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Short communication

Bispyribac-sodium influence on nutrient uptake by weeds and transplanted rice

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Rice (*Oryza sativa* L.) is the staple food for more than half of the world's population. It provides 27% dietary energy and 20% dietary protein in the developing world. Among the production constraints weed infestation has been recognized as major one and yield reduction due to crop weed competition has been reported to be 28 to 45% (Singh *et al.* 2003). Nutrient depletion by weeds, besides other factors, also depends on soil type and composition of weeds. Keeping these in view, the present investigation was undertaken to know the effect of different levels of bispyribac sodium 10% SC herbicide on nutrient uptake by transplanted rice.

Field experiment was conducted during Summer 2011 at Zonal Agricultural Research Station, V.C. Farm, Mandya, Karnataka to study the bio-efficacy of bispyribac-sodium on growth, yield and yield attributes of transplanted rice. The soil texture of the experimental field was red sandy loamy with low available N (274.6 kg/ha), medium in available P (27.2 kg/ha) and available K (174.3 kg/ha) with slightly acidic in reaction (pH 6.05). There were 11 treatments consisting of bispyribac-sodium 10% SC at 10, 15, 20, 25, 30 and 35 g/ha at 15 DAT, pretilachlor 50% EC at 750 g/ha at 5 DAT, bensulfuron-methyl + pretilachlor (10 kg/ha) at 8 DAT, hand weeding and passing cono-weeder twice at 20 and 40 DAT, respectively and unweeded check. The experiment was laid out in randomized complete block design (RCBD) with three replications. Twenty five days old seedlings (variety *'Jaya'*) were transplanted at a spacing of 20 x 10 cm. Crop was raised by as per the recommendation of state university (10 t/ha FYM and 125:62.5:62.5 kg NPK/ ha). Bispyribac-sodium was sprayed by knapsack sprayer fitted with flat fan nozzle using 500 l/ha of water as spray solution. The pre-emergence herbicides like pretilachlor and bensulfuron-methyl + pretilachlor were applied at 3 and 8 DAT, respectively. Weed population and weed dry weight of weeds were recorded at 60 DAT and yield and yield components at maturity. The data on weed count and weed dry weight were subjected to square root transformation using the formula $\sqrt{x+0.5}$ and analysis was done. The composite plant and weed samples were collected at harvest was oven dried and grounded into fine powder using Wiley mill.

Nitrogen, phosphorus and potassium content of the samples were estimated by microkjeldhal method, vanadomolybdo phosphoric yellow colour method and flame photometer method, respectively and subsequently the nutrient uptake by weeds, grain and straw was computed on hectare basis as computed by Sunil *et al.* (2011). The procedure followed by Sunil *et al*. (2011) was adopted to work out the economics of different weed control treatments information on the existing market price of different herbicides and inputs was used. The data collected were subjected to statistical analyses in the randomized complete block design following the method of Gomez and Gomez (1984).

Effect on weeds

Cyperus difformis, Cyperus iria, Fimbristylis woodrowii (among sedges); *Panicum repens, Echinochloa colona, Echinochloa crusgalli, Cynodon doctylon* (among grasses); *Rotala densiflora, Eclipta alba, Spilanthus calva, Portulaca quadrifida* (among broad-leaved weeds) were the major weeds associated with the transplanted rice.

Application of bispyribac-sodium 35 g/ha at 15 DAT recorded lower weed population and dry weight and this was statistically at par with bispyribac-sodium 30 g/ha at 15 DAT and bispyribac-sodium 25 g/ha at 15 DAT. Whereas, unweeded check recorded significantly higher weed population and weed dry weight. The reduction in the weed population and weed dry weight in these treatments were mainly due to effective control of weeds at all stages of crop growth period. These results confirmed findings of Veeraputhiran and Balasubramanian (2013).

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Effect on yield

Application of bispyribac-sodium 25 g/ha at 15 DAT recorded significantly higher grain and straw yield as compared to unweeded check, which was also at par with the application of bensulfuron-methyl + pretilachlor (10 kg/ha) at 8 DAT. The increase in yield was mainly attributed to better control of weeds throughout the crop growth which resulted in better utility of nutrients, moisture and light by the crop which reflected through increased leaf area, number of productive tillers per hill, number of filled grains per panicle, panicle weight and test weight. These results were in conformity with the findings of Sunil *et al.* (2010). The lowest grain and straw yield were recorded in unweeded check owing to severe weed competition which resulted in reduction in the magnitude of growth and yield components (Table 2). Veeraputhiran and Balasubramanian (2013) recorded grain yield of 6.84 and 6.51 t/ha during 2010 and 2011, respectively by post-emergence application of bispyribac-sodium at 25 g/ha, which were at par with higher doses of bispyribac-sodium, twice hand weeding and weed free and significantly higher than butachlor application. However, Kumar *et al.* (2013), recorded bispyribac-sodium at 30 kg/ha dose as the best treatment in terms of net returns due to weed management in transplanted rice at Palampur, Himachal Pradesh

Effect on nutrient uptake by weeds and crop

Lowest uptake of nutrients by weeds was noticed with bispyribac-sodium 35 g/ha at 15 DAT (Table 1). The nutrient uptake by crops was inversely proportional to nutrient uptake by weeds. Similarly increase in nutrient uptake by increase in weed competition also reported by Singh *et al.* (2003).

Table 1. Effect of weed management practices on weed growth, nutrient uptake by weeds and its economics

Treatment	Weed population (no./m^2)	Weed dry weight (g/m^2)	Nutrient uptake by weeds (kg/ha)			Economics	
			N	P	K	Net returns (x10^3 `/ha)	B:C ratio
Bispyribac sodium 10 g/ha at 15 DAT	8.49(71.6)	3.79(13.9)	6.28	1.47	9.25	30.02	1.01
Bispyribac sodium 15 g/ha at 15 DAT	7.68(59.1)	3.41(11.2)	4.15	1.32	8.75	33.60	1.12
Bispyribac-sodium 20 g/ha at 15 DAT	7.06(49.3)	3.17(9.6)	3.52	1.28	6.23	37.45	1.23
Bispyribac-sodium 25g/ha at 15 DAT	5.71(32.1)	2.63(6.4)	1.18	0.25	1.75	45.48	1.48
Bispyribac-sodium 30 g/ha at 15 DAT	5.37(28.3)	2.41(5.3)	1.09	0.23	1.68	33.22	1.07
Bispyribac-sodium 35 g/ha at 15 DAT	5.12(25.7)	2.30(4.8)	1.02	0.21	1.62	32.76	1.04
Pretilachlor 750 g/ha at 5 DAT	7.24(52.0)	3.22(9.9)	5.82	1.45	7.08	30.23	1.01
Bensulfuron-methyl + pretilachlor 10 kg/ha at 8 DAT	7.08(49.7)	3.18(9.6)	3.45	1.25	6.15	39.47	1.29
Two hand weeding at 20 and 40 DAT	6.03(34.6)	2.68(6.7)	1.75	0.34	2.54	41.20	1.27
Conoweeder at 20 and 40 DAT	7.56(56.6)	3.33(10.6)	5.52	1.15	6.52	34.32	1.12
Unweeded check	11.78(132.3)	5.25(27.1)	12.32	2.78	20.28	22.28	0.85
LSD (P=0.05)	0.76	0.23	1.72	0.37	1.68		

DAT: days after transplanting, a.i.: active ingredient

Table 2. Effect of weed management practices on grain yield, straw yield and nutrient uptake by transplanted rice

Treatment	Grain yield (t/ha)	Straw yield (t/ha)	Nutrient uptake by transplanted rice (kg/ha)								
			N			P			K		
			Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
Bispyribac-sodium 10g/ha at 15 DAT	5.06	6.07	50.5	45.6	96.1	9.49	2.84	12.3	12.9	117.2	130.2
Bispyribac-sodium 15 g/ha at 15 DAT	5.39	6.47	54.2	48.6	102.7	10.1	3.03	13.1	13.8	124.9	138.8
Bispyribac-sodium 20 g/ha at 15 DAT	5.70	6.84	58.6	51.4	113.0	10.6	3.20	13.8	14.6	132.0	146.7
Bispyribac-sodium 25g/ha at 15 DAT	6.47	7.66	65.0	57.5	122.6	12.1	3.59	15.7	16.6	147.9	164.5
Bispyribac-sodium 30 g/ha at 15 DAT	5.45	6.54	54.7	49.1	103.9	10.2	3.06	13.2	13.9	126.3	140.3
Bispyribac-sodium 35 g/ha at 15 DAT	5.44	6.53	54.7	49.1	103.8	10.2	3.05	13.2	13.9	126.1	140.0
Pretilachlor 750 g/ha at 5 DAT	5.11	6.11	51.3	45.9	97.3	9.58	2.86	12.4	13.1	118.1	131.2
Bensulfuron-methyl + pretilachlor (10 kg/ha) at 8 DAT	5.99	7.23	60.2	54.3	111.6	11.2	3.39	14.6	15.3	139.6	155.0
Two hand weeding at 20 and 40 DAT	6.24	7.49	62.7	56.3	119.0	11.7	3.51	15.2	16.0	144.7	160.7
Cono weeder at 20 and 40 DAT	5.50	6.60	55.2	49.6	104.9	10.3	3.09	13.4	14.1	127.4	141.5
Unweeded check	4.10	4.92	41.2	37.0	78.2	7.69	2.30	9.99	10.5	95.0	105.5
LSD (P=0.05)	0.38	0.42	4.09	3.48	0.38	1.98	0.58	1.82	2.34	13.4	15.1

DAT: days after transplanting, a.i.: active ingredient

Application of bispyribac-sodium 35 g/ha at 15 DAT recorded significantly higher NPK uptake by transplanted rice as compared to unweeded check. However, it was at par with bensulfuron-methyl + pretilachlor (10 kg/ha) at 8 DAT. Higher nutrient uptake of crop in these treatments was mainly attributed to lower weed population and weed dry weight and this has helped the crop to grow well and absorb more nutrients from the soil. These results are in line with Sunil *et al*. (2011).

Economics

The lowest cost of cultivation was recorded with unweeded check. Whereas, highest cost of cultivation was recorded with two hand weeding at 20 and 40 DAT followed by application of bispyribac-sodium 35 g/ha at 15 DAT. Application of bispyribac-sodium at 25 g/ha at 15 DAT has recorded highest net returns and B:C ratio which was followed by bensulfuron-methyl + pretilachlor (10 g/ha) at 8 DAT. Whereas, the lowest net returns and B:C ratio was obtained in unweeded check (Table 2).

Correlation studies

The grain yield had significant and positive correlation with growth parameters like plant height at maturity, No. of leaves per hill, number of tillers per hill at maturity, leaf area at 90 DAS and total dry matter at maturity. The yield parameters such as number of productive tillers per hill, panicle length, weight of panicle, 1000-grain weight, number of filled grains per panicle showed significant and positive correlation with grain yield. There was a significant and positive correlation with total nitrogen uptake, phosphorus uptake and potassium uptake. The grain yield was significant and negatively correlated with weed parameters like total weed density at maturity and weed biomass at maturity. There was a significant and negative correlation between grain yield and weed uptake, v*iz.* N uptake, P uptake and K uptake (Table 3).

Table 3. Correlation between growth, yield, nutrient uptake parameters

Growth and yield attributes, nutrient uptake and weed parameters	Correlation coefficient (r)
Growth parameter	
Plant height at maturity	0.803*
No. of tillers at maturity	0.930*
No. of leaves per hill at maturity	0.847*
Leaf area at 90 DAS	0.911*
Total Dry Matter at maturity	0.913*
Yield parameter	
No. of productive tillers per hill	0.981*
Panicle length	0.958*
Weight of panicle	0.980*
1000 - grain weight	0.828*
No. of filled grains per panicle	0.951*
Nutrient uptake by transplanted rice at maturity	
Nitrogen uptake	0.996*
Phosphorus uptake	0.998*
Potassium uptake	0.997*
Weed parameter	
Weed density at maturity	-0.817*
Weeds biomass at maturity	-0.779*
Nutrient uptake by weeds at maturity	
Nitrogen uptake	-0.837*
Phosphorus uptake	-0.777*
Potassium uptake	-0.821*

*Correlation significant at P = 0.01

SUMMARY

Application of bispyribac-sodium 25 g/ha at 15 DAT recorded significantly lower total weed population and higher grain (6.47 t/ha) and straw yield (7.66 t/ha) as compared to pretilachlort 750 g/ha at 5 DAT. The nutrient uptake by weeds for N,P and K was significantly higher with unweeded check (12.32, 2.78 and 20.28 kg/ha, respectively). Whereas the lowest uptake was noticed with bispyribac-sodium 35 g/ha at 15 DAT (1.02, 0.21 and 1.62 kg/ha, respectively). The nutrient uptake by rice for N, P, and K was significantly higher with bispyribac-sodium 25 g/ha at 15 DAT (122.66, 15.74 and 164.51 kg/ha, respectively) as compared to unweeded check (78.24, 9.99 and 105.58 kg/ha, respectively). Similar trend was observed with net returns and B:C ratio.

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