrichum dematium* FGCN#54 a possible bio-control agent against *Parthenium hysterophorus* L. *Colletotrichum dematium* FGCN#54 is a pathogen of parthenium and various other weeds with potential to be developed into a mycoherbicide. The fungus has been reported effective under controlled conditions, but not under field conditions. It is believed that the lack of efficacy in the field is due to failure of the fungus to contact the target weed long enough for infection to take place. Liquid based formulation evaluated during the course of this study showed significant effect on the biological activities of *C. dematium* FGCN#54, a mycoherbicidal agent for Parthenium. It was observed that all the adjuvants promoted the spore germination and appressoria formation to a great extent except Triton-x and Gelatin. Germination and appressoria formation were highly significant in the presence of Tween-80, which was followed by Tween-20. Vegetable oil and sucrose also supported these parameters significantly. The time required for germination of 50% of spores was also found to be lesser in Tween-80 vegetable oil emulsion and Tween-20. Triton-x was found to inhibit spores germination significantly. Maximum seedling mortality at 10 DAT was observed when Tween- 80 was used as an adjuvant. It was followed by sucrose, water alone and vegetable oil. Triton-X and gelatin formulation were again failed to support seedling mortality. Performance of eight solid carrier based formulation was also tried to improve the efficacy of *C. dematium* FGCN#54 against the seedlings of the weed Parthenium. Maximum seedling mortality was recorded when pesta granules were used in three combinations namely Pesta granules A (wheat bran + kaolin), Pesta granules B (wheat flour) and Pesta granules C (gram flour + kaolin). It was followed by fungus infested dry substrate, alginate granules and kaolin talc. Comparatively less seedling mortality was recorded when fungus inoculum was formulated with vermiculite. The realization that formulation can greatly increase efficacy has come only slowly and has reflected the formulation approaches taken in the agrochemical industry modified to accommodate the special biological needs of the organism.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-150

Encapsulation of beneficial microbes: A new era for the management of weeds

Divya Mishra* and Bijeeta Thangjam
Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana 500 030
**Email: mishradivya04@gmail.com*

Agriculture is the process of managing plant communities to obtain useful materials from a limited number of species called crops. Since man first began to cultivate crops, undesirable plants, called weeds, have been a problem. Weeds reduce agricultural production in several ways: they compete with the crop for resources; increase general additional costs due to ploughing, harrowing, and disking; they may cause cultivating and harvesting problems; be hosts of diseases and parasites of crop plants; and cause toxicity, undesired colour, taste or odour in the final products. Crop losses due to weeds are still very large and can result in significant financial burdens for farmers. It has been estimated that on a global basis, weeds are considered responsible for a 10% reduction of crop yield. In general, it causes more economic losses on agricultural lands than all other pests combined. Much of the last half-century of weed science and weed management technology has been directed at total weed eradication, although this is not a realistic possibility in most arable fields, pastures, and rangelands. Conventional efforts to eradicate weeds with herbicides have reduced weed competition and improved farm labour efficiency, but have also incurred substantial costs, including environmental pollution, threats to human health, and growing dependence on purchased input. Sustainable agricultural systems dictate that input currently provided by non-renewable petrochemical resources should be replaced by biologically based renewable inputs. Therefore, the need for assessing and implementing alternatives to chemical controls and the development of a more integrated approach to weed management must be highlighted. Biological control of weeds using antagonistic microbes is accepted as self-sustaining, environmentally safe and economical method. It is a promising approach in protecting crops from diseases, insects and weeds, but it needs some new innovative changes in the application strategies so as to increase the efficiency and minimise losses. The induction of systemic resistance by antagonistic microbes referred as Induced Systemic Resistance (ISR) is an important strategy under biological management and is also considered as a key component of integrated weed management practices. It is a multi-component process, that can attack the parasite at different stages of its life cycle *i.e.* germination of the seed, pre/post-attachment and establishment within the host to extract the nutrients. The protection and controlled release of bioactive compounds from beneficial microbes at the right time and the right place can be implemented by encapsulation. Encapsulation of bioactive compounds has versatile advantages for targeted site-specific delivery and efficient absorption through cells. With the help of various compatible carrier materials *viz.* gelatin, cellulose, chitosan, pectins, alginates etc which are generally recognised as safe and biodegradable are used for encapsulation of microbes. This can enhance their shelf life, viability and biocontrol activities by protecting them from adverse conditions.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-151

Functional food for golden future: *Physalis* species

Saurabh Pagare*, Manila Bhatia and Bhumesh Kumar[1]

Department of P.G. Studies and Research in Biological Science, R.D. University, Jabalpur, Madhya Pradesh 482001

[1]ICAR-Indian Institute of Wheat and Barley Research (IIWBR), Karnal, Haryana 132 001

**E-mail:saurabhpagare4@gmail.com*

Food security is among the top priorities of Government of India. Another concern is malnutrition especially among poor population in India as most of them are surviving only on core grains like wheat and rice resulting in serious public health problems. To tackle such problems, diversification of food is essential, to ensure availability and access to a variety of food types to poor people. There are many wild species in the world, which have colonizing abilities (i.e. weedy traits) and are suitable for human consumption. Exploring the opportunities for farming such species will help in providing better nutritional quality to poor populations. Increased domestication of weedy relatives of crop species may provide additional income from farming, as well as resilience to climate variability and scarcity of resources, such as water. Biotypes of *Physalis peruviana* (goldenberry) species were collected from different locations in India. Results of the study suggests that *Physalis* are the species with 'weedy traits', which are climate resilient, and of high nutritional values (B, Fe, Mn, Zn, Ca, K, Mg, Na, P and S). High â-carotene content in *Physalis* fruits is of immense significance in fighting malnutrition in developing countries and industrial properties. Because of its unique storage properties, wherein the fruits can be kept for a long time, *P. peruviana* could be a suitable plant for different food applications. The development of adequate agro-technical methods can make this fruit a promising proûtable new crop for arid regions. *Physalis* can be a very interesting candidate for the processing of new functional foods and drinks. The yield of the juice is extremely high and the juice is a rich source of sugars as well as water- and fat-soluble bioactives. The preparation of new alcoholic, nonalcoholic and alpha-tocopherol-beta-carotene drinks based on the *P. peruviana* could greatly extend the distribution and marketing of this delicious fruit. Goldebberry pulp, seed and pomace oils might serve as excellent dietary sources for vitamin K1, á-linoleic acid, essential fatty acids, tocopherols and carotenoids. On the other side, *P. peruviana* is a promising candidate plant for the development of a phytomedicine against many diseases. At the same time, *Physalis* fruits are acceptable to the consumers and profitable to the growers. These species are known to display large variations in morphological traits, can grow in relatively harsh conditions, highly nutraceutical and high economical utility as a new source of bioactive phytochemicals and functional foods. Keeping in view these characteristics, *Physalis* species may be considered as 'future functional food' as for the climate smart agriculture.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-152

Comparative evaluation of manurial qualities of water hyacinth compost on yield and chemical composition of wheat and its residual effect on foddder sorghum

Gaurav Uttamrao Karad*[1], V.R. Bhatt[2], M.B. Viradiya[3] and B.D. Patel[4]
[1]*ICAR-National Institute of Agricultural Economics and Policy Research, PUSA, New Delhi, 110 012*
[2,3,4]*Anand Agricultural University, Anand, Gujarat 388 001*
Email: karadgaurav77@gmail.com

The experiment was conducted during *Kharif* and summer season of the years 2014-15 and 2015-16 in net house, Department of Soil Science and Agricultural Chemistry, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat. The experiment was laid out in completely randomized design with twenty treatments of water hyacinth composts, FYM and vermicompost combinations of RDF with and without zinc and multi-micronutrient mixture grade-V (MMMG-V) which were replicated three times. Application of RDF + water hyacinth compost with saw dust 5 t/ha + Zn 5 ppm increased wheat grain (20.82 g/pot), wheat straw (23.48 g/pot) and total yield (44.30 g/pot), which was at par with application of RDF + water hyacinth compost with saw dust 5 t/ha + MMMG-V 25 kg/ha, RDF + water hyacinth compost 5 t/ha + Zn 5 ppm and RDF + FYM 10 t/ha +Zn 5 ppm, these four treatments clearly indicated that the efficiency of water hyacinth composts with and without saw dust in combination with 5 ppm Zn and recommended dose of fertilizers was proved as good as FYM 10 t/ha with Zn and recommended dose of fertilizers. It could also be inferred that treatments comprised of water hyacinth composts, FYM, Zn and MMMG-V gave response, this could be because of deficient level of available zinc and lower organic carbon content of the soil. The highest fodder sorghum green (194.5 g/pot) and dry matter yield (44.73 g/pot) were recorded under RDF + water hyacinth compost with saw dust 5 t/ha + MMMG-V 25 kg/ha. Due to the decomposition of organic manure, an additional nitrogen and micronutrients added to the soil which could have increased the green and dry matter yield of fodder sorghum. So, water hyacinth composts and FYM application showed residual effects on the green dry matter yield of sorghum while vermicompost application did not show residual effect on the sorghum dry matter yield. Application of water hyacinth composts, FYM with and without zinc and MMMG-V effect was found higher for wheat grain, straw and total yield, also in fodder sorghum green and dry matter yield, nitrogen, iron, zinc content and uptake, phosphorus, potassium, sulphur, calcium, magnesium, manganese and copper uptake by wheat grain, straw, sorghum. The fertility status of the soil after harvest of wheat and sorghum crop in both year, found improved in organic carbon content status and other available nutrients particularly Zn, Fe due to the application of water hyacinth compost in combination of micronutrients. Among all the organic manures water hyacinth composts and FYM showed better results because of its lower C:N ratio. Among all the manures tested water hyacinth composts was found as the best in increasing grain, straw and total yield of wheat as well as the green and dry matter yield of fodder sorghum.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-153

Medicinal aspects of different weed flora in North and Central India

Suryaprakash Sharma*, Shahiba Khatoon and Anay Rawat
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482 004
**Email: suryasharma15795@gmail.com*

India is the richest country in the world in terms of plant biodiversity and India has four biodiversity hotspots. Often weed is considers as undesirable and troublesome plant which cause losses to human being as well as animals. There are only about 250 plant species which are sufficiently troublesome universally to be regarded as weeds and agriculture has been a major factor influencing their evolution. Besides harmful effects weeds also have numeral beneficial aspects like food and fodder, compost, aromatic, medicinal use, soil and water conservation, phytoremediation, mulching *etc*. Towards medicinal approach, there are so many weeds which have medicinal properties and it is a great alternative to allopathic drugs and it is a secondary source of income for farmers. It was how-ever, reported by tribes and agricultural labourers of other communities that they use these weeds for curing wounds, abscesses, indigestion, flatulence or some other temporary disorders only but do not use them to cure serious or chronic diseases. Although allopathic drugs have immediate affect on disease but so many after effects on human body. India is one of the second largest exporters of medicinal plants after china. Various plant parts like root, tuber, flowers, fruit bark are collected from natural habitat and have been used for medicinal purpose. The annual global market for herbal remedies estimated at approximately US$ 23 billion and makes a considerable contribution to the economies of producer countries. According to the World Health Organization (WHO), approximately 80% of the world's people depend on traditional medicine and in India, 65% of the population in the rural areas use Ayurveda and medicinal plant to help meet their primary health care needs (WHO, 2002). In India, more than 43% of the total flowering plants are reported to be of medicinal importance and mostly are common weeds. Common diseases like dysentery and skin related problems may be easily cured by weeds especially belonging to family Amaranthaceae, Asteraceae, Poaceae and Molluginaceae. Common examples are *Tridex procumbens* for wound healing, *Phyllanthus niruri* for jaundice, *Eclipta alba* for hairfall prevention, *Solanum virginianum* for bronchial asthma, *Portulaca oleracea* for gum bleeding, diabetes, burning sensation, *Mollugo pentaphylla* for check bleeding of wounds, skin diseases, *Bacopa monnieri* for epilepsy. Mostly leaves were used for preparation of medicines for different ailments. Percentage of plant parts used for curing different diseases were that the use of leaf was about 33% against different diseases followed by whole plant (29%) and root (20%). This paper reviews the medicinal importance of weeds of North and central India in different systems like Ayurveda, Unani, Homeopathy.

Theme 8

Herbicide residues and herbicide resistance in weeds and herbicide tolerant crops

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-154

Evaluation of herbicide resistance in *Rumex* sp.

Sunil, Samunder Singh and Rajbir Garg
Department of Agronomy, CCSHAU, Hisar, Haryana 125 004
**Email: sonisunil810@hau.ac.in*

Rumex sp. is an important broad-leaf weed of *Rabi* season and a very serious problem in irrigated wheat particularly in rice-wheat cropping system in north-western Indo-Gangetic alluvial plains of India comprising of the state of Haryana, Punjab, and Western Uttar Pradesh. This weed is highly competitive and yield losses up to 55% have been reported. Besides reducing the yield, it also interferes with manual harvesting. Manual weeding is cumbersome and less efficient, so application of herbicide is the most powerful method for weed management. However, due to continuous application of a similar herbicide, complaints of poor efficacy of several herbicides against *Rumex* sp. have been reported recently from the farmer fields of different locations of Haryana State. Therefore, there is need to know the status of herbicide resistance to different herbicides against *Rumex* sp. and to evaluate alternate herbicidal options for its management. The present investigation was carried out during *Rabi* season of 2017-18 in the screen house of Department of Agronomy, CCSHAU, Hisar. The pot experiment was conducted in a CRD, replicated thrice with four populations of *Rumex* sp. named as HHH (HAU Hisar), UPH (Ujha, Panipat), JHH (Jind), and JJR (Jhajjar) were collected from putative resistance affected farmers fields. CCS HAU population was a standard sensitive population for comparison. Three herbicides, *viz.* metsulfuron, Lanfida (ready mix of metsulfuron and carfentrazone) and 2,4-D ester were applied at three doses (0.5X, X and 2.0X). Backpack sprayer fitted with floodjet nozzles delivering 375 L water volume/ha was used for spraying herbicides. One unsprayed control was also kept for each population and herbicides for comparison. The results, in general, indicated that UPH, JHH biotypes showed resistance against metsulfuron even at double of the recommended, wheres HHH and JJH biotypes were susceptible. At the double of the recommended dose of Lanfida, 80-90% visual control was observed in all biotypes at 4 WAT. Higher values of plant height, chlorophyll fluorescence, fresh weight, and dry weight and lower value of EC was observed in the herbicidal treatment showing poor efficacy. Most of the biotypes were sensitive to application of 2,4-D ester at double of the recommended doses. It provided 80-90% control to all biotypes at double of the recommended dose. The study confirms resistance to metsulfuron as observed under farmers fields. The information generated from this study will facilitate proactive management of herbicide resistance through application of 2, 4-D ester or Lanfida.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-155

Management of herbicide resistant wild oat in wheat with different herbicides

Amandeep Kaur* and Samunder Singh
Punjab Agricultural University, Ludhiana, Punjab141 004
**Email: aman.in.pau@gmail.com*

Wheat (*Triticum aestivum* L.) is one of the most important crop among the cereals and staple food of majority of world's population and widely adapted to environment and various agro-climatic conditions. Productivity of wheat is governed by many factors, but one of the most serious and less noticed causes of low yield is the presence of weeds in wheat. Weeds reducing 10-82% yield loss depend upon weed density and weed species, time period of infestation and competitive ability of crop plant to weeds under different agro-ecological conditions. A lot of research work has been done on weeds in wheat, some of which support that wild oat (*Avena ludoviciana*) and wild canary grass (*Phalaris minor)* are two most dominant grassy weeds making wheat cultivation very difficult and the major reasons for the low yields. Not only weeds, but also the knowledge about the herbicides is vital to promote the growth and getting higher yield of wheat. Weeds are a major impediment to crop production through their ability to compete for light, moisture, nutrients and space. Weeds not only cause huge reductions in crop yields, but also increase cost of cultivation, reduce input efficiency, interfere with agricultural operations, impair quality, act as alternate hosts for several insect-pests and diseases, affect aesthetic look of the ecosystem, damage native biodiversity, as well as effect on human and animal health. In India, presence of weeds in general reduces crop yields by 31.5, 22.7 and 36.5% in winter, summer and *Kharif* season, respectively. In some cases, weeds can cause complete crop failure. Wild oat is a persistent weed of cereals in different parts of the world and widely abundant in northern India, the Mediterranean region economically damaging weed of cotton-wheat rotation, reduces crop yield because of it competitive nature, staggered germination, crop mimicry, seed shattering and ability of seeds to persist in the soil seed bank. Temperature around 25°C and moist soils are favourable for the germination of wild oat and emerges throughout the growing season, establishes deep and extensive root system. Seeds of wild oat have potential to emerge from 20 cm depth below the soil surface. Wild oat has primary and secondary dormancy and viable in soil for 3-6 years due to dormancy, environmental factors such as moisture and temperature as well as differential seed size. Due to these reasons infestation of wild oat growing every year and some plants mature earlier than wheat maturity, shatter seeds readily before crop harvest thus early seed dispersal reduce options to remove seeds from cropping system at harvest. All the treatments produced significantly higher grain yield than weedy check treatment. Significantly higher grain yield was obtained in weed free treatment, which was statistically similar with herbicide mixture (pinoxaden + metsulfuron) and sequential application of pendimethalin *fb* pinoxaden, but significantly higher than all other treatments. Statistically similar grain yield was recorded in pyroxasulfone (62.1 q/ha) and pyroxasulfone + pendimethalin (60.9 q/ha) treatments. Application of flumioxazin and flumioxazin + pendimethalin provided effective weed control, but grain yield was lower due to crop phytotoxicity after first irrigation in light texture soils.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-156

Weed management in herbicide resistant weeds in stacked corn hybrids for (TC1507 x NK603) enhancing crop productivity

K. Sivagamy*, C. Chinnusamy and P. Parasuraman
Tamil Nadu Agricultural University, Thiruvannamalai, Tamil Nadu 641 003
**Email: ksivagamy@yahoo.com*

Maize (*Zea mays L.*) is an important cereal in many developed and developing countries of the world and provides maximum share of human food. Weeds are posing a serious problem in maize. The congenial climatic conditions encourage more weed growth in the widely spaced crop like maize and cause yield reduction to the tune of 29 to 70%. Major yield reducing factors for corn cultivation in India are weeds and insects. Transgenic corn hybrids with stacked event, (TC1507 X NK603) were developed for preventing yield losses of corn and improve the productivity. The stacked product having both insect protection and herbicide tolerant traits will provide protection to the crop against target pests and also provide effective weed management system to farmers. Advancement in biotechnological research enables genetic engineering to enhance production and minimize crop yield losses through development of crops that are tolerant to insects and herbicides.Transgenic corn hybrids with stacked event, (TC1507X NK603) having both insect protection and herbicide tolerant traits, which will provide protection to the crop against target pests and also provide effective weed management. The field experiment was carried out during *Kharif,* 2013 at research farm of Tamil Nadu Agricultural University, Coimbatore, India. The experiment was laid out in Randomized block design with treatments replicated thrice. The treatments consisted of transgenic stacked 30V92 with PoE glyphosate at 900 g a.e/ha, transgenic stacked 30V92 with PoE glyphosate at 1800 g a.e./ha, transgenic stacked 30V92 with control (no weed and insect control), transgenic stacked 30B11 with POE glyphosate at 900 g a.e./ha, transgenic stacked 30B11 with PoE glyphosate at 1800 g a.e./ha, transgenic stacked 30B11 with control (no weed and insect control), non-transgenic 30V92 with PE atrazine at 0.5 kg/ha on 3 DAS *fb* HW 40 DAS and insect control, T8 - Non-transgenic 30V92 with no weeding and only insect control, non-transgenic 30V92 with no weeding and no insect control, non-transgenic 30B11 with PE atrazine at 0.5 kg/ha on 3 DAS *fb* HW 40 DAS and insect control, non-transgenic 30B11 with no weeding and only insect control, non-transgenic 30B11 no weeding and no insect control, BIO 9681 with PE atrazine at 0.5 kg/ha on 3 DAS *fb* HW 40 DAS and insect control, BIO 9681 no weeding and no insect control, - CoHM 5 with PE atrazine at 0.5 kg/ha on 3 DAS *fb* HW 40 DAS and insect control and CoHM 5 no weeding and no insect control. From the study it is concluded that early post-emergence application of glyphosate at 1800 g a.e/ha recorded lower weed index, weed dry weight and high weed control efficiency at all the intervals compared with other treatments. Higher grain yield was recorded with application of glyphosate at 1800 g a.e/ha in transgenic stacked maize hybrid of 30V92HR recorded high productivity and profitability. Unweeded control accounted lesser grain yield which in turn reflected through higher weed index of 58.39% due to heavy competition of weeds for nutrients, space and light.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-157

Inheritance of resistance against alternate herbicides in various biotypes of *Phalaris minor* from different parts of Haryana

Paras Kamboj* and S.S. Punia

Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004

**Email: paras.thind@gmail.com*

Wheat (*Triticum aestivum* L.) is the second most important crop in India, grown in 29.57 million ha. There are reports of reduced efficacy of recommended herbicides against *P.minor* in wheat at farmers' fields in Haryana. The reason might be the wrong method of application, dose or development of cross- resistance in *P. minor*. Hence, different bioypes of *P. minor* from farmers' fields were collected from different parts of Haryana and were subjected to graded doses of different herbicides under pot-culture for assessment of the herbicidal efficacy and the cross-resistance development. The seeds of 15 canarygrass populations were collected from wheat fields of farmers' on the basis of problem reported by the farmers. Of these 15 populations; 4 were from Karnal (kachhwa, Ramba, Sitamai, Uchana), 4 from Jind (Rasidan, Kalwan, Danoda, Ujahana), 2 from Kaithal (Kheri raiwali and Teek), 2 from Hisar (Hindwan and H.A.U Farm), 1 from Yamunanagar, 1 from Fatehabad and 1 from Kurukshetra district of Haryana. Hindwan, Hisar was taken as susceptible population from clodinafop. All the herbicides were applied as post-emergence on canarygrass. Clodinafop at 30 g/ha (1/2X), 60 g/ha (X), 120 g/ha (2X), 240 g/ha (4X); sulfosulfuron at 12.5g/ha (1/2X), 25g/ ha (X), 50 g/ha (2X), 100 g/ha (4X); mesosulfuron + iodosulfuron (RM) at 7.2 g/ha (1/2X), 14.4 g/ha (X), 28.8 g/ha (2X), 57.6 g/ha (4X); pinoxaden 25 g/ha (1/2X), 50 g/ha (X), 100 g/ha (2X), 200 g/ha (4X) were applied at 2-4 leaf stage of canarygrass. Almost all the populations show resistance to clodinafop. Even at 2x dose of this herbicide only 3 populations were controlled out of 15 populations. Sulfosulfuron provides better control than clodinafop. But the control with this herbicide was not up to the satisfactory level. Futher, ready mix application of mesosulfuron + iodosulfuron provides better control than sulfosulfuron. But the control with this herbicide was lesser than the pinoxaden. 13 populations were controlled with the 2x dose of pinoxaden, which was higher than all the other herbicides application. This shows there is increase in resistance in *Phalaris minor* against different herbicides. There is need to replace clodinafop with other available herbicide for the control of resistance population of *Phalaris minor* in Haryana. So, the development of resistance can be controlled up to some extent.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-158

Herbicide tolerant crops: An advanced weed management option for crop production in india agriculture

C. Chinnusamy[1]*, P. Murali Arthanari[2] and C. Bharathi[2]

[1]*Vanavarayar Institute of Agriculture (Affiliated to Tamil Nadu Agricultural University), Manakkadavu, Pollachi Tamil Nadu 642 103*

[2]*AICRP* on WM,Department of Agronomy

Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003

**Email: chinnusamyc@gmail.com*

Crops made resistant to herbicides by biotechnology are being widely adopted in various parts of the world and several herbicide resistant crops have become available in many countries for commercial cultivation. But in India, the technology of herbicide tolerant crops is in initial stage of field evaluation. Hence, field trials have been carried out to evaluate and consolidate the agronomic advantages of herbicide tolerant transgenic cotton and maize.Herbicide tolerant stacked traits of maize and cotton have been evaluated under Biosafety Research Level (BRL I) as confined field trials for its agronomic efficiency on weed control and enhanced crop productivity at TNAU, Coimbatore for three years (2010 to 2013). In both crops, potassium salt formulation of glyphosate was sprayed at different doses (900, 1350, 1800, 2700, 3600 and 5400 g a.e./ha twice at 25 and 60 DAS in cotton and 900,1800 and 3600 g a.e./ha at 25 DAS in maize). Evaluation was made on weed control efficiency, phyto-toxicity on crops, yield and economics and carryover effects on the succeeding crops. Application of glyphosate at 2700 g a.e/ha recorded lower weed density, dry weight and higher WCE in cotton. POE glyphosate at 900, 1800 and 3600 g a.e/ha registered lower weed density, dry weight and higher WCE in transgenic Hishell and 900 M Gold and in 30V92 and 30B11 corn hybrids. Post-emergence application of glyphosate in transgenic maize hybrids did not affect the germination per cent, vigour and yield of succeeding green gram in the transgenic maize trials and sunflower, soybean and pearl millet in cotton trials. Phytotoxicity symptoms were not observed in cotton with glyphosate at lower doses,, *viz.* 900, 1350, 1800 and 2700 g a.e/ha. Higher doses, *viz.* 3600 and 5400 g a.e/ha were noticed with phytotoxicity symptoms at early stages of herbicide application. Glyphosate applied at 900, 1350, 1800 and 2700 g a.e/ha recorded more number of bacteria, fungi and actinomycetes compared to atrazine treatments. Higher grain yield was recorded with POE application of glyphosate at 900, 1800 and 3600 g a.e/ha in Hishell and 900 M Gold transgenic hybrids and higher net return and benefit cost ratio was recorded in glyphosate at 1800 g a.e/ha in transgenic 900 M Gold in all the four seasons. Post-emergence application of glyphosate at 900 and 1800 g a.e/ha registered higher grain yield in transgenic 30V92 and 30B11 corn hybrids.In maize and cotton transgenic crops, post-emergence weed management with glyphosate proved to be the better management option for the control of weeds.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-159

Herbicide resistant weeds and their management

Pooja Goswami and Atul Shrivastava
Jawaharlal Nehru Krishi Vishwa Vidyalaya, College of Agriculture, Murjhad Farm, Waraseoni, Waraseoni, Madhya Pradesh 481 331
**Email: agropooja17@gmail.com*

A herbicide may kill all the weeds in a population of a particular weed species except for a few individuals with the genetic capacity to survive the herbicide. Weed populations may naturally contain herbicide resistant individuals at very low frequencies as a result of rare random genetic mutations. The frequency is dependent on the weed species and the herbicide mode of action. Herbicide resistance is the evolved capacity of a susceptible weed population to withstand herbicide application and complete its lifecycle when the herbicide is used at normal rates in an agricultural situation. For some herbicides, such as the ALS inhibitors, the frequency of resistant individuals prior to herbicide application may be as high as 1 in 10,000 meaning that ALS inhibitors are prone to a rapid development of resistance. The evolution of herbicide resistant weeds is an ongoing challenge in modern agriculture. Worldwide, there were more than 249 herbicide resistant weedy biotypes in 47 countries. Some management practices like use of same herbicides repeatedly increase the likelihood of developing herbicide resistant weeds. Monoculture often encourages the use of the same herbicide. Resistance is most likely to develop in annual weed species since they produce high numbers of seeds (pigweed, lamb's-quarters and foxtail are good examples of these types of weeds). Resistance management strategies involves: use of herbicides only when necessary, use of the recommended rate, use of herbicide mixtures that include two or more herbicide groups, rotate herbicides between herbicide groups. Rotating herbicides controls the resistant weeds in the years when effective herbicide groups are used with the goal of reducing the resistant weed population. Herbicide tolerant crops also provide opportunities to use different herbicide mechanisms of action to control existing populations of herbicide resistant weeds. Herbicide tolerant crops are the new concept for controlling herbicides resistant weed. It contains traits that allow them to survive certain herbicides that previously would have injured or destroyed the crop along with the targeted weeds. This allows the farmers to use herbicides more effectively and, in some cases, to use less herbicide.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-160

Multiple herbicide resistance in *Phalaris minor* in wheat in Haryana: Monitoring, current status and management options

Dharam Bir Yadav*, Raghuveer Singh, S.S. Punia and Ashok Yadav
CCS Haryana Agricultural University, Regional Research Station, Karnal, Haryana 132 001
**Email: dbyadav@gmail.com*

Little seed canary grass (*Phalaris minor* Retz.) is a problematic weed in wheat under rice-wheat cropping system in north-western India. In early 1990s, it evolved resistance against phenyl-urea herbicides like isoproturon, and yields were reduced to such levels that farmers even resorted to harvesting for fodder in certain situations. Alternate herbicides (clodinafop, fenoxaprop, sulfosulfuron and tralkoxydim) were recommended in 1998 for management of herbicide resistant *P. minor*. Development of resistance against new herbicides was speculated if these were not used properly. Hence, monitoring of cross-resistance in *P. minor* biotypes against different herbicides using pot bioassay at RRS, Karnal (2007-08 to 2015-16), systematic survey on current status of herbicide resistance in Haryana covering 300 farmers from five districts (2017-18), different studies on its management options at Karnal and farmers' fields (2008-09 onwards), along with a long-term experiment on use of herbicides at Karnal (since 1999-2000) were undertaken to understand different aspects of *P. minor* resistance and management. The bioassay studies indicated that fenoxaprop was the least effective herbicide against most number of biotypes, and it showed low efficacy (< 80% control) against all biotypes during 2009-10. Clodinafop was next after fenoxaprop showing low efficacy against maximum number of biotypes over the years, with all biotypes showing <80% control during 2010-11. However, its efficacy has been fluctuating over different seasons. Sulfosulfuron was the third herbicide in sequence showing poor efficacy, however, its efficacy was again fluctuating over the years. Pinoxaden has been effective against most of the biotypes (85-100%), indicating its suitability in managing the resistant populations. Mesosulfuron + iodosulfuron was also found effective against 75-88% biotypes during 2012-13 to 2015-16, which could also be used against biotypes showing resistance against FOPs. Maximum number of biotypes (60-100%) showed poor efficacy against one or more herbicides, followed by biotypes (30-90%) with low efficacy against two or more herbicides. There were no biotypes showing low efficacy of all the four herbicides over the years, except two biotypes in 2008-09 and one in 2014-15. This showed scope for management of *P. minor* with one or the other herbicide. The survey conducted during 2017-18 indicated that farmers were using different combination of herbicides with an average use of about 3-X dose of herbicides. Clodinafop was contributing about half of the total herbicide use despite the farmers' opinion that it did not give good results. Mesosulfuron + iodosulfuron provided good control, but its use was very less due to concerns about its phyto-toxicity. Recently, farmers have started using sequential (with pendimethalin) and tank-mix (with metribuzin) use of recommended post-emergence (PoE) herbicides. Majority of farmers applied herbicides using lower water volume and without flat-fan nozzle under delayed conditions, which further reduced herbicide efficacy. In field studies, sequential application of pendimethalin 1000 g/ha, trifluralin 1000 g/ha or metribuzin 175 g/ha (pre-emergence) followed by recommended PoE herbicides improved the control of *P. minor* over PoE herbicides alone. Tank-mix of metribuzin 105 g/ha with PoE herbicides also improved its control. Mesosulfuron+ iodosulfuron, pinoxaden and pyroxasulfone were potential alternative herbicides, however, pinoxaden should be used up to 2-4 leaf stage only. However, good efficacy of continuously used herbicide clodinafop and rotationally used herbicides against *P. minor* over the years in long-term experiment continue since 1999-2000, highlighted the importance of proper spray techniques (proper herbicide dose, water volume, time of application, nozzle *etc*).

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-161

Fate of herbicide residues in the soil and plants in maize - wheat cropping system

Shobha Sondhia
ICAR-Directorate of Weed Research, Jabalpur, Madhya Pradesh 482 004
**Email: shobhasondia@yahoo.com*

Persistence of herbicide residues is of great concern as presence of herbicide residues in the soil may not only damage the sensitive succeeding crops but also adversely affect human and animal health due to harmful level of residues in crop produce. Therefore a study on fate of herbicide residues under maize-wheat cropping system was undertaken. Maize and wheat plant and soil samples were evaluated to see persistence of herbicide residues under maize-wheat cropping system in *Khraif* and *Rabi* seasons. Atrazine, tembotrione, and topramizone were applied at recommended doses of 1.0 kg/ha, 120 and 25 g/ha to the maize crop in *Kharif* and clodinafop+metsulfuron-methyl (60+4 g/ha), sulfosulfuron+metsulfuron-methyl (28+4 g/ha) and pendimethalin (750 g/ha) were applied in *Rabi* to wheat plots at recommended doses, respectively. Herbicide residues dissipation was determined in soil and maize and wheat plants at 0 days to till harvest. The UFLC methods were developed for quantification of tembotrione, topramezone atrazine, clodinafop-propargyl, metsulfuron-methyl, sulfosulfuron and pendimethalin residues in soil and plants with a detection limit of 0.01, 0.01 and 0.001 µg/g. Atrazine, tembotrione and topramezone residues in the soil of maize crop were found in the range of 1.717 to 0.031 µg/g in the soil at 0 to 60 days, whereas residues of these herbicides were ranged between 1.564 to 0.336 to 0.182 µg/g in maize plant at 0 to 30 days. In maize grains and straw, atrazine resides were found 0.0085 and 0.0307 µg/g which were found below the MRL value of 0.1 µg/g. Metsulfuron-methyl, sulfosulfuron residues in *Rabi* were found to be in the range of 0.1573 to 0.0014 µg/g in the wheat plants at 0 to 30 days, After 90 days, metsulfuron-methyl, and sulfosulfuron residues were degraded to below the detection limit in wheat grains and straw. However 0.761 to 0.058 µg/g pendimethalin residues were detected in the soil at 0 to 90 days. In wheat grains and straw, pendimethalin residues were found 0.022 and 0.0056 µg/g, respectively. Dissipation of herbicides in the soil in both the crops was found to follow first order reaction kinetics (R2 > 0.90) irrespective of season and crop. It may be concluded that persistence of herbicides in the soil in maize-what cropping system could not significantly affect the soil physical chemical properties.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-162

Mitigation of pendimethalin residues in sandy clay loam soil grown with greengram

C. Bharathi*,C. Chinnusamy and P. Murali Arthanari

AICRP on Weed Management, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003

**Email: cbharathi75@yahoo.co.in*

Pendimethalin is a widely used versatile herbicide for broad spectrum weed management in pulses, oilseeds, cotton and vegetable crops. Hence, its efficiency and residual toxicity vary with soils and crops. Hence, a study has been formulated to evaluate various mitigation measures for pendimethalin in sandy clay loam, grown with greengram in pot culture during 2018-19. Treatments were imposed 3 days before sowing of greengram (Co 8). On 3rd day after greengram sowing, the pendimethalin was applied to each pot at 1.0 kg/ha. Soil samples were collected from a depth of 0-15 cm on 0, 1, 3, 5,10, 15, 30, 45 and 60 DAA and analysed for pendimethalin residues. Residue of pendimethain was extracted using methanol and determined by HPLC. Results revealed that the initial deposition on zero day after application ranged from 0.465 to 0.793 mg/kg across different treatment sources consisting of cultural and microbes application to enhance the degradation of pendimethalinin soil. Irrespective of the treatments the pendimethalin residues persisted up to 45 DAS. It was found that the dissipation was faster under FYM, VAM and biochar applied treatments and slower degradation was noticed in control. Lower half life of 8.57 days was observed in FYM treatment. Based on the present results it was found that the FYM 10 t/ha or vermicompost 5/ha or biochar 5 t/ha was efficient in reducing the residual concentration of pendimethalin in greengram grown soil. Addition of agro-industrial and composted organic wastes like composted sheep manure, composted pine bark, spent coffee grounds and coir waste at a rate of 10 % (*w*/*w*) increased the adsorption of phenyl urea herbicides and decreased their mobility in the soil, reducing their leaching. Similarly, bio-stimulation in conjunction with crop rotation and increasing the organic matter content by application composted organic materials, is definitely a promising technique for managing the herbicide persistence and residue in the soil. Further, it is reported that tillage encouraged herbicide decomposition indirectly through increased microbial and chemical breakdown and applications of farm yard manure and green manuring not only increase the microbial population but also enhance the herbicides degradation at faster rate. This could be due to the enhanced adsorption of the compounds by these sources.The application of FYM degraded the pendimethalin very fast with the half live 8.57 days and slow degradation by microbes could be ascribed to the low quantity of application when compared to FYM.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-163

Efficacy of propaquizafop alone and in mixture with imazethapyr on weeds, productivity of soybean

J.K. Kutariye*, H.S. Kushwaha, M.L. Kewat and J.K. Sharma

Department of Natural Resources Management, Faculty of Agriculture,Mahatma Gandhi Chitrakoot Gramodaya Vishwa Vidyalaya, Chitrakoot, Satna, Madhya Pradesh 485 780

**Email: jagdishagrojnkvv@gmail.com*

A field experiment was conducted at the Research Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during *Kharif* 2016-17 and 2017-18 under edaphic and climatic conditions of Jabalpur (M.P.). Thirteen weed control treatments comparising of four doses of propaquizafop + imazethapyr mixture (47+66, 50+70, 53+74, 56+78 g/ha), sodium acifluorfen + clodinofop-propargyl mixture (165+80 g/ha), alone application of propaquizafop (75 g/ha) and imazethapyr (100 g/ha) as post-emergence, hand weeding twice (at 20 and 40 DAS), weedy check and weed free, were laidout in a randomized complete block design with four replications. Soil of the experimental field is clay loam in texture, neutral in reaction (pH 7.2), medium in organic carbon (0.61) and available N (368.50 kg/ha), available P (15.68 kg P2O5/ ha) and high in available K (323.20 kg K_2O/ha). Weed flora observed in experimental field was comprised of monocots weeds like- *Echinochloa colona, Dinebra retroflexa, Cyperus iria, Cynodon dactylon* and dicots weeds like- *Alternanthera philoxeroides, Eclipta alba, Mollugo pentaphylla*. The higher relative density found in case of *Echinochloa colona* and *Dinebra retroflexa* (33.39 and 23.12), respectively. The highest weed density and weed biomass were recorded in weedy check plots. But application of propaquizafop + imazethapyr mixture (56+78 g/ha) at 20 DAS recorded lower weed density of monocot and dicot weeds as well as dry biomass of weeds (28.31 and 5.45 g/m^2 respectively) with 93.41% WCE being statistically at par with propaquizafop + imazethapyr mixture (53+74 g/ha), hand weeding twice and weed free plots. The higher seed yield (2242 kg/ha) was recorded with the application of propaquizafop + imazethapyr mixture (56+78 g/ha) to that of hand weeding twice (2325 kg/ha) and weed free plots (2356 kg/ha). But the B: C ratio was highest (2.38) with the application of propaquizafop + imazethapyr mixture (56+78 g/ha) being at par (2.33) with lower dose of propaquizafop + imazethapyr mixture (53+74 g/ha) and found better than hand weeding twice and weed free plots (1.86 and 1.44) respectively, due to excellent control of weeds from early growth stage upto the end of critical period.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-164

Residual effect of herbicides applied in black-gram on succeeding mustard, chichpea and wheat crops

Sushil Kumar Singh*, S.S.Punia, Todar Mal Punia, Samunder Singh and Manjeet
Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004
**Email: drsksagro@gmail.com*

Black gram (*Vigna mungo* L.) is one of the most highly prized most important pulse crop, among chickpea, pigeonpea and greengram. Being a pulse crop it has great potentiality of fitting in multiple cropping systems and it is cultivated in almost all parts of India. It is rich in protein, carbohydrate, fat, amino acids, vitamins, cheapest available source of protein for the poor and vegetarians and improves the soil fertility. The losses due to weeds are one of the main factors responsible for low yield of black gram, which range from 40-68%. In view of severe infestation of annual and perennial weeds in *Kharif* black gram, herbicides are applied to manage weeds. It is desirable for the herbicide to control weeds during the season of application, it is not desirable for them to persist and affect subsequent crop growth. For some herbicides, there may be a fine line between controlling weeds for the entire growing season and then planting a sensitive rotation cropsand its residual effecton succeeding rotation crop**.** To study the residual effect of herbicides applied in black-gram *(Vigna mungo* L.*)* on succeeding crops mustard, wheat and chickpea crops was conducted at Research farm of Department of Agronomy, CCSHAU, Hisar during 2018-19. Sixteen treatments with three replications were imposed in randomized block design with plot size of 6×6 m^2. The treatments were imazethapyr + pendimethalin (RM) at 1000 g/ha, 1250 g/ha, 1500 g/ha and 1250 g/ha with one hoeing at 30DAS, pyroxasulfone at 127.5 g, 150 g/ha and 127.5 g/ha with one hoeing at 30 DAS, as imazethapyr at 75 g/ha, 100 g/ha,70 g/ha, 75 g/ha with one hoeing at 30 DAS, imazethapyr + imazamox (RM) at 70 g/ha pre-emergence, imazethapyr + imazamox (RM) at 70 g as post-emergence, two hoeing (30 and 60 DAS), weed free and weed check. Post-emergence herbicide were applied at 2-4 leaf stage of weeds, these herbicides were used in black gram crop. Results revealed that none of the herbicides applied in black gram had shown any toxicity in chickpea and wheat. Herbicide pyroxasulfone did not show any residual toxicity in mustard. Maximum seed yield of mustard was obtained in the treatments different doses of pyroxasulfone at 127.5-150 g/ha which was significantly superior to imazethapyr at 70 -100 g/ha, imazethapyr + imazamox (RM) at 70 g/ha, imazethapyr + pendimethalin (RM) at 1000 -1500 g/ha. Significantly less number of leaves per plant and less grain yield was found the in treatment of imazethapyr alone and imazethapyr and imazamox as compared to other herbicides.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-165

Mitigation and management of herbicide residue in soil – A review

Kunika Silodia* and Jitendra Patidar[1]

**Department of Plant Pathology and [1]Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 482 004*

**Email:silodiyak@gmail.com*

As we know, India is dependent upon agriculture and its allied sectors. The production of agriculture is directly or indirectly depends upon several factors and any setback in these factors adversely affects the yield of crops. Pests and diseases are the two major threats to the crop plants. Among pests, weeds have been a problem for man ever since he started domestication of crop plants. Weeds compete with the crop plants for nutrients, soil moisture, solar energy and CO_2. It causes enormous losses and suffering to human beings by way of reduction in crop yield (Approx. 10-90%) and quality. In India, during seventies, manual and mechanical removal was considered as the best options available with the farmers to manage weeds in their fields and this was supplemented by cultural methods. But by the eighties, with increase in labour costs, herbicides became successful. Now globally, herbicides are used popularly to minimize the yield loss due to weeds and obtain maximum yield. The demand of herbicides in India is arising evidently for weed management in non-cropped as well as in arable areas. In general, herbicides are formulated in such a way that they degrade from environment by itself after completion of their intended work, but a few of them may persist in the environment and cause injury to succeeding crop particularly in multiple cropping systems and also to the surroundings through accumulation. Some of herbicide groups triaizines, isoxazolidinones, imidazolinones and a few of sulfonylurea showed long persistence in soil. Hence, it is essential to mitigate and manage the available amount of herbicidal residues in the soil and environment. A number of management techniques have been developed which can help to minimise the residual hazards caused in soil through cultural and mechanical methods. They may enhance the degradation, deactivation of herbicide, by reducing the availability in soil and removing from the site of contamination *i.e.* use of optimum dose of herbicide, application of farm yard manure and adding organic matter to enhances the microbial activity which accelerate the biodegradation of herbicide. Ploughing and cultivating the land reduces the herbicide toxicity and enhance the photo-decomposition of herbicide, crop rotation, use of non-phyto-toxic oil and by using activated carbon having high adsorptive capacity because of its tremendous surface area to reduce the residual hazards on succeeding crop, use of safeners and antidotes in order to protect the crop plant from possible damage by a herbicide, leaching of soil to leached out the herbicide in deep soil layer. All the preventive aspects should be kept in mind for maximum and quality yield without deteriorating the environment. Hence, combination of the mechanical and cultural management practices with herbicides might be a found promising for the management of weeds and herbicide residue hazards.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-166

Impact of climate change on the degradation pattern of pendimethalin

S. Selvakumar* and C.R. Chinnamuthu[1]

Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu 625 104

[1]Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003

**Email: selva4647@gmail.com*

Pendimethalin [N-(1-ethylpropyl)-2, 6-dinitro-3, 4- xylidine] is one of the important Pre-emergence dinitroaniline herbicide, widely used to control weeds in cotton, soybeans, maize, wheat, rice, peas, and vegetable crops. It inhibits chromosome separation and cell wall formation. Persistence and degradation of pendimethalin in soil is affected by cultivation practices, soil temperature, and moisture conditions, as well as soil type, According to the IPCC. 2007 at the end of this 21st century, earth temperature might be 2–4°C higher than current temperature and CO_2 concentration of the atmosphere will be 1000 ppm. Already scientists found that the climate change will bring change in weed physiology, so it is imperative to study the herbicide degradation pattern under elevated temperature coupled with higher CO_2 concentration for effective weed control and environmental safety in future. With this background, the persistence and degradation pattern of pendimethalin in soil was studied at the Department of Agronomy, Agricultural College and Research Institute, Madurai and Agro Climatic Research Center, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, with five different concentration (1, 5, 10, 15 and 20 ppm) in three different soil types namely sandy clay loam with high organic matter (4.58% of organic matter), clayey, sandy clay loam soil, which were kept at ambient temperature (control), with +2°C and +4°C increase under climate chamber. At +2°C increase, average half-life of the herbicide in sandy clay loam soil with high organic matter was 6 days, whereas it recorded 5 days at +4°C increase. At +2 °C increase, average half-life of herbicide in clayey soil was 7 days, whereas it was reduced to 6 days at +4°C increase. At +2°C increase, average half-life of the herbicide in sandy clay loam soil was 7 days but it was 6 days at +4°C increase. Under the ambient temperature, the half-life of the herbicide in sandy clay loam soil with high organic matter, clayey soil and sandy clay loam soil was 8, 9 and 9 days, respectively. Average decrease in half-life of sandy clay loam soil with high organic matter was 18.7% at +2°C increase and 32.2% under +4°C increase. Average decrease in half-life of clayey soil was 16.8% at +2°C increase and 31.4% under +4 °C increase, whereas the sandy clay loam soil recorded 14.7% and 30.1% decreases in half-life at +2°C and +4°C increase, respectively. Highest rate of reduction in half-life was recorded with sandy clay loam soil with high organic matter under elevated temperature. R^2 value of regression model for the degradation studies ranging from 0.473 to 0.963. These results revealed that the increase in temperature reduces the half-life of herbicide; may lead to reduction in weed control efficiency in future.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-167

Bioefficacy of new herbicide molecule bispyribac-sodium 2% w/w + 2, 4-D sodium salt 54.3% w/w SP against weed complex in direct-seeded rice

N. Ananda*, R.B. Negalur and Satyanarayanarao
University of Agricultural Sciences Raichur, Karnataka 584 104
**Email: clkananda@gmail.com*

A field experiment was conducted during *Kharif* 2017and 2018, on medium black cotton soil of ARS Gangavathi, coming under Northern dry zone of Karnataka, University of Agricultural Sciences, Raichur. The study was conducted to assess the bi-efficacy of new combi product herbicide, bispyribac-sodium 2% w/w + 2,4-D sodium salt 54.3% w/w SP against weed complex in direct-seeded rice, crop safety and yield of rice in relation to unsprayed control. The soil type was medium black soil with medium organic carbon content of 0.6%, The soil was low in available N (205.6 kg/ha, high in available P_2O_5 (71.4 kg/ha) and high in exchangeable K_2O (363.1 kg/ha). Treatments were replicated thrice in a randomized complete block design using cv. BPT-5204 and post-emergence herbicides were sprayed on 18 days after sowing coinciding with 2-4 leaf stage of weeds using a spray volume of 500 liters/ ha fitted with flat fan nozzle (WFN 60) attached to the knapsack sprayer. The crop was sown at a common spacing of 20 cm x 10 cm. Among the different treatments, application of bispyribac sodium 2% + 2,4-D sodium salt 54.3% SP (with adjuvant Adsee 611, 625 ml/ha) at 1500 g/ha and 1250 g/ha recorded lower population and dry weight of weeds and were at par with each for all the weed species and these two treatments were significantly superior over all other herbicides. It was followed by application of bispyribac-sodium 2% + 2,4-D sodium salt 54.3% SP (with adjuvant Adsee 611625 ml/ha) at 1000 g/ha, bispyribac-sodium 2% + 2,4-D sodium salt 54.3% SP at 1500 g/ha, 1250 g/ha, market standard of penoxsulam 21.7% SC 93.7 ml/ha, bispyribac-sodium 10% SC 200 ml/ha, bispyribac-sodium 2% + 2,4-D sodium salt 54.3% SP at 1000 g/ha and 2,4-D-ethyl ester 38% EC at 2500 ml/ha, respectively. Result reveal that among the herbicide treated plots, application of bispyribac-sodium 2% + 2,4-D sodium salt 54.3% SP (with adjuvant Adsee 611**)** at 1500 g/ha recorded higher grain yield (5.56 t/ha) followed by bispyribac-sodium 2% + 2,4-D sodium salt 54.3% SP (with adjuvant Adsee 611**)** at 1250 g/ha (5.56 t/ha). However, they were found at par among themselves and with 2 hand weeded treatment (5.75 t/ha). Thus, in direct-seeded rice (DSR), application of bispyribac sodium 2% + 2,4-D sodium salt 54.3% SP (with adjuvant Adsee 611) at 1500 g/ha dose found optimum for controlling the weeds which are on par with application of bispyribac-sodium 2% + 2,4-D sodium salt 54.3% SP (with adjuvant Adsee 611) at 1250 g/ha dose, which can be used as post-emergence at 18 DAS for control of weeds in rice.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-168

Evaluation of post-emergence micro-herbicides in *Kharif* maize

Radheshyam*, S.L. Jat and C.M. Parihar
ICAR-Indian Agricultural Research Institute, New Delhi 110 012
ICAR-Indian Institute of Maize Research, Delhi Unit 110 012
**Email: radheshyamsihag01@gmail.com*

The field study was conducted at ICAR- Indian Agricultural Research Institute, New Delhi, India during *Kharif* 2017. The experiment was laid out in randomized block design with three replications and 12 treatments are evaluated, *viz.* T_1:weedy check, T_2: weed free check, T_3: atrazine 1000 g/ha (PE) *fb* hand weeding at 25 DAS, T_4: ttopramezone 30 g/ha at 25 DAS, T_5: halosulfuron 75 g/ha at 25 DAS, T_6: tembotrione 150 g/ha at 25 DAS, T_7: topramezone 25.2 g/ha + atrazine 750 g/ha at 15 DAS, T_8: halosulfuron 67.5 g/ha + atrazine 750 g/ha at 15 DAS, T_9: tembotrione 120 g/ha + atrazine 750 g/ha at 15 DAS, T_{10}: atrazine 750 g/ha (PE) *fb* topramezone 25.2 g/ha at 25 DAS, T_{11}: atrazine 750 g/ha (PE) *fb* halosulfuron 67.5 g/ha at 25 DAS, T_{12}: atrazine 750 g/ha (PE) *fb* tembotrione 120 g/ha at 25 DAS. The tank-mix application of post-emergence herbicide, *viz.* tembotrione (120 g/ha) or topramezone (25.2 g/ha) at 15 DAS with 75% recommended dose of the atrazine (750 g/ha) or as sequential application at 25 DAS after PE 75% dose of atrazine gave significantly better weed control in the term of dry weight and density at different stages in *Kharif* maize. The early post-emergence tank-mix application of these pre- and post-emergence herbicides and their sequential application increased maize grain yield to the tune of 9.2 to 14.6 and 17.5 to 20.0% over recommended practice (atrazine *fb* hand weeding), respectively. The significantly higher weed control efficiency and weed control index were found in weed free check (T_2), which was at par with T_3 and the application of post-emergence herbicide, *viz.* tembotrione (120 g/ha) /topramezone (25.2 g/ha) as tank-mix with 75% atrazine as early post-emergence at 15 DAS or as sequential application of these combination. Significantly lowest weed index also observed in sequential application of tembotrione/topramezone at 25 DAS after 75% atrazine as PE. Also found the significantly higher herbicide efficiency index and lower weed persistance index under the application of post-emergence herbicide, *viz.* tembotrione (120 g/ha) /topramezone (25.2 g/ha) as tank-mix with 75% atrazine as early post-emergence at 15 DAS or as sequential application of these combination. Significantly highest net returns, additional net returns (Rs 53.09 thousand/ha) and BC ratio (1.59) in *Kharif* maize obtained by 75% atrazine as PE followed by topramezone (25.2 g/ha) at 25 DAS which was at par with the application of 75% atrazine as PE followed by at tembotrione (120 g/ha) 25 DAS and with early post-emergence tank-mix application of these combinations. However, significantly highest net returns to additional Rupees/Rupees invested was found with tembotrione along with atrazine as tank mix application at 15 DAS. It was concluded that the application of post-emergence herbicide, *viz.* tembotrione (120 g/ha) /topramezone (25.2 g/ha) as tank-mix as early post-emergence at 15 DAS with 75% recommended dose of the atrazine (750 g/ha) or as sequential application at 25 DAS after 75% atrazineas PE may be adopted for better weed control, higher yield and net return in *Kharif* maize.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-169

Efficacy of new herbicide combinations in soybean

S.U. Pawar*, Kadam S.P., D.N. Gokhale and W.N. Narkhede
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharastra 431 402
**Email: pawarsu7@rediffmail.com*

The agronomic investigation on efficacy of new herbicide combinations in soybean (*Glycine max* (L.) Merrill)' was conducted during *Kharif* season of 2017-18 at Department of Agronomy, VNMKV, Parbhani with a view to assess the effect of newly released herbicides on weed control, production and profitability of soybean. The experiment was laid out in randomized block design with ten treatments. Each experimental unit was of 5.4 m x 4.5 m and 4.5 m x 4.2 m in gross and net plot size, respectively. The treatments consisted of T_1- propaquizafop + imazethapyr PoE 75+100 g/ha, T_2-fluazifop-p-butyl + fomesafen PoE 250 g/ha, T_3- imazethapyr + quizalofop-ethyl PoE 100+75 g/ha (tank mix), T_4-imazethapyr + imazamox PoE 70 g/ha, T_5- diclosulam PE 22 g/ha, T_6 - haloxyfop + imazethapyr PoE 50+100 g/ha (tank mix), T_7- haloxyfop PoE 75 g/ha, T_8- cultural practices (1 HW + 1 Hoeing), T_9- weed free, T_{10}– weedy check with the objectives to study the efficacy of herbicides in soybean. The data indicated that treatment fluazifop-p-butyl + fomesafen PoE 250 g/ ha and cultural practices 1 HW + 1 Hoeing recorded significantly higher number of seeds/plant, seed yield/plant which were comparable with weed free. However, number of seeds/pod, seed index (g) was remained statistically non-significant. Application of fluazifop-p-butyl + fomesafen PoE 250 g/ha recorded highest seed yield among chemical weed management treatments but remained statistically at par with imazethapyr + quizalofop-ethyl PoE 100+75 g/ha, cultural practices (1 HW + 1 Hoeing) and was comparable with weed free. The lowest weed count and dry weight of weeds for monocot and dicot weeds was recorded with PoE application of fluazifop-p-butyl + fomesafen 250 g/ha and was comparable with weed free. Thus PoE application of fluazifop-p-butyl + fomesafen and imazethapyr + quizalofop-ethyl PoE 100+75 g/ha, was found effective for weed control in soybean as compared to other herbicide treatments.

Indian Society of Weed Science Biennial Conference on "*Weed Management for Enhancing Farmers' Income and Food Security*", ICAR - Central Coastal Agricultural Research Institute, Goa (India); 5-7 February, 2020.

P-170

Sorption studies of selected herbicides under varied climatic conditions

Ravi Kumar Katikala and Ramesh Atmakuru*
Department of Analytical Chemistry, International Institute of Bio-technology and Toxicology, University of Madras, Chennai, Tamil Nadu 600 005
**Email: raamesh_a@yahoo.co.in*

The sulfonylurea herbicides were used to weed control in cereals and for other weed clearing activities. The efficiency of the soils and applied herbicides are dependent on their adsorption capabilities and the nature of the adsorbent, pH and temperature influence the adsorption. The adsorption-desorption behavior of four selected sulfonylurea herbicides mesosulfuron-methyl, sulfosulfuron, triasulfuron and metsulfuron-methyl under varied temperature and humidity conditions on two different soils using a batch equilibrium method was investigated. The adsorption efficiency depends on the oganic matter, pH and temperature studies were conducted. The results of adsorption efficiency fitted well for Freudlich equation and Freudlich equation constant (K_f) values ranges from 0.24 to 4.9 mL/g and adsorption isotherms were nonlinear with $1/n_f$ values <1. Adsortion efficiency of mesosulfuron-methyl, triasulfuron and metsulfurom-methyl does not depend on pH, whereas sulfosulfuron adsorption increases with decreasing soil pH. Adsorption on soil was at rather high level under low pH value conditions and decreased with increasing pH values. When temperature increases adsorption efficiency decreases in all herbicides. The adsorption KF and Freundlich exponents were decreased when temperature was increased for all herbicides.

National Bank for Agriculture and Rural Development

Our Mission: Promotion of sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives.

Research and Development on matter of importance pertaining to agriculture, agricultural operations and rural development including the provision of training and research facilities.

Consultancy services related to Agriculture & Rural Development through subsidiary (NABCONS).

Our Functions:

Provide Credit/Refinance for production credit and investment credit to eligible banks and financing institutions.

Development functions undertaken through Farm Sector Promotion Fund (FSPF), Financial Inclusion Fund (FIF), Watershed Development Fund (WDF), Tribal Development Fund (TDF) Rural Infrastructure Development Fund,(RIDF) etc.

Supervisory functions in respect of Cooperative Banks and Regional Rural Banks.

Head Office Plot C-24, 'G' Block Bandra Kurla Complex, Bandra (East) Mumbai - 400 051

HOW CAN WE FEED MORE PEOPLE FROM THE SAME FIELD?

Seeds that make your harvest. Crop protection that maximizes your yield. And data that gives you insights into how you can improve next season. We depend on farmers to support the world, and farmers can depend on us. Learn more at Corteva.in

KEEP GROWING

CORTEVA™
agriscience

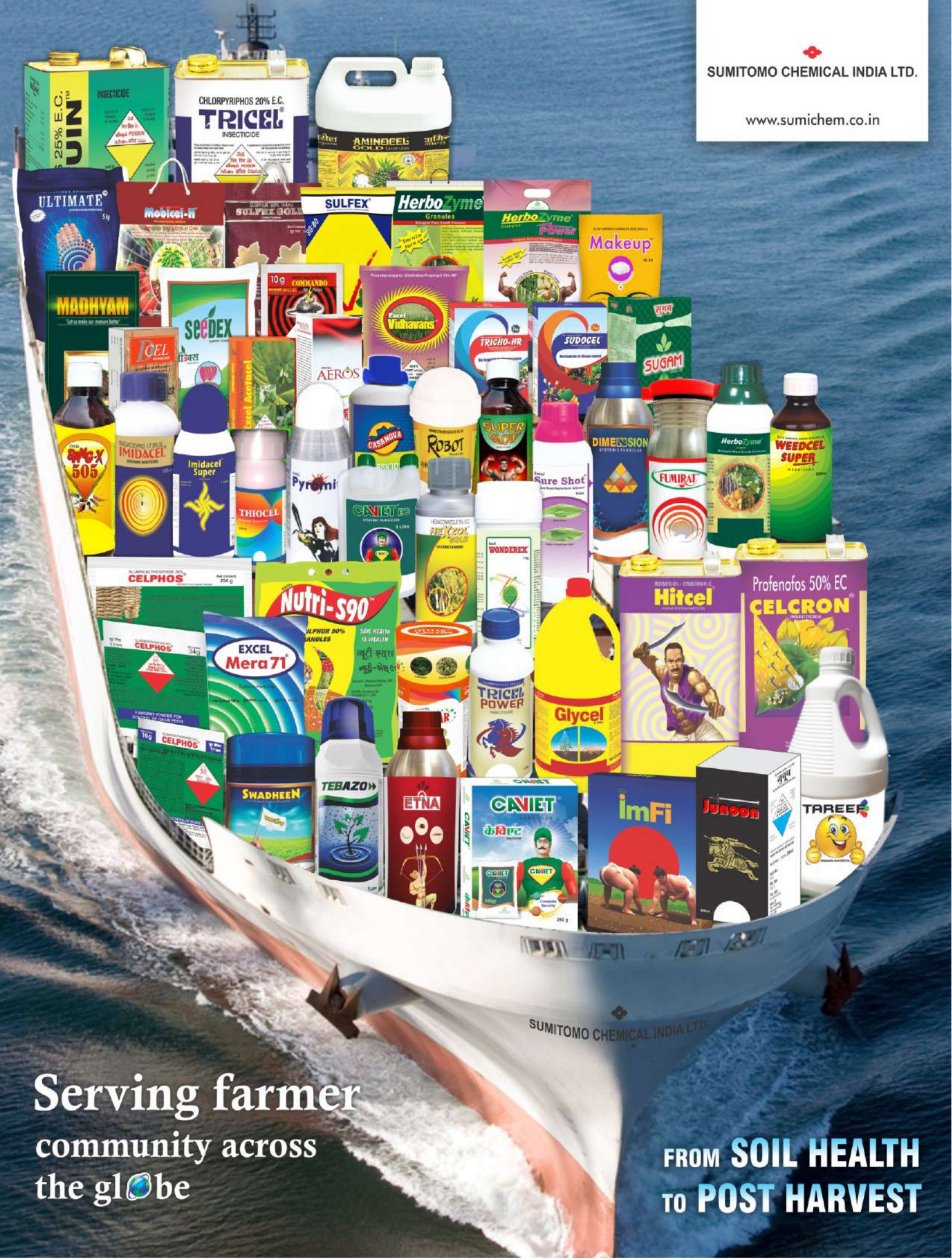
UPL

UPL salutes Indian farmers
who made India the 2nd largest producer
of Agriculture Commodities in the World.

India's farmers
have achieved the record production of
US$ 401* billion
worth of agriculture produce
in the year 2017.
*World Bank

Farmer First

www.uplonline.com


SUMITOMO CHEMICAL INDIA LTD.
www.sumichem.co.in
INSECTICIDE
CHLORPYRIPHOS 20% E.C.
TRICEL
INSECTICIDE
AMINDEEL
GOLD
ULTIMATE
Mobicel-H
SULFEX
HerboZyme
Granules
HerboZyme
Power
Makeup
MADHYAM
seeDEX
10g
COMMANDO
Excel
Vidhavans
TRICHO-HR
SUDOCEL
SUGAM
AEROS
CASANOVA
ROBOT
SUPER
DIMENSION
FUMIRAT
WEEDCEL
SUPER
IMIDACEL
Imidacel
Super
THIOCEL
Pyrami
CAVIET
Sure Shot
WONDEREX
CELPHOS
Nutri-S90
SOIL HEALTH
IS WEALTH
EXCEL
Mera 71
Hitcel
Profenofos 50% EC
CELCRON
TRICEL
POWER
Glycel
SWADHEEN
TEBAZO
ETNA
CAVIET
केविएट
ImFi
Junoon
TAREER
SUMITOMO CHEMICAL INDIA LTD.
Serving farmer
community across
the globe
FROM SOIL HEALTH
TO POST HARVEST

BASF
We create chemistry

Committed to Farmer Safety

BASF 'Sanrakshan Kit': Personal Protection for Safe Farming

Dedicated 'Suraksha Hamesha' meetings to educate and create awareness amongst :

- Farmers
- Spraymen
- Women farmers
- School children
- Retailers & Distributor of crop protection products

Sanrakshan Kit: Affordable, high-quality set of personal protection equipment

Suraksha HAMESHA

Inspired by Science

Discovering the balance of producing more from less.

Rice Solution

The land available for agriculture is decreasing rapidly. Now, more than ever, we need to increase our productivity and deliver more from less.

We at PI, are constantly in search of new answers. For more than 60 years, our line of products for rice crop such as Foratox®, Biovita®, Nominee®Gold, Osheen®, Vibrant® Kitazin®, Fluton®,Sanipeb, Bunker® etc. have been aiding farmers in improving their crop quality, increasing productivity and protecting their crops from insects, weeds and fungi. Today, we are helping to feed millions of hungry mouths while improving the farm income. Our comprehensive solution to enable the adoption of Direct Seeded Rice (DSR) has helped increase the farm income, conserving the precious natural resource, water. It is this technology that is helping us in building a better tomorrow.

PI Industries Ltd

www.piindustries.com | mktg@piind.com