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Evaluation of Bispyribac-sodium for Weed Control in Transplanted Rice

D. B. Yadav, Ashok Yadav[1] and S. S. Punia[1]
CCSHAU Regional Research Station, Karnal (Haryana), India

ABSTRACT

Bispyribac-sodium was evaluated against mixed weed flora in transplanted rice at Karnal, Haryana. Major associated weeds were *Echinochloa* glabrescens and *E. colona* (L.) Link among grasses, *Ammannia baccifera* L. and *Euphorbia* sp. among broad-leaved weeds and *Fimbristylis miliacea* (L.) Vahl, *Cyperus iria* L., *C. rotundus* L. and *C. difformis* L. among sedges. Weeds allowed to grow throughout crop season caused 68 and 27% yield reduction during 2006 and 2007, respectively. Bispyribac applied at 15 or 25 DAT was found equally effective against grassy weeds, but control of broad-leaved weeds and sedges was comparatively more when applied at 15 DAT. Bispyribac 25 g/ha applied at 15 or 25 DAT was adjudged the most suitable herbicidal treatment resulting in 174-199% and 37-41% increase in the rice grain yield over weedy check during 2006 and 2007, respectively. There was no phyto-toxicity of bispyribac on rice and no residual toxicity on succeeding crop of wheat during both the years of study.

Key words : Herbicide toxicity, weed control efficacy, complex weed flora, herbicide residue

INTRODUCTION

Infestation of weeds in transplanted rice not only results in yield reduction but quality of produce is also impaired. Yield reductions in transplanted rice due to weeds have been reported to be 28-45% (Raju and Reddy, 1995; Nandal *et al*., 1999; Singh *et al*., 2003). Pre-emergence herbicides such as pretilachlor, butachlor, oxadiargyl and anilofos are being frequently used for the effective management of weeds in transplanted rice but the window of their application is very narrow (1-3 days after transplanting). The need of post-emergence herbicides is often realized by the growers to combat weeds emerging during later growth stages of crop. Due to increasing problem of labour availability for transplanting, the concept of direct-seeding, particularly in scented rice is also catching interest of farmers as well as researchers in north-western part of India. This situation warrants for initiating research efforts to evaluate and identify suitable post-emergence herbicide(s). Bispyribac-sodium, a pyrimidinyl carboxy herbicide, is effective to control many annual and perennial grasses, sedges and broad-leaved weeds in rice fields (Schmidt *et al*., 1999; Yun *et al*., 2005). Bispyribac applied mid- to late-post-emergence at 20 to 23 g/ha has been reported to control barnyardgrass 98%; however, when applied late post-emergence to three-tiller barnyardgrass, the control was reduced to 70% (Williams, 1999). Since it is a new post-emergence herbicide in rice in India, the present study was undertaken to standardize its dose and time of application against complex weed flora in transplanted rice.

MATERIALS AND METHODS

The efficacy of bispyribac-sodium was evaluated during **kharif** 2006 and 2007 at CCS Haryana Agricultural University Regional Research Station, Karnal, Haryana, India. The soil of experimental field was clay loam in texture, low in available nitrogen, medium in available P_2O_5 and high in K_2O with slightly alkaline in reaction (pH 8.1). The treatments included bispyribac 15, 20, 25, 30 and 60 g/ha each at 15 days after transplanting (DAT) and 25 DAT, pretilachlor 750 and 1000 g/ha at 3 DAT and butachlor 1500 g/ha at 3 DAT alongwith weedy and weed free checks. The experiment was laid out in a randomized block design with three replications. Bispyribac was sprayed by knapsack sprayer fitted with flat fan nozzle using 300 litres of water per hectare. Butachlor and pretilachlor were applied by splash after mixing in five litres of water per hectare. Seedlings (35 days old) of rice cultivar HKR-47 were transplanted on July 7, 2006 and July 9, 2007 at a spacing of 20 x 15 cm. Crop was raised according to package of practices of the State University. Density and dry weight of weeds were recorded at 75 DAT, and

[1]Department of Agronomy, CCS HAU, Hisar.

yield and yield attributes at maturity of the crop. Data on per cent control (visual) were recorded at 60 DAT in comparison to the control levels of 90 and 100% in weed free during 2006 and 2007, respectively. Data on crop phyto-toxicity were recorded at 15 and 30 DAT. Crop was harvested on October 20, 2006 and October 19, 2007. Residual toxicity of bispyribac was also recorded on succeeding crop of wheat. Since, there was no crop phyto-toxicity on rice, and no residual toxicity on succeeding crop of wheat, data on these aspects were not included herein.

RESULTS AND DISCUSSION

Effect on Weeds

Weed flora of the field consisted of mainly *Echinochloa glabrescens* L. and *E. colona* (L.) Link among grasses (85%), *Ammannia baccifera* L. and *Euphorbia* sp. among broad-leaved weeds (8%), and *Fimbristylis miliacea* (L.) Vahl, *Cyperus iria* L., *C. rotundus* L. and *C. difformis* L. among sedges (7%). The weed pressure during 2006 was comparatively more than 2007.

Density and dry weight of grassy weeds decreased with increase in dose of bispyribac at both the stages of application and during both the years (Tables 1 and 2). All the treatments of bispyribac except 15 g/ha applied at 25 DAT during 2007, resulted in significantly lower density and dry weight of grassy weeds than the weedy check. During 2006, 30-60 g/ha bispyribac applied at 15 DAT and 25-60 g/ha doses applied at 25 DAT were at par with weed free, pretilachlor 1000 g/ha and butachlor 1500 g/ha. During 2007, bispyribac 30-60 g/ha applied at 15 DAT and 60 g/ha applied at 25 DAT resulted in lower density of grassy weeds than butachlor, while other doses were at par with butachlor except dose of 15-20 g/ha at 25 DAT. Dry weight of grassy weed under all treatments of bispyribac except 15 g/ha at 25 DAT was at par with weed free and pretilachlor. All the bispyribac treatments were at par with butachlor in respect of dry weight of the grassy weeds.

Density of broad-leaved weeds (BLW) under all the bispyribac treatments was higher than weed free check during both the years (Table 1). During 2006, bispyribac 20-60 g/ha at 15 DAT and 30-60 g/ha at 25 DAT were at par with pretilachlor and butachlor in terms of population of BLW. While during 2007, bispyribac at all doses and at both the stages of application was at par with pretilachlor, while it was at par with butachlor when applied at 15 DAT only. In general, lower density of sedges was observed at 25 DAT than 15 DAT during 2006, while reverse was true during 2007. Density of sedges due to bispyribac 30-60 g/ha at 25 DAT was at par with weed free check, while other bispyribac treatments were inferior during 2006. Bispyribac 20-60 g/ha at 15 DAT and 15-60 g/ha at 25 DAT resulted in density of sedges at par with pretilachlor and butachlor. During 2007, bispyribac applied at 15 DAT only was at par with butachlor.

In general, bispyribac applied at 15 or 25 DAT reduced the dry weight of BLWs and sedges similarly during 2006 (Table 2). But its application at 15 DAT was superior during 2007. During 2006, bispyribac 25-60 g/ha at both the stages of application was at par with pretilachlor and butachlor. During 2007, all the doses of bispyribac at 15 DAT and only 60 g/ha at 25 DAT were at par with pretilachlor and weed free check. Whereas it was at par with butachlor at all the doses and both stages of application.

Per cent control of grassy as well as broad-leaved weeds and sedges increased with corresponding increase in dose of bispyribac (Table 1). During 2006, control of grassy weeds with bispyribac 15-60 g/ha was 61-88% at 15 DAT and 53-90% at 25 DAT, while the corresponding figures for 2007 were 90-100 and 75-100%. Bispyribac has been reported very effective against mixed flora of weeds in wet-seeded rice also (Yadav *et al*., 2007).

Effect on Crop

There was no phyto-toxicity of bispyribac on rice. Also, there was no residual toxicity on succeeding crop of wheat during both the years of experimentation (data not given).

Plant height and panicle length of rice were not influenced by any weed control treatment during both the years (Table 2). Different treatments of bispyribac being at par with each other produced effective tillers statistically similar to pretilachlor during both the years, and also with weed free check during 2006 except 15 g/ha at 25 DAT.

Weeds allowed to grow throughout crop season caused 68 and 27% yield reduction during 2006 and 2007, respectively. During 2006, bispyribac 25-60 g/ha at both the stages of application gave yield at par with

Table 1. Effect of bispyribac-sodium on density of weeds and their per cent control in transplanted rice

Treatments	Dose (g/ha)	Time (DAT)	Weed density*/m^2						Per cent control (Visual)				
			Grassy		Broad-leaved weeds		Sedges		Grassy		BLW+ sedges	BLW	Sedges
			2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2007
Bispyribac	15	15	4.79 (22.0)	2.69 (6.7)	9.50 (90.0)	7.68 (58.0)	5.83 (44.7)	2.93 (10.0)	61	90	16	62	92
Bispyribac	20	15	4.17 (16.7)	2.60 (6.0)	9.05 (85.3)	8.31 (68.7)	4.63 (24.0)	2.04 (5.3)	63	98	33	62	94
Bispyribac	25	15	3.28 (10.0)	2.37 (4.7)	7.64 (61.3)	9.57 (90.7)	5.46 (34.7)	3.04 (8.7)	78	95	46	62	94
Bispyribac	30	15	1.82 (2.7)	1.24 (0.7)	7.53 (58.0)	8.34 (71.3)	5.48 (34.7)	2.99 (8.0)	81	98	46	62	93
Bispyribac	60	15	1.90 (2.7)	1.41 (1.3)	7.16 (52.7)	7.90 (62.7)	5.42 (33.3)	1.24 (0.7)	88	100	53	78	98
Bispyribac	15	25	6.93 (48.0)	5.13 (25.3)	12.6 (168.0)	9.55 (90.7)	4.63 (23.3)	4.73 (22.0)	53	75	26	25	37
Bispyribac	20	25	3.77 (13.3)	4.49 (19.3)	9.46 (90.0)	10.56 (111.3)	4.39 (19.3)	5.05 (24.7)	81	92	30	35	52
Bispyribac	25	25	1.41 (1.3)	3.29 (10.0)	9.38 (87.3)	10.71 (114.0)	3.06 (10.7)	4.68 (22.0)	90	98	30	38	45
Bispyribac	30	25	1.24 (0.7)	3.29 (10.7)	7.76 (60.0)	12.10 (146.0)	3.53 (14.7)	4.50 (20.7)	90	100	46	38	55
Bispyribac	60	25	1.00 (0.0)	1.41 (1.3)	7.15 (54.7)	8.74 (77.3)	1.41 (1.3)	3.65 (13.3)	90	100	63	52	67
Pretilachlor	750	3	1.96 (3.3)	1.00 (0.0)	6.42 (43.3)	4.00 (15.3)	4.07 (16.7)	2.75 (6.7)	88	98	60	97	98
Pretilachlor	1000	3	1.00 (0.0)	1.00 (0.0)	6.23 (38.0)	2.51 (6.7)	3.13 (11.3)	1.00 (0.0)	88	100	63	100	100
Butachlor	1500	3	1.41 (1.3)	2.75 (8.7)	6.50 (44.0)	7.82 (69.3)	3.21 (9.3)	2.08 (4.0)	90	83	53	73	83
Weed free	-	-	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	90	100	90	100	100
Weedy check	-	-	8.49 (72.0)	6.06 (36.0)	8.57 (72.7)	6.35 (39.3)	3.13 (4.8)	4.97 (24.0)	0	0	0	0	0
LSD (P=0.05)	-	-	1.09	1.22	2.88	2.35	2.49	1.58	-	-	-	-	-

*****Original figures in parentheses were subjected to square root transformation ($\sqrt{X+1}$) before statistical analysis.
DAT–Days after transplanting, BLW–Broad-leaved weeds.

Table 2. Effect of bispyribac on dry weight of weeds, and yield and yield attributes in transplanted rice

Treatments	Dose (g/ha)	Time (DAT)	Dry weight (g/m^2)				Plant height (cm)		Effective tillers/mrl		Panicle length (cm)		Grain yield (kg/ha)	
			Grassy		BLW+Sedges									
			2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Bispyribac	15	15	131.8	31.3	40.5	2.93	92.3	91.8	59.5	54.7	22.1	21.6	5155	5958
Bispyribac	20	15	59.9	15.4	27.0	3.27	92.1	92.1	58.3	55.3	21.7	21.1	5418	5704
Bispyribac	25	15	47.7	8.3	24.2	3.80	88.9	91.1	59.8	57.8	22.3	21.1	5895	6465
Bispyribac	30	15	36.3	0.0	23.1	3.40	90.1	89.1	64.5	61.3	21.7	21.5	6289	6212
Bispyribac	60	15	31.8	7.9	19.2	2.80	90.0	90.5	59.3	57.0	22.3	21.0	5943	5810
Bispyribac	15	25	283.9	77.2	32.9	6.87	87.7	89.5	50.7	61.7	21.5	21.1	3962	6308
Bispyribac	20	25	49.2	36.1	29.6	6.73	90.1	89.6	62.3	59.0	21.9	20.4	5704	6212
Bispyribac	25	25	9.5	15.5	24.0	8.93	90.1	90.8	59.0	58.7	21.5	21.4	6432	6615
Bispyribac	30	25	8.8	15.0	20.8	9.53	87.4	89.2	59.0	62.0	21.4	21.5	6181	6276
Bispyribac	60	25	0.0	0.3	16.5	3.93	87.4	90.5	69.2	61.0	22.0	20.9	6706	6488
Pretilachlor	750	3	32.5	0.0	15.1	0.67	87.4	90.4	61.0	56.0	21.8	21.3	6635	6467
Pretilachlor	1000	3	0.0	0.0	14.9	0.20	87.5	91.0	66.7	60.0	21.5	20.9	6802	6825
Butachlor	1500	3	11.6	41.9	14.3	5.33	89.3	90.6	60.3	63.7	21.7	21.3	6657	6762
Weed free	-	-	0.0	0.0	0.0	0.00	88.9	91.4	67.0	68.3	21.9	21.9	6820	6424
Weedy check	-	-	401.3	186.9	15.3	5.27	84.7	88.2	47.0	54.0	20.5	20.6	2148	4704
LSD (P=0.05)	-	-	34.7	52.8	10.2	5.37	NS	NS	9.3	7.4	NS	NS	1022	812

DAT–Days after transplanting, BLW–Broad-leaved weeds, mrl–metre row length.
NS–Not Significant.

weed free check and pretilachlor (Table 2). During 2007, all the bispyribac treatments were at par with weed free check in respect of grain yield. Bispyribac at 25 g/ha applied at 15-25 DAT resulted in 174-199 and 37-41% increase in the grain yield of rice over weedy check during first and second year, respectively. The wide differences in the yield increment due to bispyribac in two years were obviously due to wide variations in yields obtained under untreated plots, as the weed pressure was very high during 2006. Based on the results of present investigation, it might be concluded that bispyribac at 25 g/ha applied at 15-25 DAT could be a suitable herbicide for complex weed flora in transplanted rice.

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