Short communication

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Control of complex weed flora in transplanted rice with herbicide mixure

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Rice (*Oryza sativa* L.) is one of the most important food crop of India, contributing to about 40% of total food grain production. It plays a vital role in food security and livelihood for almost every household. Out of the total 44 mha area under rice cultivation, puddled rice culture occupies 56% (Anonymous, 2005). Weeds pose a major problem in rice production as they not only compete with crop but also hinder the quality. Weed competition brings reduction in yield of transplanted rice by about 28-45% (Kumar *et al*. 2008, Yadav *et al*. 2009). Therefore, timely weed control is imperative for realizing desired level of productivity. Accordingly, an efficient and economic weed management program is necessary to control different types of weeds throughout the cropping period. Hand weeding is expensive, time consuming, difficult and often limited by scarcity of laborers in time. On the other hand, herbicides offer economic and efficient weed control if applied at proper dose and stage (Prakash *et al.* 2013).

The weed flora under transplanted condition is very much diverse and consists of grasses, sedges and broad-leaf weeds. The effective control of weeds at initial stages (0-40 DAT) can help in improving productivity of this crop. Therefore, presently there is a need to use high efficacy herbicides in combination coupled with broad spectrum nature to control the complex weed flora in transplanted rice (Gnanavel and Anbhazhagan 2010).

A field experiment was conducted during *Kharif* season of 2013 at Crop Research Centre (CRC) of G.B Pant University of Agriculture and Technology, Pantnagar, District, Udham Singh Nagar (Uttarakhand). The soil of experimental site was silty loam in texture having high organic carbon (0.89%), medium available P (21.7 kg/ha) and available K (144.8 kg/ha), low available N (228.9 kg/ha) and pH (7.4). The experiment was laid out in a randomized block design with three replications to evaluate twelve treatments, *viz*. post-emergence application of bispyribac-sodium at 25 g/ha, pre-emergence application of pretilachlor at 1000 g /ha, early post-emergence application of penoxsulam at 22.5 g /ha, pre-emergence application of pyrazosulfuron at 20 g/ha, post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g/ha, post-emergence application of bispyribac-sodium 20 g/ha + chlorimuron ethyl + metsulfuron-methyl 4 g/ha, pre-emergence application of pretilachlor at 750 g /ha *fb* post-emergence application of ethoxysulfuron at 18.75 g/ha, pre-emergence application of pretrilachlor at 750 g/ha *fb* post-emergence application of chlorimuron-ethyl + metsulfuron-methyl at 4 g/ha (RM), pre-emergence application of pyrazosulfuron at 20 g /ha *fb* manual weeding at 25 DAT, pre-emergence application of pretilacholor (6%) + bensulfuron (0.69%) (RM) at 660 g/ha, weed free and weedy check. The transplanted rice variety was "*Sarjoo 52*". Twenty four days old seedlings were transplanted in puddle field using two seedlings per hill at spacing of 20 x 15 cm on 27th June, 2013. The crop was raised by following recommended packages of practices for rice in Uttarakhand. The data on weed density and weed dry weigh were collected from each unit plot at 30, 60, 90 DAT and at harvest. A quadrate of 0.25 m^2 was placed randomly and weed species within the quadrate were identified and their number was counted. The average number of sample was multiplied by four to obtain the weed density/meter square. The weeds inside the quadrate were uprooted, cleaned and then oven dried. Dry matter of weeds was recorded and expressed in g/m^2. The data, the weed density and weed dry matter were analyzed after subjecting to square root transformation for comparison. The data on grain yield were recorded from the net plot and weed control efficiency was worked out.

In the experimental plots, the dominant weeds were *Echinochloa colona, E. crusgalli, Ischaemum rugosum, Caesulia axillaris, Ammania baccifera,*

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Alternanthera sessilis and *Cyperus iria*. All the herbicides showed effective control of all categories of weeds resulting in less weed dry matter and higher weed control efficiency as compared to weedy check. Combination of post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g/ha was most effective in minimizing the weed population and their dry matter accumulation as compared to other herbicidal treatments (Table 1). The reason behind the control of total weed density by the combination of post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g/ha might be due to the efficient broad spectrum control by bispyribac-sodium which resulted in elimination of both grassy and broad-leaf weeds and ethoxysulfuron being the broad-leaf killer and also reduces the population of sedges effectively. Post-emergence application of bispyribac-sodium alone and in combination at 20 and 25 g/ha was effective against mixed weed flora in transplanted rice. Similar results were reported by Walia *et al*. (2008) and Yadav *et al*. (2009). Ethoxysulfuron being an ALS inhibitor when applied at 18.75 g/ha was most effective against the population of *Caesulia axillaris, Ammania baccifera, Alternanthera sessilis*.The effectiveness of ethoxy-sulfuron against *Alternanthera* sp. was also reported by Shahbaz *et al.* (2007).

Weed control efficiency (WCE) with respect to grass, sedge and broad-leaved weeds (98.2%) was highest with post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g/ha followed by pre-emergence application of pretrilachlor at 750 g/ha *fb* post-emergence application of chlorimuron-ethyl + metsulfuron-methyl at 4 g/ha (93.4%). Highest dry matter accumulation was recorded in weedy check. The increase in dry weight of weeds in weedy check may be attributed to more nutrition available to the weeds. The results are in conformity with the findings of Ehsanullah *et al.* (2009) who observed numerically higher dry weight of weeds in weedy check over other treatments.

The highest rice grain yield (6.74 t/ha) was recorded in weed free plots which was statistically at par with post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g/ha fol-

Table 1. Effect of treatments on total weed density, weed dry weight, weed control efficiency and grain yield in transplanted rice

Treatment	Dose (g/ha)	Weed density (no./m^2)			*Weed dry weight (g/m^2)			WCE (%)	Grain yield (t/ha)
		Grasses	BLW	Sedges	Grasses	BLW	Sedges		
Bispyribac-sodium	25	3.1 (8.7)	5.6 (31.3)	1.0 (0.0)	3.8 (14.0)	2.4 (5.0)	1.0 (0.0)	77.7	6.05
Pretilachlor	1000	3.6 (12.0)	8.1 (65.3)	1.9 (2.7)	4.9 (23.2)	3.6 (12.3)	1.7 (2.0)	55.3	5.83
Penoxsulam	22.5	2.8 (6.7)	5.8 (32.7)	2.5 (5.5)	4.6 (19.9)	2.5 (5.2)	2.1 (3.7)	65.9	6.02
Pyrazosulfuron	20	4.1 (16.0)	8.1 (65.3)	2.6 (6.0)	6.0 (34.6)	3.4 (10.5)	2.5 (5.1)	40.0	5.55
Bispyribac-sodium + ethoxysulfuron	25 + 18.75	1.5 (1.3)	3.0 (8.0)	1.0 (0.0)	1.2 (0.5)	1.4 (1.0)	1.0 (0.0)	98.2	6.51
Bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (RM)	20 + 4	1.9 (2.7)	4.7 (20.7)	2.1 (3.3)	2.0 (3.1)	1.9 (2.7)	1.5 (1.3)	91.6	6.38
Pretilachlor *fb* ethoxysulfuron	750/ 18.75	2.2 (4.0)	5.3 (26.8)	1.0 (0.0)	3.1 (8.7)	1.9 (2.8)	1.0 (0.0)	86.6	6.22
Pretilachlor *fb* chlorimuron-ethyl + metsulfuron-methyl (RM)	750/4	1.5 (1.3)	4.5 (19.4)	1.9 (2.7)	1.6 (1.7)	1.9 (2.7)	1.5 (1.2)	93.4	6.39
Pyrazosulfuron *fb* manual weeding	20/25 DAT	2.5 (5.4)	6.2 (37.3)	1.0 (0.0)	4.1 (16.0)	2.3 (4.4)	1.0 (0.0)	76.0	6.05
Pretilacholor (6%) + bensulfuron (0.69%) 6.69% (RM)	660	3.2 (9.4)	6.9 (46.6)	3.4 (10.7)	4.6 (20.4)	2.7 (6.5)	3.3 (10.0)	56.3	5.96
Weed free	-	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	100.0	6.74
Weedy check	-	5.4 (28.0)	10.6 (111)	5.2 (26.0)	6.7 (44.3)	4.3 (17.2)	4.9 (22.7)	0.0	4.38
LSD (P=0.05)	-	0.5	0.4	0.2	0.6	0.3	0.3	-	0.59

Original value are given in parentheses

lowed by pre-emergence application of pretrilachlor at 750 g/ha *fb* post-emergence application of chlorimuron ethyl + metsulfuron methyl at 4 g/ha (RM) (Table 1)

The increase in grain yield under this treatment was due to less weed density and weed biomass as compared to all other treatments tried under this study. Application of post-emergence application of bispyribac-sodium at 25 g/ha caused significantly higher grain yield. Similar results were reported by Kumar *et al.* (2013). Ethoxysulfuron being an ALS inhibitor also significantly increased the grain yield when applied in combination with other herbicides. The results were in conformity with the findings of Dewangan (2011). Also, chlorimuron-ethyl + metsulfuron-methyl at 4 g/ha (RM) also proved to increased the grain yield when applied as post-emergence by suppressing weed population and reducing the weed biomass. Similar results were reported by Upasani *et al.* (2012).

No residual effect of tested herbicide in soil was observed after the harvest of rice crop. It is, therefore recommended that post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g/ha can safely be used for controlling the complex weed flora other combinations like. Pre-emergence application of pretrilachlor at 750 g/ha *fb* post-emergence application of chlorimuron-ethyl + metsulfuron methyl at 4 g/ha (RM); post-emergence application of bispyribac-sodium at 20g/ha *fb* post-emergence application of chlorimuron-ethyl + metsulfuron-methyl at 4 g/ha (RM); pre-emergence application of pretrilachlor at 750 g/ha *fb* post-emergence application of ethoxy-sulfuron at 18.75 g/ha in transplanted *Kharif* rice were at par with each other to improve the grain yield.

SUMMARY

Different herbicides alone and in combination were tested for the control of complex weed flora in transplanted rice during *Kharif* season 2013 at Crop Research Centre (CRC) of G.B Pant University of Agriculture and Technology, Pantnagar, District, Udham Singh Nagar (Uttarakhand). The experiment was laid out in randomized block design with three replications to evaluate twelve treatments. The major weeds were *Echinochloa colona, E. crusgalli, Ischaemum rugosum, Caesulia axillaris, Ammania baccifera, Alternanthera sessilis* and *Cyperus iria*. Combination of post-emergence application of bispyribac-sodium at 25 g/ha + ethoxysulfuron at 18.75 g /ha was most effective in controlling weed species and yielded maximum grain yield (6.51 t/ha) among the herbicidal treatments after weed free (6.74 t/ha).

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