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Short communication

Efficacy of bispyribac-sodium on weed flora and yield of drilled rice

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Rice (*Oryza sativa* L.) being a major food crop of Madhya Pradesh is cultivated on 1.68 million ha with production of 1.56 million tones (Anonymous 2009). Direct seeding of rice has more benefits as compared to traditional transplanting like easier planting, timely sowing, less drudgery, early crop maturity by 7-10 days, less water requirement, better soil physical condition for next crop and low production cost and more profit. Weeds are one of the limiting factors in direct- seeded rice which reduced the yield up to 50-97% in rainfed uplands (Kurchania *et al.* 1992, Singh *et al.* 1996).

Pre-emergence herbicides like pretilachlor, butachlor, anilophos, and post- emergence herbicides like 2,4-D, and Almix are used frequently to control grassy and broad-leaved weeds in drilled rice. These herbicides are effective against weeds but most of them are specific and applicable for narrow range of weed species. Continuous application of these herbicides may also results in weed flora shift and development of herbicidal resistance in weeds. This situation warrants for initiating research efforts to develop and evaluate new and alternate herbicides which have wider applicability and weed control spectrum. Bispyribac-sodium is effective against many annual and perennial grasses, sedges, and broad leaved weeds in rice. The meager information is available in this regard for Kymore plateau and Satpura Hills Zone of M.P. Keeping all these facts in view, the present investigation was undertaken.

A field experiment was carried out during *Kharif* season of 2010 at Jawaharlal Nehru Kirshi Vishwa Vidyalaya, Jabalpur (M.P.) to test the efficacy of bispyribac-sodium against weeds. The soil of the experimental field was clayey in texture, neutral in reaction (pH 7.1), medium in organic carbon (0.64%) and available N (372 kg/ha), and available P (17.45 kg P_2O_5/ha) and high in available K (297 kg K_2O/ha). Rice variety '*IR 64*' was grown in the experimental field with recommended package of practices during *Kharif* 2010. Total 10 treatments were laid-out on well prepared seed bed in a randomized block design with three replications. Treatments were; bispyribac-Na 10 g/ha, bispyribac-Na 20 g/ha, bispyribac-Na 30 g/ha, bispyribac-Na 40 g/ha, bispyribac-Na 80 g/ha, bispyribac-Na 20 g/ha + 2,4-D 500 g/ha, cyhalofop -butyl 75 g/ha, butachlor 1500 g/ha, hand weeding twice (20 and 40 DAS), weedy check. All the herbicides were applied at 15 days after sowing (DAS) except butachlor which was applied at 1 DAS whereas hand weeding was done at 20 and 40 DAS. Fertilizers were applied uniformly to all the plots through urea, single super phosphate and muriate of potash at the rate of 120 kg N, 60 kg P_2O_5 and 40 kg K_2O/ha, respectively.

The herbicides were applied by knapsack sprayer fitted with flat-fan nozzle using 500 litres water/ha. Weed density of major weeds *viz.*, *Echinochloa colona*, *Cyperus iria*, *Dinebra retroflexa*, *Eclipta alba* and *Phylanthus niruri* and other associated weeds were recorded at 40 DAS and at harvest by quadrate count method. The quadrate of 0.25 square metres (0.5 x 0.5 m) was randomly placed at three places in each plot and then the species wise and total weed count was recorded. The data thus obtained, were transformed and expressed in number per square metre. The percentage composition of weed flora was estimated from weedy check plot. The weed biomass from different plots under all the treatment was recorded only at before application, 40 DAS and harvest. The associated weeds were collected randomly with 0.25 m^2 quadrat from three places in each plot. The weeds were first sun dried and thereafter kept in paper bags and dried in oven at 60^0C for 48 hours and dry weight was recorded till constant weight was achieved. Lateron, the data on weed biomass was transformed and expressed in g per square metre. The data obtained on various observations were tabulated and subjected to their analysis by using analysis of variance (ANOVA and the treatment was tested by F test. The data on weed count and weed biomass were subjected to square root transformation, *i.e.*$\sqrt{x+0.5}$, before carrying out analysis of variance and comparisons were made on transformed values.

Grassy weeds were more prominent followed by broad-leaved as they constituted (65%) and (24.18%) mean relative density, respectively at 60 DAS, but sedges

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attained only (10.67%) mean relative density. However, *Echinochloa colona* among the grassy weeds and *Eclipta alba* among the broad-leaved weeds were more dominant in rainfed direct- seeded rice. Almost similar weed flora associated with rice was reported by Yadav *et al.* (2009).

Herbicidal treatments significantly influenced the population and dry matter production of weeds. Among the herbicidal treatments, the lowest weed density (2.74/m^2) was observed under bispyribac-sodium 80 g/ha at 15 DAS followed by bispyribac-sodium 40 g/ha (3.94/m^2). The minimum weed dry weight (0.71/m^2) was recorded in weed free treatment and proved significantly superior over all weed control treatments. The maximum weed dry weight (7.93 g/m^2) was noted in weedy check. Among the herbicides treatments, the lowest weed dry weight (0.95 g/m^2) was observed under bispyribac-sodium 80 g/ha (Table 1). These results are in conformity with the findings of Yadav *et al.* (2009).

Weed index is a measure of reduction in the seed yield due to competition stress offered by weeds as against weed free treatment. Weed control treatments caused significant variation on weed index of direct-seeded rice. The maximum weed index (66.4%) was recorded in weedy check. Among the herbicidal treatments bispyribac-sodium 80 g/ha recorded minimum weed index (5.2%). This clearly indicated that weeds were controlled effectively under bispyribac-sodium 80 g/ha.

Weed control methods caused significant variation on grain yield of direct-seeded rice. The maximum grains yield (4.85 t/ha) recorded in hand weeding (at 20 and 40 DAS) and lowest (1.62 t/ha) under weedy check. The yield loss due to uncontrolled growth of weeds as compared to hand weeding was 67.5%. Among the herbicidal treatments bispyribac-Na 80 g/ha recorded maximum grain yield (4.59 t/ha) which was at par with other lower doses of bispyribac-Na except 10 g/ha, but was significantly higher as compared to cyhalofop-butyl and butachlor. Cyhalofop-butyl and butachlor produced 11.3% and 9.3% less grain yield compared to bispyribac-Na 20 g/ha. The crop under weed free plots attained lush growth due to elimination of weeds from inter and intra-row spaces besides better aeration due to manipulation of surface soil and thus, more space, water, light and nutrients were available for the better growth and development, which resulted into superior yield attributes and consequently the highest yield. Yadav *et al.* (2009), also reported hand weeding as an effective method of weed control for achieving the maximum yield of direct seeded rice. Weed control methods caused significant variation on straw yield of direct-seeded rice. The maximum straw yield (6.53 t/ha) recorded in two hand weeding (at 20 and 40 DAS) and lowest straw yield (3.05 t/ha) found in weedy check plot.

Cost of cultivation varied under different weed control treatments. The minimum cost of cultivation (₹ 17028/ha) was registered under control plot. However, it was maximum (₹ 25428/ha) under hand weeding twice (at 20 and 40 DAS). The cost of cultivation under different herbicide treatments varied from ₹ 17800 to ₹ 22000. The cost of cultivation of weed free treatment receiving two hand weeding was the highest due to maximum variable cost, which was not affordable by the poor farmers and at the same time availability of laboures during peak period is also questionable.

Table 1. Weed density and dry weight and yield of rice as influenced by different weed control treatments

Treatment	Weed density (no./m^2)	Weed dry matter (g/m^2)	Weed index	Grain yield (t/ha)	Straw yield (t/ha)	Cost of cultivation (x10^3 ₹/ha)	B:C ratio
Bispyribac-Na 10 g/ha	8.77 (76.3)	4.58 (20.5)	30.8	3.35	4.85	17.87	2.04
Bispyribac-Na 20 g/ha	6.20 (38.0)	3.52 (11.9)	7.3	4.49	6.08	18.47	2.63
Bispyribac-Na 30 g/ha	4.67 (21.3)	2.97 (8.3)	7.0	4.51	6.13	19.07	2.56
Bispyribac-Na 40 g/ha	3.94 (15.0)	2.29 (4.7)	5.9	4.56	6.15	19.67	2.51
Bispyribac-Na 80 g/ha	2.74 (7.0)	0.95 (0.4)	5.3	4.59	6.23	22.07	2.25
Bispyribac-Na 20 g/ha + 2,4-D 500 g/ha	4.82 (22.8)	2.92 (8.0)	8.2	4.45	6.43	18.87	2.56
Cyhalofop-butyl 75 g/ha	7.45 (55.0)	4.05 (15.9)	17.6	3.99	5.83	18.28	2.38
Butachlor 1500 g/ha	8.69 (75.0)	5.29 (27.4)	17.4	4.00	5.93	18.02	2.42
Hand weeding	0.71 (0.0)	0.71 (0.0)	0.0	4.85	6.53	25.43	2.06
Control	15.02 (225.0)	7.93 (62.4)	66.5	1.62	3.05	17.03	1.06
LSD (P=0.05)	0.70	0.36	-	0.18	0.39	-	-

Value in parantheses are original. Data transformed to square root transformation

All the treatments received post-emergence application of bispyribac-sodium 10 to 80 g/ha, cyhalofop-butyl (75 g/ha) and butachlor (1500 g/ha) needed less variable cost over hand weeding. Thus, use of herbicides for control of weeds seems to be cheaper. Application of bispyribac-sodium 20 g/ha was more remunerative (2.63) than rest of the treatments including weed free treatment (2.06). Similar findings have also been reported by Subramanium *et al.* (2006) and Yadav *et al.* (2009).

SUMMARY

A field experiment was conducted during *Kharif* seasons of 2010 at JNKVV, Jabalpur to study the efficacy of bispyribac-sodium and other herbicides against weeds in drilled rice. The field was infested with grassy weeds *viz., Echinochloa colona, Dinebra retroflexa, Cyperus iria, Eclipta alba* and *Phyllanthus niruri*. The efficacy of bispyribac-sodium as post- emergence was significantly superior when applied at 80 g/ha over other herbicides. However, the application of bispyribac-sodium 20 g/ha was more remunerative. Among the herbicidal treatments bispyribac-Na 80 g/ha recorded maximum grain yield (4.59 t/ha) which was at par with other doses of bispyribac-Na except 10 g/ha and significantly higher as compared to cyhalofop-butyl and butachlor.

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