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# *Abstracts of Papers*

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## SESSION 1

### WEED CONTROL IN CEREALS, WHEAT BARLEY AND OATS

#### WEED CONTROL STUDIES IN WHEAT UNDER NORMAL AND SALINE SOIL CONDITIONS

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Field and pot culture studies were carried out to evaluate the effect of various weed control treatments on wheat grown on normal and saline soils. In a field experiment, ten weed control treatments viz. 2, 4-D (0.5 kg/ha), isoproturon (1.0 kg/ha), metoxuron (1.4 kg/ha), and methabenzthiazuron (1.6 kg/ha), each weeded once along with weedy and weed-free checks were tried under two soil conditions viz; normal (0.4 mmhos/cm) and saline (4.3 mmhos/cm) during *rabi* 1981-82. The pot culture study (*rabi* 1981-82) included four levels of soil salinity viz; normal, 2.0, 4.0 and 6.0 mmhos/cm and five doses of metoxuron viz; 0, 0.25, 0.5, 1.0 and 2.0 kg/ha.

Saline plots had the predominance of *Chenopodium album* while in normal soil *Melilotus indica*, *Lathyrus aphaca*, *Vicia sativa* and *Chenopodium album* were present. Maximum grain yield of wheat was recorded with 2, 4-D+weeded once which differed significantly from weedy check, isoproturon+unweeded, methabenzthiazuron+unweeded and metoxuron+weeded as well as metoxuron+unweeded. A significant reduction in grain yield of wheat was observed under saline condition. Further, the grain yield was markedly reduced due to application of metoxuron as compared to other herbicides. However, the magnitude of reduction was more in saline soil than on normal soil. Pot culture study revealed that increasing levels of metoxuron markedly reduced the dry weight per plant at 42nd day under normal as well as saline conditions. This effect was more pronounced under higher levels of soil salinity.

#### EVALUATION OF HERBICIDES IN WHEAT (*TRITICUM AESTIVUM* L.)

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A field trial was carried out during 1980 and 1981 to evaluate the efficacy of recently developed herbicides in wheat. Fourteen treatments consisting of UCIL-75038 at 1.0, 1.4 and 1.8 kg/ha as pre-and post-emergence, Methabenzthiazuron at 1.4 kg/ha pre-and post-emergence, Benthicarb at 1.0, 1.25



and 1.5 kg/ha pre-emergence, hand weeding twice (25+50 DAS), weedy and weed-free check were tried. *Phalaris minor*, *Avena fatua* and *Chenopodium album* were controlled effectively using methabenzthiazuron 1.4 kg/ha pre-as well post-emergence and UCII-75038 1.4 and 1.8 kg/ha 35 days after sowing.

Height, dry matter and effective tillers meter row of the crop were influenced by herbicide treatments and were comparable with that of weed-free and hand weeding twice (25+50 DAS) treatments during both the years. A similar trend was observed in biological and grain yield.

#### TILLAGE, FERTILITY AND WEED MANAGEMENT SYSTEMS IN RELATION TO WHEAT PRODUCTION

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An experiment was conducted during the *rabi* season of 1974-75 to explore the possibility of minimising tillage in wheat with herbicidal use at variable fertility rate. The treatments consisted of three levels of tillage systems (minimum moderate and traditional) in the main plots and combination of each of the three fertility levels  $F_1$  (N-60,  $P_2O_5$ -30 and  $K_2O$ -20 kg/ha),  $F_2$  (N-90,  $P_2O_5$ -45 and  $K_2O$ -30 kg/ha) and  $F_3$  (N-120,  $P_2O_5$ -60 and  $K_2O$ -40 kg/ha) and three weed management practices  $W_1$  (no weeding),  $W_2$  (hand weeding twice) and  $W_3$  (Pre-emergence spray of Tenoran and post-emergence spray of Taficide-80 each @ 1 kg/ha in the sub-plots).

Tillage intensities did not affect wheat yield significantly. However, net returns increased under reduced tillage systems. Higher rates of fertilization raised the yield and income plateau. Chemical weeding gave the maximum yield and profit potential.

#### CULTURAL METHODS OF WEED CONTROL IN WHEAT

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Field experiment was conducted during *rabi* 1979-80 and 1980-81 with nine treatments having the combinations of normal and high seed rate (100 and 150 kg/ha, respectively), narrow (15 cm) and normal (23 cm) spacing, cross sowing, interculture and chemical weed control (Tolkan @ 1.0 kg a.i./ha) alongwith unweeded check were tested to overcome the weed problem, particularly, *P. minor* Retz. The

composition of weed flora was 24% *P. minor*, 34% *C. album*, 23% *L. aphaca*, 7% *V. hirsuta* and 19% other weeds. There was 28 to 33% increase in the grain yield by the use of herbicide, crop planted with narrow spacing and hand weeding or interculture over unweeded check. 44 to 79% of dry matter of weeds was depressed by the use of these methods of weed control as compared to unweeded check. Significantly negative linear relationship was observed between dry matter of weeds and productivity of wheat. Under *dab* system, the grain and straw yields were poorer than unweeded check.

#### CHEMICAL WEED CONTROL IN WHEAT

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A field experiment was laid out during *rabi* 1980-81 to evaluate the effect of herbicides isoproturon at 0.5, 1.0 and 1.5 kg/ha, methabenzthiazuron at 0.75, 1.5 and 2.25 kg/ha and metoxuron at 0.8, 1.6 and 2.4 kg/ha, each applied as pre-emergence and post-emergence (40 days after sowing), on the control of weeds, growth and yield of wheat.

Pre-emergence application of isoproturon at 1.5 kg/ha produced the lowest population and dry matter of total weeds at 120th day of crop growth. Methabenzthiazuron at 2.25 kg/ha and metoxuron at 2.4 kg/ha, irrespective of time of application, provided good control of grassy and non-grassy weeds. All the herbicide treatments significantly increased the grain yield of wheat over weedy check. The highest grain yield (4355 kg/ha) and significantly higher even over weed-free condition was produced with pre-emergence application of isoproturon at 1.5 kg/ha. It was followed by the pre-emergence application of isoproturon at 1.0 kg/ha, which was at par with weed-free condition. Increased grain yields with isoproturon application were due to improved crop growth, and yield attributes and less nitrogen uptake by weeds.

#### EFFECT OF PRE-EMERGENCE APPLICATION OF HERBICIDES ON THE CONTROL OF *PHALARIS MINOR* IN WHEAT

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Methabenzthiazuron (1.5, 2.0, 2.5 kg/ha), pendimethalin (1.0, 1.5, 2.0 kg/ha) and bifenox (1.0, 2.0, 3.0 kg/ha) were tried as pre-emergence for the control of

*Phalaris minor* in wheat. All the herbicides significantly reduced the density and dry matter of *Phalaris minor* as well as of other weeds associated with the crop. Weedy condition resulted in 35.5% reduction in the grain yield. Herbicides at all the rates produced grain yields significantly higher than the weedy check and at par with that of weed-free treatment. There was reduction in the population of *P. minor* with the increasing rates of herbicides, however, the increase in the grain yield was not significant. The lower rates of methabenzthiazuron (1.5 kg/ha), pendimethalin (1.0 kg/ha), bifenox (1.0 kg/ha) and weed-free treatments produced 55.4, 52.9, 58.9 and 56.7 q/ha grain yields, respectively.

#### EFFECT OF NITROFEN FORMULATIONS ON WHEAT AND ASSOCIATED WEEDS

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Three formulations of nitrofen, viz. emulsifiable concentrate (EC), Wettable powder (WP) and granular were tested at different rates and methods of application for weed control in wheat. Post-emergence application of WP @ 1.0 kg/ha and pre-emergence application of EC @ 1.5 kg/ha were quite effective in reducing the population of *Phalaris minor* and non-grassy annual weeds. These treatments produced grain yields comparable with that of weed-free treatment. Post-emergence application of WP caused more toxicity to the crop than the EC formulation. Granular formulation was not effective in controlling the weeds.

#### EFFECT OF METOXURON ON THE PERFORMANCE OF WHEAT VARIETIES

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Twelve varieties of wheat (UP 115, Kalyansona, UP 2110, UP 2104, UP 2042, DWL 5023, UP 131, UP 1033, UP 1002, Sonalika, UP 368 and UP 2003) were tested for their tolerance/susceptibility to metoxuron at 1.6 and 3.2 kg/ha. UP 115 was the most susceptible variety to metoxuron. Dry matter production and grain yield of this variety were reduced significantly with the increase in the rate of metoxuron. Almost all the varieties showed some toxicity of metoxuron at 3.2 kg/ha. There was significant reduction in the grain yields of Kalyansona, UP 2042 and Sonalika at 3.2 kg/ha of metoxuron when compared with control and 1.6 kg/ha. In other varieties there was no reduction in the grain yield even at 3.2 kg/ha of metoxuron. UP 2003 showed better tolerance to this herbicide than all other varieties.



POST-EMERGENCE APPLICATION OF ISOPROTURON, METOXURON AND METHABENZTHIAZURON FOR THE CONTROL OF *PHALARIS MINOR* RETZ. IN WHEAT (*TRITICUM AESTIVUM* L.)

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The Bioefficacy of post-emergence application of isoproturon, metoxuron & methabenzthiazuron was studied for the control of *phalaris minor* in wheat during 1978-79 and 1979-80. Early application (30 days after sowing, crop in 3.5 to 4 leaf stage) of herbicides was more effective against this weed than their late application (50 days after sowing, crop in 6 to 7 leaf stage). From grain yield and weed control points of view their application at 30 to 40 days after sowing (crop in 3.5 to 5.0 leaf stage) was considered optimal. Their late application at 50 days after sowing resulted in 7.6 per cent reduction in grain yield, compared with their application 30 days after sowing on light textured soil. The mean grain yield of 47.1 q/ha was recorded in case of isoproturon 0.94 kg/ha post-emergence, which was 43% higher than the control (no weeding).

WEED MANAGEMENT STUDIES IN WHEAT-MUSTARD MIXED CROPS

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Field investigations were made for controlling weeds in mixed stand of wheat and mustard. Six promising herbicides, viz., methabenzthiazuron, metoxuron, isoproturon, pendimethalin, fluchloralin and nitrofen were included and their herbicidal efficacy and selectivity on crops were compared with manually weeded and unweeded checks. All the herbicides were sprayed as pre-emergence as well as early post-emergence.

Application of methabenzthiazuron, metoxuron and isoproturon were phytotoxic to mustard. Pendimethalin, fluchloralin and nitrofen were safe on both the crops. Pendimethalin pre-emergence application gave excellent control of weeds and was significantly superior over pre-and post-emergence application of fluchloralin and pre-emergence application of nitrofen in respect of weed control efficiency and grain production of wheat and mustard.

STUDIES ON WEED CONTROL IN MIXED STAND OF WHEAT AND CHICKPEA

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Herbicidal and selective effects of some herbicides in controlling weeds in mixed stand of wheat and chickpea were studied. Pre-planting application of

fluchloralin at 0.5 and 0.75 kg/ha and pre-emergence application of pendimethalin and nitrofen at 0.5 and 1.0 kg/ha was made. Unweeded check and manual weeding treatment were included for comparison. All the three herbicides were found safe on both the crops and reduced the dry matter accumulation of weeds significantly compared to the unweeded check. Among the herbicides pendimethalin application appeared superior.

#### HERBICIDE EVALUATION FOR INTERCROPPED WHEAT WITH MUSTARD AND LINSEED

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A field trial was conducted for two consecutive seasons (1976 and 1977) to identify a herbicide having selectivity to both wheat and its intercrops (mustard and linseed) and their weed killing efficiency. Methabenzthiazuron (1.0 and 2.0 kg/ha), dichloromate (1.0 and 2.0 kg/ha) and nitrofen (2.0 kg/ha) were tried as pre-emergence soil application 1 day after sowing. The herbicidal efficiency in terms of population and dry matter accumulation of weeds and selectivity or effect on crop seed germination, seedling establishment and grain yield were assessed. *Digitaria sanguinalis*, *Dactyloctenium aegyptium*, *Sporobolus diander*, *Heliotropium indicum* and *Ageratum conyzoides* were the weeds.

All the herbicides at all levels had no adverse effect on wheat. Conversely, pre-emergence application of methabenzthiazuron (both the doses) resulted in root growth inhibition, dessication and death of mustard seedlings at 10 days after sowing while such symptoms were absent in plots where linseed was grown. None of the intercrops was affected by dichloromate and nitrofen application. Weed control efficiency increased with increasing dose of the herbicides.

#### STUDIES ON CULTURAL PRACTICES FOR WEED MANAGEMENT IN WHEAT

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Influence of seed rate, method of sowing and weed management practices was studied on weed infestation, crop growth and yield. Varying seed rates of 100, 125 and 150 kg/ha were sown in row sowing and cross row sowing. Three treatments of weed management, viz. weedy, weed-free and isoproturon @ 1 kg/ha were given to the crop after 35 days of sowing in split plot design with three replications. Increasing the seed rate from 100 kg to 150 kg/ha did not reduce the weed density. Cross sowing of wheat significantly reduced the dry weight of weeds and also increased the grain yield correspondingly. Spraying isoproturon @ 1 kg/ha. increased the grain yield significantly over weedy check.

EFFECT OF GRAMOXONE (PARAQUAT) FOR PREPLANT REDUCTION OF  
CANARY GRASS (*PHALARIS MINOR* RETZ.) IN WHEAT IN STALE SEED  
BED TECHNIQUE.

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An experiment was conducted during 1981-82 in rice-wheat rotation. Besides *Phalaris minor*, *Melilotus alba* was noticed before sowing wheat. Three dates of sowing wheat starting from Nov. 20 to Dec. 16, with one and two pre-sowing irrigations, were included. Control of *Phalaris minor* in conventionally prepared field in timely sown wheat and with post-emergence application of metoxuron at 1.25 kg/ha was evaluated and compared with that by preplant Gramoxone treatment at 0.5 Kg a.i./ha. Yields from late sowing of wheat were either comparable to those obtained in normal planting or slightly lower. Major portion of *Phalaris* weeds germinated in mid November to mid December and gradually diminished as the season progressed.

Results revealed that a considerable portion of the first flush of *Phalaris minor*, which emerged early by irrigation and soil scarification, was eliminated by preplant Gramoxone treatment in the stale seed bed plots. "Double knock" effect on *Phalaris* seedlings by uprooting them was there when the hoe-type fertilizer-cum-seed drills were used to sow wheat. Weed-free situation for 2 to 3 weeks gave wheat a good start and the later flush of *Phalaris* was killed by post-emergence herbicide. Results from the second season's trial, have confirmed that wheat can be sown within the normal season in stale seed bed.

SESSION 2-A

WEED CONTROL IN RICE

EFFECT OF PROPRIETARY MIXED HERBICIDES ON THE CONTROL OF  
WEEDS IN RICE

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An investigation was carried out during *Kharif* 1981 to find out the effect of 4 proprietary mixed herbicides in comparison with 5 common herbicides and hand weeding for the control of weeds in rice. Grain yield increased from 24.6 to 66.6% in herbicide treated and hand weeded plots compared to unweeded (control) plots



of rice. Hand weeding twice resulted in highest grain yield (53.02 q/ha) and was on par with that of 3 proprietary mixed herbicides viz. basalin 45 EC+2, 4-D EE, basalin 45 EC+2, 4-D I. P. E. and basalin 45 EC+ Basagran 40 AS. However, the common herbicides basalin 45 EC, basagran 40 AS and new machete 50% were also recorded the same level of grain yield as that of hand weeding. The weed dry matter recorded in these 3 proprietary mixed herbicides and common herbicides was also on par with that of hand weeding. Basalin individually and in combination with basagran and 2, 4-D was found better in this experiment.

#### EFFECT OF PLANTING DENSITY, FERTILITY LEVELS AND WEED CONTROL ON DENSITY AND DRY WEIGHT OF WEEDS AND YIELD OF TRANSPLANTED RICE (*ORYZA SATIVA* L.)

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Field experiments were conducted during *Kharif* 1979 and 1980. Two planting densities (26.66 and 44.44 hills/m<sup>2</sup>) and four levels of soil fertility (application of 0, 50, 100 and 150% of the recommended N, P & K doses as main plot treatments and three weed control treatments (unweeded control, hand weeding twice, 4 and 6 weeks after transplanting and application of butachlor @ 1.5 kg/ha) as sub-plot treatments were tested in split plot design.

Transplanting of rice seedlings at 15 × 15 cm spacing was significantly effective in decreasing the density and dry weight of weeds and resulted in significantly increased grain yield of rice. Application of 50% of the recommended dose of fertilizers decreased the grain yield only by 12.9% below that with full recommended dose. Hand weeding twice (4 & 6 weeks after transplanting) and application of butachlor @ 1.5 kg/ha were equally effective in significantly decreasing the density and dry weight of weeds as well as increasing the grain yield of rice.

#### WEED CONTROL IN UPLAND DIRECT SOWN RICE IN CALCAREOUS SOIL

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An experiment was conducted during *Kharif* 1981-82 with rice variety Pusa 2-21 to find out suitable weed control measures. Herbicides alone did not prove superior to handweeding and control. Combination of herbicides and handweeding resulted in significant increase over control. Pendimethalin+handweeding and butachlor+handweeding were equally effective in increasing grain yield. These two treatments gave higher yield as compared to hand-weeding but were not statistically superior.

## CHEMICAL WEED CONTROL IN TRANSPLANTED RICE

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A field experiment with butachlor and propanil at 2.0 to 4.0 kg/ha alone or 1.0 to 2.0 kg/ha in combination was conducted during wet (*kharif*) season 1979 and 1980 to find out the effective concentration of butachlor and propanil to control the weeds in transplanted rice. All the concentrations of butachlor and propanil alone or in combination reduced dry matter of weeds by 123 kg/ha and 120 kg/ha in 1979 and 1980, respectively, below unweeded control. The average grain yield was increased by 13.1 q/ha over unweeded control. Pre-emergence application of butachlor followed by post-emergence application of propanil at lower doses (1.0 kg followed by 1.0 kg/ha) was found more effective and economical than application of either herbicide at higher doses.

## ECONOMICS OF WEED CONTROL IN DRILLED RICE

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Experiments were conducted to find out the response of drilled rice to manual weedings at different stages and herbicidal-cum-cultural methods of weed control and the economics of these weed control measures. The cost of first weeding increased with delay in weeding time. The cost of two weedings done at 15 and 30 days or 15 and 45 days after sowing was much less than the cost of only one weeding done at either 30, 45 or 60 days. The highest net returns of Rs. 1,792/ha was obtained with two weedings done at 15 and 30 days after sowing. Two weedings done at 15 and 45 days gave net return of Rs. 1,510.77/ha. Three weedings done at 15, 30 and 45 days after sowing and four weedings done at 15, 30, 45 and 60 days after sowing gave comparatively less net return, in spite of more grain yields, because the increased yield could not compensate the cost of additional weedings in these treatments.

When herbicide application was combined with one manual weeding, the highest net return was obtained with benthicarb @ 2.0 kg/ha + weeding 45 days after sowing followed by butachlor @ 2.0 kg/ha + weeding 45 days after sowing and benthicarb @ 1.5 kg/ha + weeding 45 days after sowing.

## INTEGRATED CONTROL OF WEEDS IN DRILLED RICE

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Pre-emergence application of butachlor (2.0 kg/ha), pendimethalin (2.0 kg/ha), Oxyfluorfen (0.2 kg/ha) and post-emergence application of oxyfluorfen (0.2 kg/ha) alone and in combination with one weeding 45 days after sowing were tried for weed control in drilled rice. *Echinochloa colonum* was the major weed species. High weed density could completely smother the crop. All the herbicides reduced density and dry matter of weeds significantly and produced grain yields significantly higher than the weedy check. However, none of them applied alone could produce yields at par with weed-free treatment. Post-emergence application of oxyfluorfen was phytotoxic to the crop. The weeding at 45 days after sowing following the pre-emergence application of herbicides increased grain yield significantly. Pendimethalin (2.0 kg/ha)+weeding 45 days after sowing produced grain yield at par with that of weed free treatment.

## BENTHIOCARB FOR WEED CONTROL IN RICE NURSERY

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A replicated trial and nine unreplicated trials were conducted in rice nursery in Punjab in the year 1982 to assess the potential of benthocarb for weed control. Benthocarb at 1.5 kg/ha in EC formulation applied 7 days after sowing resulted in good control of *Echinochloa* spp and annual sedges without causing any phytotoxicity to rice seedlings.

## CHEMICAL CONTROL OF BARNYARD GRASS (*ECHINOCHLOA CRUSSGALLI* L.) IN RICE NURSERY

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Efficacy of butachlor, thiobencarb, pendimethalin, oxadiazon applied 3, 8 and 15 days after sowing and propanil 10 days after sowing was studied in rice nursery raised under puddled and non-puddled conditions during *kharif* 1982. Butachlor and thiobencarb 1.25 and 1.87 kg/ha, pendimethalin 1 kg/ha and oxadiazon 0.6 kg/ha applied 3 days after sowing gave promising control of barnyard grass but adversely affected the stand of the nursery sown under puddled conditions as



well as by broadcasting under non-puddled conditions. Application of these herbicides 3 days after sowing had 53.7% higher rice seedlings in drill sowing under non-puddled conditions as compared to the other two methods. Weed control efficacy decreased with the delay in the time of application in drill and broadcast sowings under non-puddled conditions but remained unchanged with time under puddled conditions. Propanil at 2.187 kg/ha applied 10 days after sowing also gave promising performance for weed control in rice nursery.

#### EFFECT OF PLANTINGS AND HERBICIDES ON WEED FLORA

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Experiments were conducted during the *Kharif* Season of 1979 and 1980. Treatments consisted of three planting methods, direct seeding (dry), direct seeding (wet) and transplanting, and eight herbicides, butachlor (L & G), Propanil, benthio-carb, nitrofen, 2, 4-D (L & G) and MCPA. There were hand weeded and unweeded controls. The most common weed species were *Cynodon dactylon*, *Echinochloa crusgalli*, *Echinochloa colonum*, *Cyperus rotundus*, *Fimbristylis miliacea*, *Phyllanthus niruri*, *Ammania baccifera* and *Caesulia axillaris*.

The grasses and sedges were minimum in transplanted crop, whereas the broad-leaved weeds were minimum in direct seeded (dry) with each herbicide. Herbicides butachlor, propanil and benthio-carb had minimum number of weeds/m<sup>2</sup> under all the planting methods. Phenoxy group of herbicide was most ineffective and had maximum number of weeds/m<sup>2</sup>.

#### EFFECT OF WEED CONTROL METHODS ON RICE UNDER DIFFERENT FERTILITY LEVELS

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A field experiment was conducted during the *kharif* Season of 1980 with three fertility levels, 0. 0. 0, 60 : 30 : 30 and 120 : 60 : 60 kg NPK/ha, and five weed control treatments, propanil (3 kg/ha) butachlor (2.5 kg/ha), two hand weedings. One hand weeding, and unweeded control. Increasing level of fertility increased the grain yield and decreased the weed population and dry weight of weeds throughout the crop period. Pre emergence application of butachlor produced grain yield equal to two handweedings and minimum number and dry weight of weeds.

## WEED CONTROL THROUGH HERBICIDES IN DIRECT SEEDED RICE UNDER INTENSIVE AND MINIMUM TILLED SOIL

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An investigation was carried out on the efficacy of intensive ploughing (3 times), spraying of paraquat at 0.5 kg/ha followed by one ploughing before sowing, 2, 4-D, butachlor and propanil alone or in combination for weed control in direct seeded rice during *Kharif* 1981-82. Hand weeding and unweeded control were also included. In split plot design, methods of land preparation were in main plots and herbicides in sub-plots.

Grain yield (26.29 q/ha) obtained under intensive ploughing was significantly more than that under weed control with 0.50 kg paraquat followed by one ploughing. But the dry matter accumulation of the weeds was significantly higher (45.7 g/m<sup>2</sup>) under the former treatment than that of the latter (35.9 g/m<sup>2</sup>). All the weed control treatments gave significantly higher yields over control. Hand weeding, being at par with sequential application of butachlor (Machete) followed by (fb) propanil (Stam F 34), butachlor fb propanil (Hexanil), 2, 4-D (G) fb butachlor and 2, 4-D (G) fb propanil (Hexanil), was found significantly superior to the other treatments. Maximum dry matter accumulation by weeds was in the unweeded control (102.99 g/m<sup>2</sup>) and the lowest under hand weeding (19.11 g/m<sup>2</sup>).

## STUDIES ON HERBICIDE-SOIL INTERACTION AND OPTIMUM DOSE OF BUTACHLOR FOR WEED CONTROL IN RAINFED UPLAND RICE

S. B. BISWAS and KHAN BASSI,

H. P. K. V. V., Palampur.

An experiment was conducted during *Kharif* 1980 to study the interaction of tilth of seed bed and butachlor, which was found most promising in previous testing programme. Butachlor applied @ 2 kg/ha followed by one handweeding showed the best result. The number and dry weight of weeds were more in poorly prepared seed bed. Weed control ratings were high in fine seed beds because of better efficiency of butachlor even at 1 kg/ha, leading to higher grain yields of more than 3 t/ha as compared to control plot yields averaging 1.6 t/ha. However, in coarse seed beds even with a higher dosage of 20 kg/ha, the same level of grain yields could not be obtained. Also, phytotoxicity was recorded high in cloddy seed bed due to uneven distribution of butachlor.

## HERBICIDES FOR WEED CONTROL IN PUDDLE SEEDED RICE

B. T. S. MOORTHY and G. B. MANNA,  
C. R. R. I. Cuttack-753006.

Results of two experiments carried out during dry seasons of 1980 and 1981 under puddle seeded condition indicate that in such a typical agro-ecosystem of rice culture, 97 to 100% of the weeds belong to sedge community. The weed flora was composed of *Fimbristylis miliacea*, *Cyperus difformis* and *Scirpus supinus* causing an yield loss of about 21%.

Among new formulations of granular pre-emergent test herbicides, butachlor+2,4-D IPE at 0.75+0.5 kg/ha, pretilachlor at 0.5 kg/ha, molinate/simetryne/MCPB at 1.8/0.1/0.1 kg/ha and naproamilide/thiobencarb at 1.0/0.7 kg/ha were observed to be at par with weed-free check and the recommended use of butachlor at 1.5 kg/ha. Results of another experiment revealed that the rate of application of granular herbicides, viz., butachlor, thiobencarb and avirosan can be reduced to 0.6 kg/ha and that of 2,4-D EE to 0.4 kg/ha.

## WEED CONTROL IN TRANSPLANTED RICE BY HERBICIDES IN DRY SEASON

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C. R. R. I, Cuttack-753006

Results of two field experiments carried out during dry seasons in transplanted rice showed that the sedges *Cyperus difformis*, *Fimbristylis miliacea* and *Scirpus supinus* caused 9% loss of grain yield. Evaluation of different formulations of granular herbicides during dry season of 1980 indicated that a wide range of choice existed among herbicides viz 2,4-D EE, butachlor, butachlor+2,4-D IPE, oxadiazon and oxyfluorfen for the transplanted crop unlike direct seeded crop.

The results of another trial on doses of herbicides during dry season of 1981 showed effective weed control in transplanted rice with reduced rates i. e. 0.4 kg a.e./ha for 2,4-D EE; and 1.0 kg/ha for butachlor, benthocarb and avirson. Post-emergent application of 2,4-D sodium salt or sand-mixed pre-emergent application of 2,4-D EE (EC) at 0.6 kg a.i./ha could be used alternative to the above mentioned herbicides with additional benefit of lower cost and easy availability.

## PERFORMANCE OF HERBICIDE MIXTURES ON CONTROL OF WEEDS IN TRANSPLANTED RICE

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Fluchloralin, arozin and benthocarb alone and in combination with 2,4-D IPE were tested for control of annual weeds and their resultant effect on



grain yield rice. In 1981 the doses of fluchlalarin, arozin and benthocarb were reduced by 50 per cent when tried in combination with 2,4-D. Mixtures were prepared as tank mix immediately before application, Granules were prepared with river washed sand.

Application of 2,4-D with fluchlalarin, arozin and benthocarb at equal recommended dose was found superior over sole use of any herbicide however the differences were not significant. However application of herbicide helped in controlling the weeds thereby increasing grain yield of rice per hectare. The infestant weeds of the experimented plots were *Echinochloa crusgalli* and *cyperus iria*.

## SESSION 2-B

### CROP-WEED COMPETITION

#### COMPETITION FOR NITROGEN BETWEEN WEEDS AND DRILLED RICE— EFFECT OF TIME OF WEED REMOVAL

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The effect of weed removal at different crop growth stages on weed competition for nitrogen in drilled rice was studied with nine treatments, viz. weedy, Weed-free, and weed removal 15, 30, 45, 15+30, 15+45, 30+45 and 15+30+45 days after sowing (DAS) the crop during kharif 1980. Weeds competed with the crop severely for nitrogen supply, the competition commenced quite early in the season. They removed the maximum quantities of nitrogen from the soil 60 days after sowing the crop. On nitrogen uptake basis, *Echinochloa colonum* was the most competitive weed species, surpassing all others in the competition for nitrogen. Weed removal once on 30th and 45th day, twice and thrice reduced the total nitrogen uptake by weeds and that by the major weed species *E. colonum*, *Trianthema portulacastrum* and *Digera arvensis* significantly below that in the unweeded check at the successive stages of crop growth,

Following weed removal twice at 30+45 and thrice at 15+30+45 DAS, the competition by weeds decreased significantly and the crop could take up as much nitrogen as under Weed-free conditions which facilitated its better growth, finally leading to increased grain yield. Significant negative correlation ( $r = -0.789$ ) and linear regression relationship were observed between the nitrogen uptake by the crop and the weeds.

## EFFECT OF TIME OF WEED REMOVAL ON THE YIELD OF MUNG BEAN

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Field experiments were conducted on sandy loam soil during 1980 and 1981 to find out the effect of time of weed removal on the yield of mung bean. The experiment consisted of weed-free and weedy check, and weed removal at 10, 20, 30, 40, 50 and 60 days after sowing the crop. Removal of weeds at 10, 20 and 30 days after sowing gave significantly higher grain yield over weedy check. The grain yield was the highest during both the years when the weeds were removed 20 days after crop sowing. Weed removal after 30 days of crop sowing did not improve the crop yields significantly.

## EFFECT OF TIME OF WEED REMOVAL ON POD YIELD OF GROUNDNUT

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A field experiment was conducted for two years (1979 and 1980) to study the effect of time of weed removal on the pod yield of groundnut. The experiment consisted of eight treatments, viz. weed removal at 0 (weedy check), 2, 4, 6, 8, 10 and 12 weeks after sowing the crop and weed-free check. The results indicated that the removal of weeds during 2nd to 8th weeks after sowing gave significantly higher pod yield over weedy check. The maximum pod yield during both the seasons was obtained when the weeds were removed 4 weeks after crop sowing. Removal of weeds after 8 weeks of crop sowing reduced the pod yield of groundnut significantly.

## CRITICAL STAGES OF CROP-WEED COMPETITION AND CHEMICAL WEED CONTROL IN SOYBEAN (*GLYCINE MAX. L.*)

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A field study was undertaken during summer and kharif 1974 to ascertain the efficacy of two herbicides in comparison with cultural treatments on weed control and yield. Seed yield was reduced drastically by 53% due to weed competition in unweed control plots (1783 kg/ha) as compared to weed-free plots (3804 kg/ha). This reduction in yield was more severe (71%) in kharif sown soybean than in

Summer sown crop (35%). Generally, increasing the herbicidal dosage increased the yield considerably in kharif. Soybean needs 60 days of weed-free period for higher yield.

Over two seasons, the soybean seed yields (3804 to 3825 kg/ha) obtained in weed-free plots as well as with use of alachlor at 2 kg/ha were similar and more than other treatments. Alachlor was better than nitrofen in controlling weeds and gave better seed yield. The study indicated inability of soybean to compete with the weeds during early crop growth stages, initial 60 days form critical period, and the suitability of alachlor at 2 kg/ha for effective control of weeds.

#### CROP-WEED COMPETITION STUDIES IN LOW LAND JUTE

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A field experiment was conducted during kharif 1976 and 1977 to study the crop-weed competition in lowland capsularis jute cv: JRC 212. There are 10 treatments with hand weeding at 7 days intervals all through the crop period and no weeding.

Weed-free conditions up to 35 and 42 days after sowing were highly effective in increasing the fibre yields. Initial 28 weed-free days with no weeding later or no weeding up to 28 days but weeded later lowered the fibre yield significantly compared to the weed-free conditions up to initial 35 and 42 days. A weed-free period of first 35 or 42 days after sowing appeared optimum to eliminate critical crop-weed competition in jute.

Weed weight increased with the decrease in weed-free period. Where no weeds were allowed to grow for 35 and 42 days, even later growth of weeds was suppressed. Highest net returns were obtained where weed-free condition was maintained up to 35 days from sowing.

#### NUTRIENT BALANCE DUE TO CROP-WEED COMPETITION IN WEEDY AND WEED-FREE CONDITIONS IN HIRSUTUM COTTONS

S. C. JAIN, B. G. IYER, K. S. YADAVA

J.N.K.V.V., Indore Campus

In a two years study, weeds depleted soils by 48-50 kg N, 8-15 kg  $P_2O_5$  and 46-80 kg  $K_2O$ /ha leaving behind only a meagre quantum of soil nutrients for cotton growth. Nutrient assimilation by crop improved tremendously by the effective weed control methods. Herbicides were as effective as cultural methods in reducing

crop-weed competition for major nutrients. Competition was more serious and pronounced at the square stage which prolonged till the first picking stage in rain grown cotton. A negative correlation between the crop and weeds was noted for nitrogen uptake both in 1979-80 and 1980-81.

#### WEED REGIMES AND THEIR IMPACT ON THE GROWTH AND YIELD OF UPLAND COTTON IN MEDIUM BLACK SOILS

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Three weed regimes were developed to determine the impact of variable degrees of weed infestation on growth and yield of cotton (*Gossypium hirsutum* L.) for two years (1979-80 & 1981-82). *Kapas* production declined almost to half when grown in fully infested condition. Initial hand weeding followed by interculture curtailed weed competition drastically and also nearly doubled the yield. Weed regimes created by the integration of herbicides applied pre-plus post-emergence or their superimposition with the interculture at the later growth phases gave equally effective weed control and yield increase—Diuron appears to be a versatile herbicide while Basalin and Stomp showed limited promise on the medium black cotton soils.

#### STUDIES ON THE EFFECTS OF PLANTING PATTERNS AND WEEDING INTERVALS IN SORGHUM BASED INTERCROPPING SYSTEM ON WEED INFESTATION AND GRAIN YIELD.

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A trial was conducted during Kharif 1980-81 to study the weed suppressing ability of four intercrops in relation to two planting patterns and three weeding intervals in sorghum crop.

Sorghum + Cowpea cropping system was significantly superior to others in reducing the weed density and weed dry matter followed by sorghum + greengram cropping system. Cowpea was effective in controlling the weeds but adversely affected the sorghum grain yield, though total grain yield and net monetary returns were higher as compared to sole crop of sorghum. Planting patterns did not influence significantly weed density, weed dry matter or grain yield. The interaction between cropping systems and weeding interval was found to be significant. When sorghum was taken as sole crop or intercropped with groundnut or greengram, two hand weeding were needed, whereas with cowpea one weeding on 15th day was sufficient to get the optimum net monetary returns.

## NUTRIENT UPTAKE AND POD YIELD OF GROUNDNUT AS AFFECTED BY WEED MANAGEMENT

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The effect of weed management by hand weeding and herbicide usage on the nutrient uptake and pod yield of groundnut (*Arachis hypogae* L.) under different phosphorus levels was studied. In unweeded check, weeds accumulated 49.5, 8.49 and 59.47 Kg/ha each of N, P and K, whereas groundnut could take up only 23.8, 2.35 and 16.33 kg of N, P and K, respectively. The nutrient uptake by the crop was higher than that of weeds under herbicides and hand weeding treatments.

Considering nutrient losses due to weeds, the amount of nutrients required by the crop to produce one quintal of pods was 8.46 N, 1.37 p, 7.14 K in Fluchloralin; 8.45 N, 1.29 P, 6.92 K in Nitrofen; 8.56 N, 1.36 P, 7.54 K in Pendi methalin; 8.99 N, 1.37 P, 7.39 K in Bentazon; 8.54 N, 1.37 P, 7.27 K in hand weeding and 29.56 N, 4.36 P, 30.57 K Kg/ha in no weeding treatments, respectively. The NPK uptake both by crops and weeds was not influenced by phosphorus levels. Observed results are presented and discussed.

## CRITICAL PERIOD OF CROP-WEED COMPETITION IN DIRECT SEEDED RICE.

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Crop-weed competition studies were conducted during *Kharif* 1981-82 on rice var. Pusa 33. In one set of treatments the crop was kept weed-free during the early stages of its growth but weeds were allowed to grow during later stages. In another set, the crop was kept weed infested in the beginning and weeds were removed at later stages. Weed-free and weedy checks were also included.

Results of the first set of treatments indicated that there was no significant variation in yield where plots were kept weed-free initially for 25, 35, 45, 55 days or throughout the crop period. Weed-free condition during the first 15 days after sowing was not effective as weeds reappeared. For reducing the weed competition and obtaining higher grain yields, weed-free conditions for initial 25 days after sowing were found to be essential. In the second set of treatments weed infestation from sowing to beyond 45 days after sowing reduced the grain yield significantly. It was concluded that the period from sowing to 45 days after sowing was most crucial for weed removal for obtaining higher rice yields.

STUDIES ON THE EFFECT OF TIME OF TRANSPLANTING AND WEED-FREE MAINTENANCE ON YIELD OF RICE AND ASSOCIATED WEEDS.

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An experiment was conducted during Kharif 1980 and 1981 on loamy soil. Three transplanting dates viz. June 16, July 1 and July 16 in the main plots and eight weed-free maintenance treatments, viz. weed-free upto 0, 15, 30, 45, 60, 75, 90 days after transplanting (DAT) and upto harvest in the sub-plots were replicated thrice. June 16 transplanted crop was found infested with weeds more heavily than July 1 and July 16 transplanted one. Weed-free maintenance upto 45 DAT was found essential to obtain good grain yields, more so in the June 16 transplanted crop. Delayed transplanting reduced grain yields, the reduction was aggravated in presence of weeds in the field.

CRITICAL PERIOD OF CROP-WEED COMPETITION IN RAGI (*ELEUSINE CORACANA* G.) AND BARNYARD MILLET (*ECHINOCHLOA FRUMENTACEA* LINN.)

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Vivekananda Parvatiya Krishi Anusandhan Shala Almora

Weed management trials on finger millet (*Ragi*) and barnyard millet were conducted during Kharif 1979, 1980, and 1981. Ten treatments were studied to find out the critical period for crop-weed competition. Percentage reductions in mean grain yields without weed control for the first 30, 45, 60 and 75 days after seeding and in the unweeded check were respectively 24, 59, 67, 74 and 77 in *Ragi* and 23, 67, 81, 98 and 98 in barnyard millet.

When weed-free conditions were maintained only upto the first 30, 45, 60 and 75 days after seeding, the percentage reductions in grain yields were 41, 23, 17 and 16 in *Ragi* and 41, 25, 14 and 6 in barnyard millet, respectively. Presence of weeds during every crop growth stage reduced crop yields. The production levels showed a progressive decline with increasing delay in weeding and also the losses were higher when the weedings were stopped early. However, the most severe reduction occurred within the first 30 to 45 days of seeding which can be taken as the critical period of crop-weed competition in these crops.



#### EFFECT OF CANNABIS SATIVA L. ON YIELD OF RABI MAIZE (*ZEA MAYS* L.)

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Infestation of *Cannabis sativa* L. caused heavy yield reduction in winter maize (62.5%). Two handweeding, 25 and 45 days after sowing, were found effective in controlling *Cannabis sativa* L. till harvest. Pendimethalin and metribuzin totally inhibited the germination of the weed. Application of 2, 4-D at 60 days stage paralysed its growth but did not kill it. Metribuzine, pendimethalin and handweeding twice proved superior to control and one handweeding, and were at par with 2, 4-D. Metribuzine application resulted in the highest yield (65.06 q/ha) followed by pendimethalin (55.06 q/ha) and two handweeding (51.66 q/ha).

1/2 kg  
Metribuzin

#### EFFECT OF DATE OF PLANTING AND ASSOCIATION OF WHEAT ON GROWTH OF *PHALARIS MINOR*.

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Seeds of *Phalaris minor* were planted separately and in association with wheat in a field on 30th October, 15th November, 1st and 15th December. Randomised Block design with three replicates and net plot size of 6 sq. m was used. It was observed that the height of *Phalaris minor* plants and their ear heads increased as the planting was delayed from 30th October to 1st December. Thereafter it decreased. Population and gross yield of *Phalaris* was drastically reduced when its seeds were sown along with wheat in comparison to its pure stand. This indicates that wheat suppresses *Phalaris* within its rows.

#### STUDIED ON THE COMPETITIVE VALUE OF Kharif CROPS.

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In the field experiment during 1980-81 and 1981-82, three weed control treatments viz. weedy check, weeding at 30 days after sowing and weed free were included and their effects on the competing ability of Moong, Cowpea, Pearl millet and Sorghum were determined. The studies revealed that weeds left through out the growing cycle of Moong, Cowpea, Pearl millet and Sorghum reduced the potential by 51.0, 52.3, 62.7 and 61.4 per cent during 1980 and 45.5, 54.5, 58.0 and 55.1 per cent during 1981, respectively. Comparison of yield from plots weeded at 30 days after sowing with weedy check showed that the yield obtained were 26.5 to 31.8, 25.1 to 37.9, 41.5 to 49.4 and 37.7 to 42.3 percent higher than weedy check in Moong, Cowpea, Pearl millet and Sorghum, respectively. The dry weight of weeds in weedy check at different stages was not significant in any of the crops tried.

### SESSION 3-A

## WEED CONTROL IN PULSES AND LEGUMES

### EFFICACY OF CHEMICAL AND CULTURAL WEED CONTROL METHODS IN BLACK GRAM

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A comparative study of different weed control methods in Black gram (*Vigna mungo* (L.), Hepper) was executed at J. N. K. Vishwa Vidyalaya, Research Station Mandsaur (M. P.). Results revealed that crop was heavily infested with both monocot and dicot weeds right from the early stage of crop growth curtailing the production level by 92 to 265 percent. Two years (1980-81 and 1981-82) trials indicated the superiority of herbicides over conventional methods of weed control by reducing weed density by more than eight times and enhancing production by two folds. Igran and stomp applied as pre emergence @ 1.0 kg a.i. kept down the weeds to a safe level. Initial handweeding followed by interculture (*Kolpa*) or exclusive hand weeding pushed up the crop yields but the levels due to such cultural means were not statistically different to some of the promising herbicidal treatments.

### RELATIVE EFFICACY OF HERBICIDES FOR WEED CONTROL IN MUNG BEAN

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The field experiments were conducted during the rainy seasons of 1980 and 1981 at the Research Farm of Haryana Agricultural University, Hissar to study the effect of various herbicides on weed control in mung bean. Twelve treatments comprising of five herbicides viz; oxadiazon (0.75 and 1.0 kg/ha), pendimethalin (1.0 and 1.5 kg/ha), methabenzthiazuron (1.0 and 1.5 kg/ha), metribuzin (0.25 and 0.5 kg/ha) and fluchloralin (1.0 and 1.5 kg/ha), weedy and weed free checks were compared in a randomized block design replicated three times. Fluchloralin was applied as pre-plant incorporation and the remaining herbicides as pre emergence spray on the next day of sowing. Application of fluchloralin 1-1.5 kg/ha, pendimethalin 1-1.5 kg/ha and oxadiazon 0.75 kg/ha effectively controlled the major weeds i.e. *Echinochloa colonum* and *Trianthema portulacastrum* and gave significantly higher seed yield over weedy check. Metribuzin and methabenzthiazuron controlled the weeds satisfactorily but had adverse effect on crop stand and thus low yields.

## STUDIES ON WEED CONTROL IN URDBEAN

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Experiments were carried out to find out the critical period of weed control and to evaluate the efficacy of herbicides for weed control in Urdbean. There was 87% reduction in the grain yield of urdbean when weeds competed for the full season. Weed competition for the first 15 days could not cause significant reduction in the grain yield whereas competition after 15 days reduced the grain yield. The weeds that emerged after 30 days of sowing had no adverse effect on the crop because of low density and slow growth. The crop developed closed canopy after 30 days and suppressed the weeds emerging at later stages. The critical period was identified to be between 15-30 days of planting.

Pre-emergence application of pendimethalin, methabenzthiazuron and pre-plant incorporation of fluchloralin caused significant reduction in the number and dry matter of weeds over weedy check. Pendimethalin at 2.0 kg/ha produced grain yields significantly higher than all the rates of methabenzthiazuron (1.0, 2.0 and 3.0 kg/ha). Two weedings done at 15 and 45 days after sowing, pendimethalin (2.0 kg/ha) and fluchloralin (1.0 kg/ha) yielded at par with each other.

## EFFECTS OF RATES OF OXYFLUORFEN, ACIFLUORFEN AND METRIBUZIN ON WEED CONTROL IN SOYBEAN

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Pre-emergence application of oxyfluorfen (0.1, 0.2, 0.3 kg/ha), metribuzin (0.5, 0.75, 1.0 kg/ha) and post-emergence application of acifluorfen were tried for weed control in soybean. The major weed species were *Echinochloa colonum*, *Digitaria sanguinalis* and *Dactyloctenium aegypticum*. There was about 70% reduction in the grain yield of soybean due to uncontrolled weeds. Total number of weeds as well as dry weight of weeds was reduced with the increase in the rate of herbicides. Metribuzin at all the rates of application gave significantly higher grain yields than oxyfluorfen and acifluorfen. There was no significant increase in the grain yield with the increase in the rates of herbicides. *Dactyloctenium aegypticum* was not controlled by acifluorfen.

## WEED CONTROL STUDIES IN GRAM

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Studies were carried out to determine the critical period of weed control and to evaluate the performance of herbicides in gram. The major weed species associated were *Chenopodium album*, *Melilotus alba*, *M. indica*, *Fumaria parviflora* and *Anagallis arvensis*. On an average, weedy condition caused 50% reduction in the grain yield of gram. Weedfree condition maintained for the first 60 days and beyond yielded at par with weedfree treatment. There was no advantage of weedfree condition maintained beyond 60 days of sowing. Weed competition for the first 30 days and beyond caused significant reduction in the grain yield.

Oxyfluorfen, pendimethalin, metribuzin, methabenzthiazuron and fluchloralin were tried at three different rate. The highest grain yield (2111 kg/ha) was obtained with metribuzin @ 1.0 kg/ha followed by metribuzin @ 0.75 kg/ha (1962 kg/ha) and oxyfluorfen @ 0.15 kg/ha (1895 kg/ha).

## CHEMICAL CONTROL OF WEEDS IN CHICKPEA (*CICER ARIETINUM*)

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Weed control studies were conducted at the Punjab Agricultural University, Ludhiana during 1978-79 and 1980-81, on loamy sand soil having low organic carbon under irrigated conditions with gram variety G 130. Pre-emergence application of terbutryn at 0.75 kg/ha or methabenzthiazuron at 1.05 kg/ha was most effective in controlling weeds. These herbicides reduced the weight and number of weeds to the same levels as two hand weedings, which is the traditional practice, and gave slightly higher yields. The grain yield of chickpea was about 40% less in the unweeded check than with two hand weedings. The herbicides, fluchloralin, alachlor and nitrofen gave less effective weed control than hand weeding, terbutryn and methabenzthiazuron.

## EFFECT OF DIFFERENT PERIODS OF WEED-FREE MAINTENANCE ON THE YIELD AND QUALITY OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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A field experiment was conducted during kharif 1980 and 1981 at Haryana Agricultural University, Hissar. The object of the experiment was to find out

the effect of different periods of weed-free maintenance on the pod yield of groundnut. Different periods of weed free maintenance viz. weed free upto 15, 30, 45, 60, 90 DAS and upto harvest were compared with weedy check in a randomized block design with three replications. Weed-free maintenance for initial 45 DAS was required to avoid significant loss in the potential yield in comparison to weed free check. On an average, the pod yield of groundnut due to weed free maintenance upto 15, 30 and 45 DAS was 811, 1873 and 3713 kg/ha as compared to 607 kg/ha in weedy check.

### SESSION 3-B

## WEED CONTROL IN OIL SEEDS, FIBRE AND SUGAR CROPS

### WEED MANAGEMENT IN COTTON

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Studies were undertaken on effect of various herbicides and cultural practices on Weed management in Cotton, variety SRT-1, under rainfed conditions in Kharif 1980-81 and 1981-82 at Marathwada Agril. University, Parbhani. The experiment consisted of 4 cultural treatments under main-plots, viz. (1) no weeding and no hoeing, (2) One hand weeding and normal hoeings, (3) One hand weeding and no hoeing and (4) Normal 3 hand weedings and 3 hoeings, and 6 herbicidal treatments under subplots, Fluchloralin @ 1.25 kg/ha preplant ( $T_1$ ) Oxadiazon @ 1 kg/ha preem ( $T_2$ ) Diuron @ 0.75 kg/ha post-em ( $T_3$ ),  $T_1+T_2$ ( $T_4$ ),  $T_2+T_3$ ( $T_5$ ) and control ( $T_6$ ).

At harvest, the lowest drymatter accumulation of weeds (172.5 kg/ha) and lowest weed index (15.5%) were noticed under 3 weedings and 3 hoeings, resulting in highest seed cotton yield (607.5 kg/ha) and maximum net profit (Rs. 1772.5/ha) as against the highest weed dry matter accumulation lowering the seed cotton yield and profit to the minimum of 215.5 kg/ha and Rupees 975/ha, respectively, under unweeded control.

Fluchloralin followed by oxadiazon ( $T_4$ ) proved to be the most effective herbicidal treatment giving 549.5 kg seed cotton/ha with a net profit of Rs. 1204/ha as against fluchloralin alone giving 478 kg seed cotton/ha with a net profit of Rs. 1099.5/ha.

## STUDIES ON CHEMICAL WEED CONTROL IN COTTON

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An experiment was conducted on cotton Cv. Mev-5 at Regional Agricultural Research Station, Lam (Guntur District) during kharif 1981. The experiment was laid out in Randomised Block Design with three replications and twelve treatments. The herbicides tried were nitrofen at 1.87 kg/ha; dalapon at 7.14 kg/ha; dalapon at 4.25 kg+paraquat at 0.25 kg/ha; oxadiazon at 0.75 kg/ha; diuron at 1.80 kg/ha; diuron at 1.0 kg+paraquat at 0.25 kg/ha; fluchloralin at 1.75 kg/ha; paraquat at 0.5 kg/ha and bentazon 2.0 kg/ha. Dalapon+paraquat; diuron+paraquat; paraquat and bentazon were used as post-emergence sprays 20 days after sowing. Good weed control was recorded in diuron and oxadiazon treatments. All herbicide treatments recorded lower weed population than hand weeding and intercultivation. Dry weight of weeds was minimum in dalapon treatment and maximum in unweeded control. Maximum yield was recorded in dalapon treatment and this was at par with hand weeding; diuron+paraquat; intercultivation; diuron and fluchloralin treatments. The net monetary returns were also highest in dalapon treatment.

## WEED CONTROL IN SUGARCANE THROUGH HERBICIDES

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A large number of herbicides were tried at H. A. U., Regional Research Station, Karnal during three crop seasons (1979-80 to 1981-82) to test their effectiveness in controlling the weeds in sugarcane, and finally their effect on cane yield and quality. Amongst all these herbicides, the application of Sencor [4-amino-6-tert.-butyl-3-(methylthio)-1, 2, 4-triazin-5-(4H)-One] @ 875 gms a.i./ha approximately three weeks after planting proved to be the most effective one in respect of weed control as well as cane yield. This was closely followed by the application of simazine or atrazine @ 2.0 kg/ha 2-3 days after planting plus 2, 4-D sodium salt @ 2.0 kg a.e./ha 3 weeks after planting and second similar dose of 2, 4-D sodium salt two weeks after earthing. The most common weeds recorded were *Cyperus rotundus*, *Cynodon dactylon*, *Convolvulus arvensis*, *Trianthema monogyna*, *Amaranthus spinosus*. All these weeds were controlled with the application of above mentioned herbicides. But in the month of June, *Cyperus rotundus* and *Cynodon dactylon* again revived in herbicide treatments which caused reduction in yield in comparison to conventional weeding.



## EVALUATION OF OXYFLUORFEN FOR WEED CONTROL IN EARLY SUGARCANE CV. COC. 671

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A field experiment was conducted during late main season (planting in April/May) of 1981 in sugarcane at the Agricultural College Coimbatore to study the nature of weed problem and to find out a suitable herbicide for weed control in quick growing and early maturing variety of sugarcane. The effect of oxyfluorfen as pre emergence herbicide applied alone at 0.125 kg/ha and 0.188 kg/ha and in combination at 0.125 kg/ha with 2,4-D 1.0 kg/ha was equivalent to the standard pre-emergence combination of atrazine and 2,4-D (2+1 kg/ha) in controlling all the annual weeds, except *Echinochloa colonnm* and *Euphorbia prostrata*. Oxyfluorfen and 2,4-D combination increased the growth and yield of sugarcane due to the better weed control. Conventional manual method (1 hoeing with hand weeding on 40th day after planting and the same on 60th day) was also comparable with these herbicide treatments. No phytotoxic effect due to oxyfluorfen was observed on the growth of succeeding crops, following sugarcane.

## WEED SPECTRUM AND POD YIELD OF GROUNDNUT AS INFLUENCED BY PHOSPHORUS LEVELS AND WEED MANAGEMENT

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The influence of weed management on weed spectrum and pod yield of Groundnut under varying Phosphorus levels was studied. Among the identified 17 weed species belonging to eight taxonomic families, *Cynodon*, *Cyperus*, *Dacteloc-tenium*, *Digitaria*, *Celosia*, *Digera*, *Lagasea* were the dominant weeds associated with Groundnut. Weed density was maximum in the initial stages and decreased gradually. Nitrofen, Fluchloralin and Pendimethalin were found to be the best herbicides in controlling many of the above weeds. Bentazon could control dicot weeds but not monocot weeds. Weed density, weed dry matter and Groundnut pod yield were not influenced by different levels of Phosphorus. Reduction in pod yield due to weeds was 76.3%. The weed control efficiency of Nitrofen was significantly higher than that of all other herbicides studied. Fluchloralin and Pendimethalin were found to be the next promising herbicides in Groundnut. Detailed results are presented and discussed in the paper.

## COMPARATIVE EFFICIENCY OF SOME HERBICIDES FOR WEED CONTROL IN GROUNDNUT

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Field experiments were conducted during 1978-79 to study the comparative efficiency of Alachlor (2.0), IC-21 (Tok+DNBP) (1.0), Dibutalin (1.12), Fluchloralin (0.8), Metabromuron (0.5) and Na salt of 2, 4-D (2.0) for weed control in groundnut grown during kharif, winter and summer seasons. All the herbicides were applied as pre-emergence soil application 2 days after sowing. These herbicide treatments were compared with farmer's practice (hoeing twice at 15 and 35 days and weeding at 30 days) and Un-weeded control. All the herbicide treatments received one hoeing operation 35 days after sowing.

During kharif significantly higher pod yield was obtained with cultural (two hoeings followed by one weeding) than herbicidal treatments and unweeded control. Among the herbicidal treatments Alachlor and Dibutalin showed good weed control and recorded significantly higher yield than other herbicide treatments.

During winter IC-21 @ 1.0 kg/ha was found to be best followed by Alachlor (2.0 kg/ha) and Fluchloralin (0.8 kg/ha). While during summer, Fluchloralin 0.8 kg/ha as pre-sowing incorporated to 5 cm and Na salt of 2, 4-D (2.0 kg/ha) showed excellent crop selectivity and weed control and recorded 2.04 and 1.73 % higher pod yield over that of cultural treatment.

## SELECTIVITY & EFFICIENCY OF SOME NEW HERBICIDES FOR WEED CONTROL IN SESAMUM.

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Field studies were carried out during kharif, 76 and summer seasons of 77 to findout a suitable herbicide for control of weeds in sesamum and its effect on the seed yield.

The treatments consisted of 4 herbicides tried alone and in combination with cultural treatment of one weeding 30 days after sowing. Conventional farmer's practice (one hoeing at 15 and hand weeding at 30 days after sowing) and un-weeded check were included to asses their relative performance during kharif, 76. While during summer trial of 77, 8 herbicides were tried with two cultural treatments of un-weeded check and conventional farmers' practice. The important weeds in the order of abundance were *Digitaria sanguinalis*, *Dactyloctenium aegyptium*, *Sporobolus diandor*, *Cyperus rotundus*, *Eupatorium glandulosum* and *Acanthospermum hispidum*.

The result of kharif, 76 revealed that application of Treflan @ 0.5 kg/ha as pre-sowing soil incorporation to 5 cm reduced the weed population and dry matter of weeds. Maximum yield of grain was recorded with Treflan + one weeding-followed by treatment of Treflan application only. Linuron (@ 1.0 kg/ha) applied pre-emergence had some phytotoxicity to the sesamum crop resulting in significantly lower yields over the Un-weeded control plots. From trial of summer, 77; it was found that all the herbicides applied either as pre-sowing or pre-emergence showed excellent selectivity to crop through uniformity of germination and seedling stand of sesamum. Asulam and Alachlor (@ 1.0 kg/ha each) applied as pre-emergence and Treflan (@ 0.5 kg/ha) as pre-sowing spray gave excellent weed control. Maximum grain yield was recorded in Asulam treated plots followed by Treflan and Alachlor.

#### STUDIES ON CHEMICAL CONTROL OF WEEDS IN INDIAN MUSTARD (*BRASSICA JUNCEA* COSS.).

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A field experiment was conducted at the Punjab Agricultural University, Ludhiana during *rabi* 1981-82 to evaluate the efficacy of fluchloralin (0.50 & 0.75 kg/ha) and trifluralin (0.5 and 0.75 kg/ha), as pre plant and terbutryn (0.5 & 0.75 kg/ha), oxydiazon (0.5 and 0.75 kg/ha), pendimethalin (0.5 and 0.75 kg/ha), isoproturon (0.5 & 0.94 kg/ha) and thiobencarb (1.0 & 1.5 kg/ha) as pre-emergence for controlling weeds in Indian mustard. The results showed that all the herbicides gave an effective control of weeds and had no phyto-toxic effect on the crop. Oxydiazon 0.5 and 0.75 kg/ha was observed to induce partial thinning of the crop but there was no depression in the seed yield. Trifluralin 0.5 kg/ha gave maximum seed yield (1500 kg/ha) and it was significantly higher than two hand weeding and other herbicidal treatments. Fluchloralin, terbutryn, isoproturon and thiobencarb at the doses tested yielded significantly higher than no weeding and were on a par with two hand hoeings. Pendimethalin gave good control of weeds but it yielded significantly lower than two hand hoeings.

#### CHEMICAL WEED CONTROL IN NIGER (*GUIZOTIA ABYSSINICA* CASS)

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To control weeds in niger (variety-N-36) field trial with 6 herbicides were carried out for two seasons. Herbicides were either at par or inferior to one hand weeding but highly effective than unweeded control. Maximum grain yield was obtained under one hand weeding at 30 days after sowing. Amongst herbicides, application of oxadiazon 1.5 kg/ha, alachlor 1.0 kg/ha and pendimethalin 1.0 kg/ha as pre-emergence produced significantly higher grain yield of niger than weedy check by controlling all types of weeds.

#### SESSION 4-A

### WEED CONTROL IN MAIZE AND MILLETS

HERBICIDAL-CUM-CULTURAL APPROACH ON WEED CONTROL IN RAGI  
(*ELEUSINE CORACANA* GAERTN).

G. K. PATRO and G. C. TOSH

Orisa University of Agriculture & Technology, Bhubneswar

MSMA and Propanil were tried at the dosage rate of 2.24 kg/ha, and MCPA at 1.5 kg/ha as post-emergence sprays for control of weeds in Ragi. They were also tried in combination with one weeding. Cultivators' practice of two hand weedings and Un-weeded control were kept for comparison.

Propanil was very effective against all dominant Gramineae and Cyperaceae weeds and caused no deliterious effect on the transplanted seedlings. Further supplementation of hand weeding was not necessary. Maximum grain yield was obtained with Propanil+weeding. Propanil+weeding and Propanil alone were significantly superior to 'cultivators' practice of two hand weedings.

STUDIES ON RESIDUAL EFFECT OF SIMAZINE AND ATRAZINE APPLIED  
TO MAIZE ON SUCCEEDING RABI FIELD AND VEGETABLE CROPS

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In field studies, the residual effect of simazine and atrazine applied as pre-emergence in maize on succeeding oats, wheat, peas, radish and turnip was investigated on a loamy sand soil during 1980-81 and 1981-82. Simazine and atrazine at 0.625, 1.250 and 1.875 kg/ha gave an effective control of annual grass and broad-leaf weeds and did not show any soil residual adverse effect on the emergence count, growth and yield of following oats, wheat (*T. aestivum*), peas, radish and turnip crops.

EFFICACY OF ATRAZINE AND OTHER HERBICIDES FOR WEED CONTROL  
IN MAIZE (*ZEA MAYS* L.).

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In field experiment conducted during 1980 and 1981, band application of atrazine 0.33 kg/ha as early post-emergence (5 days after sowing) followed by

paraquat 0.25 kg/ha gave same level of efficacy as atrazine 1.0 kg/ha pre-emergence and two hands weedings with regard to weed control potential and grain yield of maize. Delayed application of atrazine band (10 and 15 days after sowing) resulted in significant reduction in grain yield of maize compared with its pre-emergence application. Atrazine 0.625 kg/ha pre-emergence gave 15.2 & 10.8 per cent lower grain yield as compared to atrazine 1.0 kg/ha and its band application. The pre-emergence application of terbutryn 1.0 kg/ha and pendimethalin 0.75 kg/ha gave unsatisfactory control of weeds.

#### WEED CONTROL STUDIES IN INTERCROPPING SYSTEMS OF MAIZE

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Weed control studies were carried out involving four cropping systems, viz., maize alone, maize+black gram, maize+green gram and maize+soybean and five weed control treatments (fluchloralin 0.75, nitrofen 1.0, linuron 0.25 kg/ha, manual weeding and weedy check). Intercropping with black gram, green gram and soybean did not affect the weed growth. Grain yield of black gram was significantly more over green gram and soybean. Maize grain yields were not reduced due to any intercrop. Fluchloralin appeared more effective in checking the weed growth as compared to linuron and nitrofen and registered significantly more yield over these herbicides.

#### EFFECT OF CULTURAL PRACTICES ON MAIZE BASED INTERCROPPING SYSTEM

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A field experiment was carried out during Kharif 1980 and 1981 to find out the suitability of cultural practices like hand weeding and hoeing in maize-based intercropping system. The intercrops cowpea, groundnut, frenchbean, blackgram and greengram were tested. During the first year, maize+hand weeding twice recorded highest monetary return followed by maize+groundnut and maize+cowpea with one hoeing. However, in the second year maize+cowpea intercropping system with one hoeing maintained its superiority over hand weeding. Weed dry matter recorded in these two treatments was found less, compared to other treatments maize+cowpea based intercropping system with one hoeing was thus, found better in this experiment.

## INVESTIGATION ON WEED MANAGEMENT THROUGH CHEMICALS AND INTERCROPPING IN *BAJRA* (*PENNISETUM TYPHOIDES*) GROWN FOR FODDER

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To develop an effective weed control schedule for *Bajra* grown for summer fodder, a field investigation was made in sandy loam soil during summer, 1982. The results indicated satisfactory control of *Trianthema monogyna* Linn. and *Cyperus rotundus* L. by 2, 4-D resulting in an increase of 100 q/ha or 39% in fodder yield over weedy check. Pre-emergence application of atrazine controlled weeds, except *Cyperus rotundus* and gave fodder yields similar to that obtained under 2, 4-D treatment. Inclusion of Cowpea (*Vigna unguiculata* (L.) Walp.) as a weed smothering crop in intercropping resulted in weed suppression and also showed beneficial effect on fodder yield of *Bajra* to the extent of 51 q/ha or 20% over unweeded check along with 40 q/ha bonus yield of cowpea fodder. Preplanting treatment of Basalin appeared an alternative to one hand weeding.

### SESSION 4-B

## WEED CONTROL IN VEGETABLES AND ORCHARD CROPS

### CHEMICAL CONTROL OF WEEDS IN PEAS (*PISUM SATIVUM* L.)

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Three years field studies were conducted on chemical weed control in Peas at Haryana Agricultural University, Hissar during 1978-80. One pre-planting (Fluchloralin @ 1.0 and 1.5 kg/ha) three pre-emergence (Blazer, pendimethalin @ 1.0 and 1.5 kg/ha and nitrofen at 1.5 and 2.0 kg/ha), two post emergence (Blazer and Bentazone @ 1.0 and 1.5 kg/ha), along with weeding at 3 weeks and 3 & 6 weeks after sowing were compared with weed free and weedy check. In the first year alachlor was also tried but during next two years, Blazer and pendimethalin were included in the place of alachlor. The yield reduction due to presence of weeds in peas were 35.2, 24.3 and 24.6 during 1978, 1979 and 1980, respectively. Fluchloralin and pendimethalin at higher doses being almost at par with weeding at 3 & 6 weeks after sowing gave consistently higher yields as compared to other treatments. Fluchloralin applied as pre-plant incorporation and pendimethalin applied as pre-emergence at higher doses were effective in providing season long control of *Chenopodium album* and *Fumaria parviflora*. Mechanical weeding at 3 & 6 weeks after sowing was equally effective in controlling these weeds.



EFFECT OF WEED COMPETITION ON GROWTH OF YOUNG SEEDLINGS OF  
GUAVA (*PSIDIUM GUAJAVA* L.), KARNA KHATTA (*CITRUS KARNA* REF.)  
AND KAGZI LIME (*CITRUS AURANTIFOLIA* SWINGLE)

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The competitive effect of three group of weeds viz. grasses, broad leaf weeds and sedges on Karna Khatta, Kagzi lime and Guava was studied.

Three months old seedlings of above mentioned fruit trees were planted in black polythene bags filled with a mixture of soil : sand : manure in ratio of 2 : 1 : 1. Seedlings were allowed to grow in association with weeds of different groups individually and mixed. A weed free control was also included.

In all treatments, growth and vigour of karna Khatta, kagzi lime and guava seedlings was reduced drastically over control. The percent reduction in plant height and stem diameter due to competition was in the order of Kagzi lime > Guava < Karna Khatta. Karna khatta proved to be the most sensitive to weed competition. The maximum reduction in plant height recorded was 68.8% both by *Cyperus rotundus* and *Cynodon dactylon*. Whereas 50.0 per cent reduction in guava plant height was recorded by *Cynodon dactylon*. The kagzi lime reduced by 41.9 per cent in plant height due to competition with broad leaf weeds, which was maximum in comparison to other treatments. Similar reduction in stem diameter was also recorded. It is concluded that the weeds are more harmful at the early stage of seedling growth as compared to advanced stage of growth.

SCREENING TRIAL OF HERBICIDES FOR GUAVA, KARNA AND KAGZI LIME  
SEED BED

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A mini plot experiment was under taken to evaluate the performance of different herbicides for Guava (*Psidium guajava* L.) Karna Khatta (*Citrus karna* Ref.) and Kagzi lime (*Citrus aurentifolia* Swingle) seed bed. Three 2,4-D compounds (viz. Sodium salt, di-methyl amine and ethyl ester), Karmex (diuron), Sencor (metribuzin) Atrazin Nata (TCA Sodium) and Dalapon were applied at pre-emergence stage of both crop and weeds. None among the above herbicides tested could control all three types of weeds viz. grass, broad leave and sedges at same efficiency. Most of the herbicides exerted a strong impact on one or two type of weeds. Karmex (diuron) and 2,4-D compounds have effectively controlled broad leaf weeds and sedges. The performance of 2,4-D compound did not vary much in karna, kagzi lime and guava seed beds.

Grasses were reduced in number by Nata, Sencor and Atrazin treatments. The sedges were also depressed for a longer period of time. Dalapon did not show any remarkable effect on broad leave and sedges, however grasses were reduced in number.

The number of seedlings at the end of experiment was maximum in karna with sencor 2 kg a i/ha followed by Karmex at 2.0 kg a i/ha and 2,4-D ethyl ester. Highest number of guava seedlings was in 2,4-D ethyl ester at 1.5 kg a. i/ha followed by 2,4-D Sodium salt 1.5 kg a.i/ha (91.0). Atrazine drastically reduced the number of guava seedlings and exerted a strong toxic effect on germination of guava seeds. A considerable variation in plant height, stem diameter leaf number, leaf area, fresh and dry weight of seedlings of karna, kagzi lime and guava was also recorded due to herbicidal treatment.

#### CHEMICAL WEED CONTROL IN TURMERIC

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More often turmeric is grown mixed with maize, pigeon pea and castor. Therefore, an experiment was conducted to find out the efficacy of weedicides in different doses for turmeric grown in association with maize and pigeon pea. In maize+turmeric inter-cropping system simazine or atrazine @ 2 kg/ha effectively controlled weed growth and significantly surpassed manual weeding. In Turmeric+pigeon pea or Turmeric+maize+pigeon pea intercropping systems pre-emergence application of Lasso @ 2 kg a. i./ha was found to be more effective and economical than other treatments including hand weeding.

#### EFFECT OF MULCHING AND WEEDICIDES ON GROWTH AND FRESH RHIZOME YIELD OF GINGER

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Results of an experiment to find out the effect of mulching and weedicides on ginger yield revealed that mulching with dried leaves or straw remarkably suppressed early weed growth and enhanced crop emergence, crop growth and ultimate yield. In no-mulch control treatment the yield was reduced by 42.8%. Pre-emergence application of 2,4-D (1 kg a.e./ha) or atrazine (1 kg/ha) was as effective as those of four hand weeding. Higher herbicidal doses caused injury to the crop. 2,4-D or atrazine @ 1 kg/ha along with mulching gave higher yield and net monetary return.

## CHEMICAL WEED CONTROL IN MANGO NURSERY

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Weed control by herbicides in mango root stock nurseries was carried-out at the experimental farm of the Indian Institute of Horticultural Research, Hessaraghatta during the year 1981-82. Seven pre-emergent herbicides namely atrazine, diuron, terbacil sencor, butachlor, fluchloralin at 2.0 and 3.0 kg/ha and oxyfluorfen at 0.5 and 1.0 kg/ha were included in the trial. Gramoxone, fernoxone, illoxan at 2.0 and 3.0 kg a.i./ha and glyphosate at 1.0 and 2.0 kg a.i./ha were used as postemergent sprays.

Diuron, atrazine; fluochloralin and oxyfluorfen at both the concentrations were found to be equally effective in controlling both broad leaf and grassy weeds including *Cyperus* spp and *Cynodon dactylon* as measured by the dry matter production of weeds compared to control. Germination of mango stones was not affected adversely in any of the herbicide treatments. Terbacil and sencor even at lower concentrations were found to be phytotoxic to the growth of mango seedlings. Only Garmoxone and Fernoxone at higher concentration was useful as post emergent spray in controlling weeds for a period of 30-40 days.

## HERBICIDAL CONTROL OF WEEDS IN ONION (*ALLIUM CEPA* L.).

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Investigations were conducted at the Punjab Agricultural University, Ludhiana during rabi 1981-82 to study the efficacy of pre-plant and pre-emergence of application Oxadiazon (0.5 and 0.75 kg/ha), pendimethalin (0.75 and 1.5 kg/ha), methabenthiiazuron (0.875 and 1.31 kg/ha) and isoproturon (0.75 kg/ha) for control of weeds in onion for bulbs. All the herbicides applied pre-emergence gave better weed control and higher bulb yield than their application as pre-plant. Pre-emergence application of oxadiazon 0.5 kg/ha and methabenthiiazuron 0.875 kg/ha gave an excellent control of grasses and broad-leaf weeds and yielded 37.7 and 49.3 per cent higher than two hand hoeings. Isoproturon was found to be phyto-toxic to onion seedlings and adversely affected the stand of the crop.

## INFLUENCE OF HERBICIDES ON WEED CONTROL EFFICIENCY GROWTH AND YIELD OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL).

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The tolerance of tomato (*Lycopersicon esculentum* Mill.) var. Pusa Rubi to four herbicides Viz., metribuzin (@ 0.35, 0.525 kg/ha) alachlor (@ 1.0, 1.5, 2.0

kg/ha), linuron (@ 0.125, 0.25 kg/ha) and paraquat (@ 0.25 kg/ha) and their weed control efficiency were studied. The crop was tolerant to all herbicides at all levels. The highest weed control efficiency was noted in metribuzin @ 0.35 kg/ha pre plant and it produced higher yield compared to other treatments. It was also economical than other treatments and hand weeding. The dry matter content of fruit and total soluble solids were not affected by herbicide treatments.

#### STUDIES ON THE RELATIVE EFFICIENCY OF HERBICIDES FOR WEED CONTROL IN POTATO

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Field experiments were carried out during monsoon seasons of 1973-74 and 1975-76 at the High Altitude Research Station, Pottangi. During 1973-74, herbicides like nitrofen, simazine, 2, 4-D, propanil, alachlor, metabromuron, dichloromate, aresine were tested while during 1975-76 simazine, propanil, alachlor, metabromuron, dowpon were tested against weed control in monsoon potato (Kufri-chandramukhi). The herbicides were individually compared with that of weedy-check and hand weeded check (weeded on three different occasions during the season). The climatic condition during the crop season was comparatively cool and cloudy with frequent showers of rain, for both the seasons. The soil was sandyloam in texture, high in organic matter and in available nitrogen, phosphorus and potassium and acidic in reaction. *Cyperus rotundus*, *Poa annua*, *Echinochloa colonum*, *Setaria glauca* were the major monocot and *Biden pilosa* and *Ageratum conyzoides* were the dicot weeds found in the experimental area.

During 1973-74, maximum tuber yield of 77.56 q/ha was with nitrofen followed by alachlor (70.72 q/ha), hand weeded check (58.54 q/ha) and the lowest with weedy check (31.83 q/ha). Application of Propanil @ 2.0 lit/ha showed some deleterious effect which was applied as post-emergence at 15 days after sowing the crop. During 1975-76, alachlor (3.0 kg/ha) treatment resulted in highest tuber yield (78.80 q/ha) followed by hand weeded check (68.64 q/ha). The tuber yield with weedy check was (44.33 q/ha) which was the lowest due to severe crop-weed competition.

#### COMPARATIVE EFFICACY AND SELECTIVITY OF HERBICIDES ON SEED YIELD OF PEA (*PISUM SATIVUM* SUBSP *HORTENSE* L.)

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In a field experiment maximum number of branches, flowers and pods at 90 days after seeding were recorded under Prometryne 1.0 kg/ha. Prometryne, alachlor

and fluchloralin did not exhibit any phytotoxic effect on the pea crop. Presence of weed density of 211/M. Sq. during the crop life reduced the yield by 23.98 percent under weedy check. Twenty eight weed species were observed in weedy check. The most noxious weed species were *Ageratum conyzoides*, *Rumex crispus*, *Physalis minima*, *Desmodium triflorum*, *Vicia sativa*, *Lathyrus aphaca* and *Cyperus rotundus*.

All the herbicides, except fluchloralin 0.45 l/ha had significantly reduced the weed intensity over weedy check. Lowest fresh and dry matter accumulation of weeds were found in prometryne 1.2 kg and 1.0 kg which controlled *Cyperus rotundus* also. Prometryne 1.0 kg/ha increased the yield by 19.23 percent over other herbicides and the weed-free treatment (three hand weedings) resulting in highest gross profit. Prometryne increased the Eff<sup>+</sup> nodulation. There was no specific influence of disease incidence under different herbicidal and cultural treatments.

#### STUDY ON EFFECTIVENESS OF PRE-EMERGENCE HERBICIDES ON WEED CONTROL AND SEED YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* (L) MOENCH.)

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Five herbicides were tried each at two different dosages alongwith one hand weeding at 45 days after sowing. Then herbicides did not show any phytotoxicity to the crop but, the plant height significantly differed amongst various treatments. The maximum number of branches and leaves at 74 days after seeding were recorded under fluchloralin 0.48 l/ha + one hand weeding. Presence of weeds during the crop life reduced the yield by 66.36 percent under weedy check. Nineteen weed species were observed in weedy check which had the weed density of 1394.57/m<sup>2</sup> at 45 days. The most competitive weed species present were *Commelina benghalensis*, *Setaria glauca*, *Ageratum conyzoides*, *Physalis minima*, *Amaranthus viridis* and *Cyperus rotundus*.

All the herbicides significantly reduced the weed intensity over weedy check. Lowest fresh and dry weight of weeds was found in fluchloralin 0.48 l/ha + one hand weeding followed by prometryne 1.6 kg/ha + 1 H. W. and alachlor 2.5 l/ha + 1 H. W. The maximum seed yield (12.62 and 12.47 percent respectively over 3 hand weedings) was obtained with fluchloralin 0.48 l/ha + 1 H.W. and prometryne 1.6 kg/ha + 1 H. W. than all other treatments. Maximum concentration of nutrients (N, P & K) in straw at harvest was found under fluchloralin 0.48 l/ha + 1 H. W. and prometryne 1.6 kg/ha + 1 H. W. Highest gross profit was obtained with fluchloralin 0.48 l/ha closely followed by prometryne.

## INFLUENCE OF HERBICIDAL TREATMENTS ON THE GROWTH AND SEED YIELD OF GARDEN PEA (*PISUM SATIVUM* SUBSP. *HORTENSE* L.)

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In a field experiment weed control efficiency of all the 16 treatments differed significantly. Fluchloralin 0.9 l/ha was top ranking in yield as it provided weed-free environment without any adverse effect on crop growth. Though its efficiency was slightly less than Terbutryne at both (0.9 & 1.5 kg/ha) concentrations. Alachlor 1.0 l/ha was second regarding yield and net profit over weeded control (one hand weeding). It was significantly superior in reducing weed intensity over Bentazon (0.96 & 1.92 kg/ha) diuron (0.74 kg/ha), prometryne (1.00 & 2.00 l/ha), linuron (0.250 & 0.500 kg/ha) methabenzthiazuron (1.05 kg/ha) and nitrofen (1.25 l/ha) at all the periodic intervals. Prometryne followed by nitrofen, methabenzthiazuron also increased the yield over one hand weeding. Terbutryne at higher dose and linuron at both concentrations were less effective.

## STUDY OF THE EFFICACY OF CERTAIN HERBICIDAL TREATMENTS IN ONION (*ALLIUM CEPA* L.).

P. L. BHALLA and M. L. DUBEY  
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In onion fluchloralin 0.72 l/ha (ppi) exhibited phytotoxic effects and reduced the crop stand. Maximum bulb yield was obtained with pendimethalin 2.0 l/ha which was 38.78 per cent over weeded control. Maximum number of 'A' grade bulbs were obtained in Pendimethalin 1.5 l/ha + 250 g. Linuron/ha (Preplant combination) followed by Pendimethalin 1.5 l/ha + Propanil 3.5 l/ha. The presence of weeds reduced the crop stand and the size of bulbs resulting in a loss of yield by 8.62 per cent. Out of twelve weed species observed the most predominating weed was *chenopodium album*. Fluchloralin, methabenzthiazuron and propanil did not prove effective. There was no harmful effect on quality characteristics i. e. protein content, total soluble solids and dry matter contents of the onion bulbs.

## STUDIES ON WEED CONTROL IN POTATO (*SOLANUM TUBEROSUM* L.)

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The studies on weed control in potato were conducted on black clay loam soils, at Agril. College Farm, Dharwad in kharif season under rainfed conditions.



Three herbicides 1) atrazine 2) simazine each at 0.25, 0.50 and 0.75 kg/ha and nitrofen at 2, 2.5 and 3 kg a.i/ha were compared with hoeing+hand weeding, completely weed free and unweeded check treatments. The results revealed that in the weed free check the tuber yield was maximum (2.6 t/ha) and it was on par with Nitrofen at 3 a.i/ha (2.5 t/ha) and hoeing+hand weeding treatments (2.1 t/ha). Nitrofen was effective in controlling both the dicot and monocot weeds. No crop injury with nitrofen was noticed while with atrazine and simazine at 0.5 and 0.75 ai kg/ha had caused injury to the crop. The dry matter production in potato was inversely proportional to the weed dry matter production.

#### HERBICIDAL WEED CONTROL IN POTATO

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A field experiment was conducted in *Rabi* 1980-81 at Bihar Agricultural College Farm, Sabour. The treatments consisted of pre-plant application of EPTC and fluchloralin each at 1.5 kg/ha nitrofen at 1 kg/ha as pre-emergence, paraquat at 0.25 kg/ha as pre emergence after emergence of weed but before the crop, 2, 4-D Na salt at 0.5 kg a. e./ha as pre emergence, metoxuron at 0.5 kg/ha as pre-emergence, paraquat @ 0.25 kg/ha as post-emergence at 5% germination, paraquat at 0.25 kg/ha at 5% germination plus at 25% germination, as directed spray propanil at 2 kg/ha as post emergence, EPTC followed by propanil, EPTC followed by paraquat, fluchloralin followed by paraquat along with weedy check and hand weeding twice. Herbicidal efficiency was measured by dry matter accumulation by weeds and selectivity by dry matter and tuber yield. After harvesting of tuber crop, the residual toxicity was studied by sowing green gram and sesamum and taking the per cent survival of plants 30 days after sowing and also recording the yield data of bioassay crops.

All the weed control treatments except fluchloralin either applied alone or in combination produced 13.06 q/ha more yield over control which gave tuber yield of 155.86 q/ha. The increased yield was attributed to higher dry matter production and uptake by crop and lower dry matter accumulation and nitrogen depletion by weeds. Nitrofen which equalled to hand weeding, EPTC, propanil, metoxuron and row directed spray of paraquat was efficient in bringing down the weed dry matter and increasing the tuber yield. Fluchloralin was proved very toxic to potato when it was applied alone or in combination resulting delayed and poor germination which caused lower tuber yield. There was no residual toxicity of these herbicides in soil as germination percentage and grain yield of both bioassay crops were unaffected.

## CHEMICAL WEED CONTROL IN BRINJAL SEED CROP (*SOLANUM MELONGENA* L.)

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Four week old brinjal seedlings were planted in a field laid in R. B. D. with replications three and net plot size of  $4.2 \times 4.2$  m<sup>2</sup> immediately after spraying of herbicides. The herbicides were fluchloralin @ 0.75, 1.0 and 1.25, oxyfluorfen 0.125, 0.25 and 0.375, pendimethalin 1.5 and 2.0, oxadiazon 1.0 and 1.5 kg/ha along with one weeding (30 DAP), two weedings (30 and 45 DAP) and weedy check making a total of 13 treatments. Important weeds were *Trianthema portulacastrum*, *Cyperus rotundus*, *Eclipta alba*, *Echinochloa crusgalli* and *Euphorbia thymifolia*. All the herbicides were significantly superior over weedy check in decreasing dry weight of weeds and increasing seed yield of brinjal. The minimum dry matter of weeds (5.9 q/ha) was recorded in oxadiazon 1.5 kg closely followed by stomp 2.0 kg and was significantly superior over fluchloralin 0.75, 1.0 and 1.25 kg/ha and one weeding in decreasing dry weight of weeds. The maximum seed yield was recorded in oxadiazon 1.5 kg/ha (3.21 q/ha) closely followed by two weedings and was significantly superior over oxyfluorfen 0.25, 0.125, one weeding, fluchloralin 0.75, 1.0 and 1.25 kg/ha and minimum was recorded in weedy check (1.07 q/ha).

## SESSION 5

### BIOLOGY OF WEEDS (ECOLOGY, PHYSIOLOGY AND BIOCHEMICAL ASPECTS OF WEEDS)

#### CHANGES IN WEED FLORA OF PADDY FIELDS OF PATIALA DISTRICT (PUNJAB) DURING ELEVEN YEARS

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Studies on the weed flora of paddy fields were initiated in 1971. As many as 68 species belonging to 28 families of flowering plants were observed to grow in the fields and along margins of fields. The paddy crop suffers badly due to higher density and frequency values of sedges and grasses. Weeds, namely *Trianthema portulacastrum*, *Echinochloa colonum* and *Cyperus iria*, are characterized by their higher frequency values (100%). Other important dicot weeds are *Sesbania bispinosa*, *Digera arvensis* and *Eclipta alba*.

Fields were regularly visited every year (1971 onwards). so as to note any changes in the composition of weed flora of paddy crop fields with the passage of time. Majority of the common weeds were noticed to maintain their distribution whereas *Aeschynomene indica*, *Ceratophyllum demersum* and *Lindernia parviflora* have become rare. Interestingly, *Fimbristylis* spp. have become quite common. Detailed studies on changing pattern of composition of weed flora will be of considerable help to plan weed control measures accordingly.

#### INFLUENCE OF SIMAZINE ON DRY WEIGHT, CRUDE PROTEIN AND AMINO ACIDS OF FENUGREEK AND MUNG

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A significant increase in the dry weight and crude protein content of two crops viz. Fenugreek (*Trigonella foenum-graecum* L.) and Mung (*Phaseolus aureus* Roxb.) resulted by applications of simazine. The crops were treated with Simazine at four different developmental stages. The third leaf stage of the plant under spraying action of simazine was affected most. The increase in crude protein content was not, however, concomitant with an increase in lysine and methionine contents. Studies indicated that subtoxic applications of simazine causes an increase in protein content in agronomic crops. However, it appears that consistent enhancement of protein content is difficult to obtain.

#### STUDIES ON EMERGENCE AND POPULATION DYNAMICS OF *PHALARIS MINOR* AND OTHER WEEDS

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An experiment was conducted to study the chronological emergence of *Phalaris minor* and other weeds population in *niche* under different hoeing treatments. The five treatments consisted of control, 1-hoeing on 23, Dec. 2-hoeings (23, Dec. and 12, January), 3-hoeings (23, Dec., 12, January, Feb.) and 4-hoeings (3 hoeings as in 4th+1 at 21, Feb.). The infested field was kept fallow and irrigated first 20 days before these hoeings, subsequently all the plots were irrigated on 23, Dec., 12, January, 1, February and 21, February.

The emergence of *Phalaris minor* was lower under no hoeing. The maximum emergence was noted after first hoeing. The emergence continued after each hoeing

upto 12th March but the population reduced gradually. During the first flush the maximum germination was noted in *Spergula arvensis* followed by *Echinochloa crus-galli*, *Portulaca oleracea*, *Phalaris minor* and *Chenopodium album*. During second flush *Spergula arvensis* again had the higher population followed *P. minor*. After first, second, third and fourth hoeing *P. minor* had the higher emergence as compared to any other species, followed by *Spergula arvensis*, *Portulaca oleracea* and *Chenopodium album*. Germination of *Melilotus alba*, *Medicago denticulata*, *Trifolium flagiform*, *Vicia sativa* and *Anagallis arvensis* was not found after second hoeing and onwards.

#### SUBMERGENCE EFFECT OF RIVER FLOOD WATER ON THE SURVIVAL OF WEED FLORA

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Extensive area of Allahabad Agricultural Institute farm land was inundated by Yamuna river flood water in September 1982. The study on submergence effect of river flood water was conducted on 83 common weed species present in the area.

The degree of tolerance to flooding was classified into four categories as highly susceptible, susceptible, moderately resistant and resistant. Out of the total number of species under study, 12 were highly susceptible, 4 were susceptible, 10 were moderately resistant and rest of the species were resistant to flood water. Four perennial weed species were found to regenerate after initial killing of vegetative parts. In general, broadleaved weeds were more susceptible to flood water than grasses and sedges.

#### SOIL PROFILE DISTRIBUTION, AND EFFECT OF TEMPERATURE AND SOIL DEPTH ON GERMINATION OF *PHALARIS MINOR* RETZ.

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Soil profile distribution of *Phalaris minor* Retz. seeds was studied by wet sieving the soil samples from different depths and counting the screened seeds. Effect of room temperature on the rate and percentage of germination of seeds, kept in petridishes, was observed for two 'rabi' seasons. In a miniplot experiment the effect of depth of seed placement on germination percentage and plant growth was studied.

Maximum number of seeds were obtained from the soil surface. There was a decrease in seed number with increase in the soil depth, upto 15 cm. Similar

trend was obtained for either filled or unfilled seeds. On the whole the percentage of unfilled seeds increased with the increase in the soil depth. The optimum room temperature for the highest germination percentage of seed was between 17° to 21°C in 1980-81, and 19° to 21°C in 1981-82. An increase or decrease in the optimum temperature reduced the germination percentage, whereas the time taken for germination remained unaffected. At a constant temperature of 14°C, the germination percentage (96%) was maximum. The constant temperature less than 14°C increased the time required for germination and reduced the percentage germination, whereas the constant temperature above 14°C and upto 17°C reduced the percentage germination as well as the time taken for germination. The maximum germination percentage (44%) was obtained from the soil surface. Seed could germinate even from 10 cm soil depth, but with the increase in the depth the percentage germination reduced. Depth of seed placement had no effect on the maturity time, plant height and number of tillers per hill.

#### SEED MYCOFLORA OF WEED SEEDS

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With a view of prevention and control of the spread of certain important diseases, *Ageratum conyzoides* L., *Flaveria australasia* Hook. and *Parthenium hysterophorus* L. belonging to the family Asteraceae were selected for the study of seed mycoflora. Photosynthetically *Ageratum conyzoides* L., belongs to C<sub>3</sub> group. *Flaveria australasia* Hook. to C<sub>4</sub> group and *Parthenium hysterophorus* L., is an intermediate between C<sub>3</sub> and C<sub>4</sub>.

The number of seed borne-fungi were estimated by employing "Agar plate method". Maximum fungal numbers were recorded from the seeds of *Flaveria australasis* Hook., although the moisture content of seeds was quite low (0.1%). Fungal numbers isolated from the seeds of *Ageratum conyzoides* L., and *Parthenium hysterophorus* L., were not only equal but the moisture content was also same.

#### EFFECT OF SOME NEW HERBICIDES ON GROWTH AND CHLOROPHYLL CONTENT OF MUNG BEAN

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Seeds of mungbean were sown in earthen pots filled with soil. Fluchloralin @0.5, 0.75 and 1.0 kg/ha; dichlorprop methyl @0.6, 0.9 and 1.2 kg/ha; pendimethalin

@ 1.0, 1.5 and 2.0 kg/ha and Oxyfluorfen @ 0.1 and 0.2 kg/ha were applied to surface soil as spray one day after sowing. Fluchloratin was gently incorporated in the soil with a hand hoe. Each treatment was replicated ten times, control was water spray. Bean plants were taken out carefully by washing the soil on 30th and 45th day after sowing and their growth data and chlorophyll content were recorded. Initially with the exception of fluchloralin in @ 0.5 kg/ha all herbicides caused reduction in shoot length but at later stage plants treated with pendimethalin @ 2.0 kg/ha and Oxyfluorene only showed reduction in growth. Nodulation and chlorophyll content varied according to herbicide and its dose.

#### EFFECT OF SIMAZINE AND FLUORODIFEN ON THE BIOCHEMICAL COMPOSITION OF *CHENOPODIUM ALBUM* L. PLANTS

JAI PRAKASH and S. D. BANGA

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H. A. U., Hissar

*Chenopodium album* plants obtained from gram field treated with pre-emergence sprays of simazine and fluorodifen @ 0.125, 0.25 and 0.5 kg/ha were analysed for nitrogen, phosphorus, total sugars and nucleic acids on 45 and 90 days after sowing of gram crop. Herbicides in general reduced the nitrogen, phosphorus and total sugars content of treated plants. Plants treated with simazine @ 0.125 and 0.25 kg/ha had more DNA and RNA compared to other treatments.

#### EFFECT OF SOME NEW HERBICIDES ON GROWTH OF PEA PLANTS

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Effect of new herbicides, methabenzthiazuron and pendimethalin @ 1.0, 1.5 and 2.0 kg/ha, dichlorpropmethyl @ 0.6, 0.9 and 1.2 kg/ha, fluchloralin @ 0.5, 0.75 and 1.0 kg/ha and oxyfluorfen @ 0.1 and 0.2 kg/ha used as pre-emergence applications was studied on the growth of pea cv. Bonville under pot culture conditions. Treatment with herbicides in general reduced root length but not the shoot length. Dichlorpropmethyl @ 0.6 and 0.9 kg/ha increased the total root growth resulting in greater dry matter accumulation than any other treatment. At later stages of growth dry weight of shoot was increased by methabenzthiazuron @ 1.0 and 1.5 kg/ha diclofopmethyl @ 0.6 kg/ha, fluchloralin at all doses, pendimethalin @ 1.5 and 2.0 kg/ha and oxyfluorfen @ 0.1 kg/ha. On 60th day, treated plants had more leaves per plant than control. Methabenzthiazuron @ 1.0 and 1.5 kg/ha; diclofopmethyl @ 0.6 kg/ha, fluchloralin @ 1.0 kg/ha; pendimethalin @ 1.0 and 1.5 kg/ha and oxyfluorfen @ 0.1 kg/ha increased the number of nodules per plant in comparison to control. Since none of the chemicals has proved too toxic they can be tested in field for weed control in pea crop.

SESSION 6

**PROBLEM WEEDS (PARASITIC, AQUATIC, NON CROP SITUATIONS)**

**STRIGA MANAGEMENT IN SORGHUM**

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A field experiment was conducted on a Striga-sick Sandy loam soil during kharif seasons of 1980 and 1981, under dryland conditions to evolve an efficient method of managing Striga in sorghum. Of the various pre-sowing, pre-emergence and post-emergence treatments tested, application of 2, 4-D (Sodium-salt) @ 2 kg ae/ha 4 weeks after sowing sorghum (pre-emergence to Striga) showed good promise in reducing striga emergence and increasing sorghum grain yield. Post-emergence application of 2, 4-D helped in killing emerged Striga plants but contributed less to sorghum grain yield increase. The other treatments (post-emergence to Striga) like urea, ammonium sulfate and common salt spray helped in reducing Striga population to some extent but regrowth of Striga plants was observed. The other treatments tested viz. pre-sowing application of Ethephon, Atrazine application 4 weeks after sowing and hand-pulling of Striga did not show any promise either in reducing Striga population or increasing sorghum grain yield.

**PRODUCTIVE AND REPRODUCTIVE EFFORT IN *STRIGA ANGUSTIFOLIA* (DON.) SALDANHA**

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Mean fresh and dry weight values of root, shoot and reproductive parts at various growth periods have been determined with respect to the populations of *Striga angustifolia*. Plant growth increment occurred upto 40 days after germination. Later gradual decline was noticed due to seed dispersal. There was a fall in the r/s ratio with the age of the plant. Reproductive efficiency was maximum at peak growing stage incurring more than 50% of production to reproductive parts which implied greater allocation of photosynthates to next generation.

A phenological calendar timescaling the major phenophases in the life cycle of this weed species with a life span of nearly 70 days has been prepared. This is considered useful in control programmes for this weed.



## PRELIMINARY STUDIES ON BROOMRAPE (*OROBANCHE* SPP.)—A PARASITIC WEED ON BRINJAL

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A detailed survey was undertaken in the infested cultivated field during 1980 and 1981 at seven different locations in Banki block. The bionomics of the parasite was studied under varying time of planting and land type.

In the presence of its susceptible host crop (brinjal, *Solanum melongena*), the orobanche seeds germinated during the third week and developed underground sprouts of varying sizes till the fifth week. *Orobanche* shoots started emerging above ground from the sixth week onwards. Life cycle of the parasite is completed in about 75 to 90 days after planting of brinjal. Flowering of *Orobanche* coincides with that of the flowering of host plant.

Maximum infestation was observed in crops planted during October to December, while minimum infestation was in crops planted during April to July. Where the field remained dry due to want of moisture, the infestation was more serious in nature. The loss in yield of brinjal was from 15 to 35% depending on the time and intensity of infestation.

The parasite was also seen infesting tomato (*Lycopersicon esculantum*) crop.

Hand pulling of *Orobanche* shoots before seed ripening gave good result but in brinjal it was not possible as it caused uprooting of the host plant. In the infested areas crop rotation with rice (short duration) during kharif, chillies (*Capsicum frutescens*) during winter and brinjal during March has been found to reduce the infestation.

## PRELIMINARY STUDY ON THE CONTROL OF LORANTHUS FROM FRUIT TREES

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A preliminary study was undertaken during April, 82 on some infested plants of mango, orange, sapota, pomegranate, pumelo and rose apple for control of *Loranthus* using different chemicals and applying them by different methods (cut-end, both-end and boring). Chemicals used were Weedamin (Amine salt of 2,4-D), Weedox (Na salt of 2,4-D) and  $\text{CuSO}_4$  alone and in combinations. Weedox +  $\text{CuSO}_4$  mixture (1 : 4) applied as cut-end treatment showed promising result in preventing regeneration of the parasite in all the trees. Weedamin applied through boring showed promising result in rose apple and pumelo in killing the parasite selectively. There were no phytotoxic effects of herbicides on the trees. The yield and other quality parameters of the fruits were not affected significantly.

STUDIES ON THE USE OF PARAQUAT AND 2, 4-D FORMULATIONS FOR THE CONTROL OF WATER HYACINTH (*EICHHORNIA CRASSIPES* (MART) SOLMS).

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2, 4-D sodium salt and 2, 4-D ethyl ester were tried either alone or in combination with paraquat and urea. Combination of 2, 4-D sodium salt at 2.0 kg a.e./ha and paraquat at 0.9 kg/ha with or without 1% urea caused 99 to 100% weed mortality by 21st day after spraying. These treatments recorded the lowest weed dry weight (248 to 279 g/m<sup>2</sup>). Treatments with 2, 4-D sodium salt or paraquat alone were inferior to combination. Further, 2, 4-D ethyl ester was better than 2, 4-D sodium salt. The herbicides hampered the growth of weeds as evidenced by reduced weed dry weight, lower leaf number and reduced plant height and root length.

The study indicated utility of combination sprays of 2, 4-D sodium salt at 2 kg a.e./ha + paraquat at 0.9 kg/ha or 2, 4-D ethyl ester at 0.9 kg a.e./ha + paraquat at 0.9 kg/ha for effective control of water hyacinth.

CHEMICAL CONTROL OF WATER HYACINTH

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The effect of different herbicides alone and in different combinations was studied during August, 1981. The herbicides tested were different combinations of 2, 4-D Na salt + paraquat; 2, 4-D amine alone and in combination with sando-vit. Water hyacinth was killed within 30 days after spraying in all the treatments. But it was quick in 2, 4-D amine treatment and was slow in 2, 4-D Na salt + paraquat combination. Resprouting was not noticed upto 90 days in the case of 2, 4-D amine treatment. Among all the treatments 2, 4-D amine @ 3.60 kg a.e./ha was found to be the best.

STUDIES ON CHEMICAL CONTROL OF ALGAE

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A pot culture experiment was conducted in Kharif 1982 with six treatments viz. Copper Sulphate at 1 ppm. daily for five days; Copper Sulphate at 5 ppm.; diuron at 1.2 ppm.; simazine at 2 ppm. and 2, 4-D at 2 ppm. + diuron at 2 ppm. Quick control of algae was observed in the treatment where 2, 4-D at 2 ppm. + diuron at 2 ppm. was applied and this was followed by simazine at 2 ppm.

## CHEMICAL COMPOSITION OF SOME IMPORTANT AQUATIC WEEDS

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The concentration of 8 inorganic elements in different aquatic weeds was studied at three stages over a period of one year during 1978-79. The plants studied were *Typha angustata*, *Scirpus* sp., *Paspalum distichum*, *Eichhornia crassipes*, *Hydrilla verticillata*, *Ceratophyllum demersum*, *Potamogeton pectinatus*, and *Vallisneria spirallis*. The percent content of all elements was minimum in the month of April and it increased upto September. P and K content was found to be minimum in *Typha angustata* and in *Scirpus* sp. In general, sub-merged aquatic weeds contained higher percentage of Ca and Mg as compared to emerged aquatic weeds. In all aquatic weeds, Zn content varied from .001 to .008 percent. Maximum Zn content was obtained in *Vallisneria spirallis*. The percent content of Mn was found to be maximum in *Ceratophyllum demersum*. Cu content in all the aquatic weeds varied from .001 to .005 percent. Fe content in *Typha*, bullrush and water hyacinth was lower than all the submersed weeds.

## NOXIOUS AQUATIC VEGETATION IN WEST BENGAL

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Aquatic weeds are problems in all types of non-cropped water bodies and deep water paddy areas in this state. Most predominant aquatic weed is free-floating water hyacinth (*Eichhornia crassipes*). Next in order of intensity of prevalence are *Lemna* sp, *Pistia* sp. (free floating); *Hydrilla verticillata*, *Vallisneria* sp. (rooted submerged); *Typha* sp, *Sagittaria* sp, *Monochoria* sp, *Echinochloa crusgalli*, *Phragmites* sp, and *Cyperus iria* (emerged) and *Chara* (algae). Some investigations to control noxious aquatic vegetation in cropped areas have brought out certain findings to check the problem of aquatic weeds in deep water and transplanted paddy crops. Chemical method has shown promise.

## ECOLOGICAL STUDIES ON *CYPERUS ROTUNDUS* L.

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Studies on the viability of tubers of *Cyperus rotundus* revealed that the tubers brought to the surface during hot weather cultivations were rendered non-

viable within 24 hours. The tubers retained their viability for longer periods if desiccated at room temperature (maximum temp.  $31 \pm 2^\circ\text{C}$ ). At higher temperatures either in incubator or on soil surface during hot months, the tubers lost their viability at lower degree of moisture loss. The viability is lost directly due to temperature injury and not because of certain threshold of moisture loss. In the field which had received six hot weather cultivations, the maximum shoots emerged from tubers at 12-25 cm depths. The continuous sub-emergence of tubers completely checked their sprouting till brought to the normal condition of watering.

#### CHEMICAL CONTROL OF *EUPATORIUM ODORATUM* L. REGROWTH

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In the field trials herbicides and herbicide mixtures were sprayed on the two-month-old regrowth of *Eupatorium odoratum* during November, 1981 with surfactant Teepol. 2, 4-D (ester or amine)+paraquat mixtures (1:1) were more effective as they gave complete control of the weed which was rapid and long lasting. All other herbicides were slow in their action. The regrowth plants were very susceptible to the herbicides and were killed completely even by the lower doses of 2, 4-D (ester) and bentazon but only after 60 days of spraying. 2, 4-D ester was superior to 2, 4-D amine. Diuron and bromacil also exhibited foliar activity and gave 62-89% mortality. The regrowth of the plants slashed in September (two months earlier to flowering) did not flower in that season.

#### BIOCONTROL OF *PARTHENIUM HYSTEROPHORUS* L. AND *XANTHIUM STRUMARIUM* L. THROUGH PHYTOPATHOGENS

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Studies on biocontrol of *Parthenium* and *Xanthium* using fungal and bacterial pathogens over 7 years have indicated a possibility of successful control of these two problem weeds. Strains of pathogens with some host specificity tried for weed killing activity have yielded promising results. Use of phytopathogenic toxins also has been attempted with some success. Consideration of other parameters for successful control, crop cycle, environmental factors and interactions on Phyllophane is needed. Bioherbicide tactic as applied to these two weeds and other aspects are discussed. The author advocates development of host-specific strains of phytopathogens or metabolites of selected phytopathogens.

## TRANSLOCATION OF HERBICIDES IN *OXALIS LATIFOLIA* H. B. & K.

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The accumulation of simazine (a pre-emergence weedicide) and paraquat (a post-emergence weedicide) in different parts of *Oxalis latifolia* was studied. Simazine @ 0.0, 0.5, 1.0, 2.0, 3.0 and 5.0 kg/ha and Paraquat @ 0.0, 0.5, 1.0, 2.0 and 3.0 kg/ha were supplied at the time of planting of *Oxalis* bulbs and when thick foliage of *Oxalis* developed, respectively.

Simazine treatment at all levels suppressed fresh and dry matter production and inhibited sexual (flowering) and asexual (bulbs) means of propagation of the weed. The weed plants showed slender and lanky growth of the foliage and the starch content of the bulbs was also reduced significantly. Translocation of simazine to bulbs and foliage was detected. Paraquat, on the other hand, was not translocated to bulbs, though in the foliage its concentration increased with time and also with the rates of application. Paraquat treatments killed the foliage of *Oxalis latifolia* within three days of application. Fresh and dry weight of tissues, number and starch content of the bulbs also decreased following paraquat treatments. It could suppress sprouting of the foliage for 60 days following treatments.

## EFFECT OF *OXALIS LATIFOLIA* H. B. & K. ON THE GROWTH OF APPLE TREES

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A trial on the evaluation of damage caused by *Oxalis latifolia* H. B. & K. to young apple trees (cv. Starking Delicious on M<sub>7</sub>) was conducted. The trial consisted of four treatments (each being represented by two plants), viz. control (without weed) and apple plant in a bucket with 10, 25 and 50 bulbs of *Oxalis latifolia*. The results showed that the presence of *Oxalis* weed reduced extension growth and trunk cross-sectional area of the apple trees. Progressive increase in the rate of *Oxalis* infestation hampered growth and vigour of young apple trees.

## SESSION 7

### DEVELOPMENT AND HERBICIDES

#### RATE OF DEGRADATION OF ATRAZINE IN AUTOCLAVED SOIL

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The degradation of atrazine was studied in autoclaved and unautoclaved soil by bioassay technique. The residues of atrazine were quantified by Oat (*Avena sativa* L.) bioassay by comparing the growth of test plants grown in the soil containing known and unknown amounts of herbicide. The per cent dry weight of test plant was subjected to probit analysis and the GR-50 values obtained were used for estimating rate of degradation of atrazine. After 4 months of incubation 72 and 61 per cent of initially applied atrazine was found to be degraded in unautoclaved and autoclaved soils respectively. In autoclaved soil, the half life of atrazine was found to be around 80 days and in unautoclaved soil the half life was around 50 days. The degradation of atrazine was faster in the first month as compared with others and followed the first order reaction.

#### COST BENEFIT ANALYSIS OF WEED CONTROL IN TRANSPLANTED RICE IN HARYANA

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Rice farmers in Haryana are using herbicides on very large scale since last five years. The area under weed management of rice through herbicides is increasing every year. A study based on farmers field location trials all over the rice belt of the state has revealed *Echinochloa crusgalli*, *E. colunum* and *Cyperus iria* as predominant weeds of rice fields. Butachlor (Machete & Delchlor) and fluchloralin (Basalin) revealed cost benefit ratio of 1:5.49, 1:5.46 and 1:6.31, respectively. Benthocarb (Saturn) treatments and hand weeding two times gave return in the ratio of 1:4.82 and 1:4.64. Cost benefit of such a high order may be one of the reasons for increase in use of herbicides for controlling weeds in transplanted rice in Haryana.

#### COMPARATIVE COST-BENEFIT ANALYSIS OF CHEMICAL CONTROL OF GRASSY WEEDS IN WHEAT IN HARYANA

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Wheat crop has been found infested heavily with weeds of both grassy and broad leaved nature. However the high percentage of infestation of *Phalaris minor*

has created an alarming situation in wheat cultivation particularly in rice-wheat cropping system belt of Haryana. Though the efficacy of the chemical weed control has been accepted as the successful method to control this problem weed, yet the economics of the application of recommended herbicides needs study. An attempt was made to study the cost benefit ratio of the herbicides demonstrated at the farmers' field locations in district Karnal. Application of isoproturon (Arelon, Tolkon) gave higher cost benefit ratio (1:5.46 & 1:4.65) when compared with methabenzthiazuron (Tribunil) which was superior over metaxuron (Dosanex). Handweeding (twice) gave the cost benefit ratio of 1:1.57 only.

#### PERSISTENCE OF ISOPROTURON IN WHEAT SOIL AND ITS RESIDUES IN GRAIN AND STRAW

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Persistence of isoproturon (N-4-isopropylphenyl N, N-dimethyl urea) in soil and its residues in wheat grain and straw were studied in a field trial conducted during November 1981 to April 1982. Isoproturon was applied as postemergence at 1.0, 1.5 and 2.0 kg/ha in a 38-day old wheat crop. The soil samples were collected from 15 cm depth with the help of a 1 m posthole soil auger 1 hr after application and subsequently on the 5th, 10th, 15th, 30th, 45th and 60th day after application as well as on the day of harvest. The soil/grain/straw samples were suitably extracted and analysed for the presence of isoproturon by thin layer chromatographic method with Dragendroff's reagent as the chromogenic chemical. Isoproturon was revealed as an orange spot and the sensitivity of the method was 1 µg. The quantification was made with the help of analytical standard of isoproturon, spotted along the soil/plant samples. The studies indicated that isoproturon could not be detected in soil on the 45th and 60th day after application at 1.0 and 1.5 kg/ha treatments, respectively. When applied at 2.0 kg/ha, it persisted even up to 92nd day to the extent of 0.05 ppm. The  $RL_{50}$  values for the three dosages viz. 1.0, 1.5 and 2.0 kg/ha were 4.30, 5.01 and 6.02 days, respectively. No residues of isoproturon could be detected in either grain or straw. These results indicate that isoproturon poses no residue hazard to consumers and livestock.

#### EVALUATION OF ISOPROTURON FOR WEED CONTROL IN WHEAT

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Field trials were conducted at Palam village in Delhi to study the effect of isoproturon (N-4-isopropylphenyl-N, N-dimethyl urea) for controlling the weed



flora of wheat, its compatibility with ethylester of 2, 4-D (2, 4-dichlorophenoxy acetic acid) and its phytotoxicity to some popular varieties of wheat during November 1981 to April 1982. The studies revealed that isoproturon alone satisfactorily controlled *Phalaris minor*, the most noxious weed of wheat and it was compatible with 2, 4-D. The significantly higher grain yield was obtained when the combination of isoproturon+2, 4-D (1+1 kg/ha) was applied alone at 1.0 kg/ha and isoproturon+2, 4-D (0.5+0.5 kg/ha) combination, with no significant difference between these two treatments. Phytotoxicity of isoproturon was rated in the scale of 0 to 10 representing 0 to 100%. The results indicated that isoproturon when applied even at 2.0 kg/ha caused no injury to Kalyan Sona and Sonalika varieties. The same treatment was, however, found to be slightly (10%) phytotoxic to Sonara-64 and H. D. 1982 varieties, although the plants recovered later. This indicated the presence of varietal differences in wheat to isoproturon toxicity.

#### STUDY ON THE LEACHING OF HERBICIDES IN SOIL

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The leaching behaviour of simazine, atrazine and metoxuron was studied under field conditions and its residual toxicity at different depths was determined by bioassay using cowpea (*Vigna sinensis*) as a test plant. It was observed that atrazine and simazine in a loamy sand soil leached upto 15 cm soil profile but metoxuron remained in the upper 10 cm profile of soil. There was a marked decrease of metoxuron phytotoxicity to the test plants in the 10-15 cm soil profile.

#### RESIDUAL TOXICITY STUDIES ON THE HERBICIDES SPRAYED TO RICE ON SUCCEEDING RABI CROPS

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Studies were conducted during the year 1980-81 to know the efficacy of different herbicides in the control of weeds in upland drilled Rice (IET-1444). The results indicate that herbicide oxyfluorfen was quite effective in controlling weeds of all kinds, right from early days to the harvest. It was also effective on weed *Cyperus iria* at 0.4 kg/ha. The grain yield of paddy was highest (2275 kg/ha) in Oxyfluorfen which was closely followed by weed free check (2225 kg/ha).

Further studies in residual toxicity on rabi crops with the herbicides revealed that Bengal gram and Field bean were sensitive to residues of Bentazon 1.5 kg a. i./ha and little retardation of growth of bean was observed with Oxyfluorfen at 0.4 kg/ha. *Cyperus iria* was controlled even during rabi season under drilled conditions.