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Bio-efficacy and phytotoxicity studies of Bispyribac Sodium 10% SC in direct seeded rice

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ABSTRACT

A field experiment was carried out at Regional Research Sub - Station, Raghunathpur, BCKV, Purulia, West Bengal, during kharif seasons of 2014 and 2015 to study the bio-efficacy and phytotoxicity of Bispyribac Sodium 10% SC on direct seeded rice cv. IET 9947 in West Bengal. Based on the experimentation, it was found that post-emergence application of Bispyribac Sodium 10% SC @ 30 g a.i. ha^{-1} followed by @ 20 g a.i. ha^{-1} gave significantly lower total weed density, weed dry weight and higher weed control efficiency at all the stages. Considering net production value (NPV), application of Bispyribac Sodium 10% SC @ 30 g a.i. ha^{-1} can be recommended to the farming community.

Keywords : Bispyribac sodium 10% SC, direct seeded rice, weed control efficiency, yield.

Rice is an important staple food crop. More than 90 per cent of the world's rice is grown and consumed in Asia, where 60 per cent of the world's population lives. Rice is capable of being grown under wide range of soils and climatic condition. Transplanting is the major method of rice cultivation in India but some areas direct seeded methods are follows. Weeds are responsible for heavy rice yield losses, to the extent of complete crop loss under extreme conditions. Out of the losses due to various biotic stresses, weeds are known to account for nearly one third (Teja *et al*., 2015). Uncontrolled weeds reduced the grain yield by 75.8 per cent and 62.6 per cent under direct seeded rice (DSR) and transplanted rice (TPR), respectively (Singh *et al*., 2011). So, herbicides are the most important input in the modern agriculture. The use of herbicide has been expanding more rapidly than that of other pesticides (Bhan and Mishra, 2001). The injudious use of herbicides in agricultural soils causes the contamination of the soils with toxic chemicals and become harmful to plant, wildlife, man & microorganisms (Amakiri, 1982). The experiment was undertaken with the objective to assess the bio-efficacy and phytotoxicity of Bispyribac Sodium 10% SC against weeds in direct seeded rice and find out the grain yield of direct seeded rice.

MATERIALS AND METHODS

The field experiment was carried out during two consecutive *kharif* seasons of 2014 and 2015 in direct seeded rice at Regional Research Sub - Station, Raghunathpur, BCKV, Purulia, West Bengal Purulia, West Bengal. The soil was sandy loam in textures with pH 6.5 and medium fertility status with medium water holding capacity.

The experiment was laid out in randomized complete block design and replicated thrice with a net plot size of 5 × 4m. Seven treatments including pendimethalin 30% EC at 1500 g ha^{-1} (PE) at 1 days after sowing, three different doses of bispyribac sodium 10% SC @10, 20, 30 g ha^{-1} (Test product) along with of bispyribac sodium 10% SC @20 g ha^{-1} (Market product) at 15 DAS (POE) were sprayed with spray volume of 500 l ha^{-1} using knapsack sprayer fitted with flat fan deflector nozzle and weed free check were assigned in a randomized block design with three replications. The data on weed density and dry matter production (DMP) were recorded at 45 and 60 DAA and weed control efficiency (WCE) of different treatments was computed using data on weed DMP. The major growth and yield parameters along with biological yields were recorded.

Seeds of variety IET-9947 were treated with *Trichoderma viride* @ 4 g kg^{-1} of rice seeds, kept under shade for one hour and then sown in the seed bed by manually during second week of August, 2010 and 2011. Recommended dose of fertilizers is 80:40:40 kg NPK ha^{-1}. Full doses of phosphorus and potash each @ 40 kg ha^{-1} are applied as basal. Recommended dose of nitrogen @ 80 kg ha^{-1} was applied in three splits at 25, 45 and 65 DAS. All the other recommended agronomic and plant protection measures were adopted to raise the crop and intercultural practices were taken as per needed.

The data were subjected to statistical analysis by analysis of variance method (Gomez and Gomez, 1984). As the error mean squares of the individual experiments were homogenous, combined analysis over the years were done through unweighted analysis. Here, the interaction between years and treatments were not significant. The weed population values being in poisson distribution were transformed into square root values to normalize for respective statistical analyses (Panse and Sukhatme, 1978).

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Table 1: Effect of different weed management practices on total weed density and dry weight in direct seeded rice

Treatments	Weed density (No. m^{-2})						Weed dry weight (g m^{-2})					
	45 DAS			60 DAS			45 DAS			60 DAS		
	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled
T_1	6.72 (44.67*)	6.92 (47.33*)	6.78 (45.67*)	6.99 (48.33)	7.20 (51.33)	7.06 (49.67)	27.20	28.74	27.97	27.97	29.97	28.77
T_2	5.82 (33.33)	5.96 (35.00)	5.84 (34.33)	6.28 (39.00)	6.44 (41.00)	6.33 (40.33)	19.74	20.66	20.20	21.86	23.88	22.37
T_3	5.76 (32.67)	5.70 (32.00)	5.69 (32.33)	6.26 (38.67)	6.18 (37.67)	6.18 (38.33)	18.73	18.37	18.55	19.82	19.44	19.63
T_4	6.28 (39.00)	6.15 (37.33)	6.18 (38.67)	6.65 (43.67)	6.52 (42.00)	6.55 (42.67)	23.36	22.44	22.90	25.26	24.26	24.76
T_5	6.57 (42.67)	6.54 (42.33)	6.55 (42.33)	6.42 (40.67)	6.39 (40.33)	6.36 (40.33)	27.51	27.25	27.38	30.08	29.80	29.94
T_6	3.94 (15.00)	3.85 (14.33)	3.89 (14.67)	4.45 (19.33)	4.38 (18.67)	4.35 (18.67)	12.68	11.78	12.03	14.53	13.93	14.23
T_7	10.04 (100.33)	9.70 (93.67)	9.86 (97.33)	12.32 (151.33)	11.90 (141.00)	12.09 (146.33)	80.78	74.74	77.41	92.50	85.34	89.42
SEm (±)	**0.39**	**0.36**	**0.41**	**0.44**	**0.48**	**0.58**	**0.60**	**0.64**	**0.68**	**0.75**	**0.87**	**0.87**
LSD(0.05)	**1.17**	**1.08**	**1.24**	**1.33**	**1.45**	**1.76**	**1.84**	**1.94**	**2.07**	**2.29**	**2.64**	**2.65**

Table 2: Effect of different weed management practices on weed control efficiency (WCE %) and weed index (WI %) on rice

Treatment	WCE (%)						WI (%)		
	45 DAS			60 DAS					
	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled
T_1	66.33	61.55	63.87	69.76	64.88	67.83	17.72	12.12	14.80
T_2	75.56	72.36	73.91	76.37	72.02	74.98	1.50	1.21	1.21
T_3	76.81	75.42	76.04	78.57	77.22	78.05	0.01	0.91	0.30
T_4	71.08	69.98	70.42	72.69	71.57	72.31	10.81	13.64	12.08
T_5	65.94	63.54	64.63	67.48	65.08	66.52	3.60	3.94	3.63
T_6	84.30	84.24	84.46	84.29	83.68	84.09	0.00	0.00	0.00
T_7	-	-	-	-	-	-	24.62	28.79	26.59

Table 3: Effect of different weed management practices on grain yield and straw yield of rice

Treatment	Grain yield (t ha^{-1})			Straw yield (t ha^{-1})			Net production value (NPV)		
	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled	1st Year	2nd Year	Pooled
T_1	2.74	2.90	2.82	3.49	3.69	3.59	1.77	1.87	1.82
T_2	3.28	3.26	3.27	4.06	4.26	4.16	2.11	2.21	2.16
T_3	3.33	3.27	3.30	4.24	4.16	4.20	2.24	2.20	2.22
T_4	2.97	2.85	2.91	3.78	3.62	3.70	1.94	1.86	1.90
T_5	3.21	3.17	3.19	4.08	4.04	4.06	2.09	2.07	2.08
T_6	3.33	3.30	3.31	4.30	4.12	4.21	1.61	1.55	1.58
T_7	2.51	2.35	2.43	3.20	2.98	3.09	0.74	0.70	0.72
SEm (±)	**0.019**	**0.021**	**0.020**	**0.027**	**0.028**	**0.029**	**-**	**-**	**-**
LSD(0.05)	**0.060**	**0.066**	**0.063**	**0.080**	**0.083**	**0.089**	**-**	**-**	**-**

T_1- Bispyribac Sodium (BS) 10% SC @ 10g a.i. ha^{-1}, T_2- BS 10% SC @ 20 g a.i. ha^{-1}(Test Product), T_3- BS 10% SC@ 30 g a.i. ha^{-1}, T_4- Pendimethalin 30% EC @ 1500 g a.i. ha^{-1}, T_5- BS 10% SC @ 20 g a.i. ha^{-1}(Market Product), T_6- Weed free check (Hand weeding), T_7- Control

**Figures in the parenthesis are original values which are subjected to square root transformation*

RESULTS AND DISCUSSION

In the experimental plots the dominant grasses were *Echinochloa colona* and *Leersia hexandra* while the sedge was *Cyperus rotundus* and among the broadleaf *Ammania baccifera* was dominant.

Post emergence application of Bispyribac Sodium 10% SC at 10, 20,30 g a.i. ha^{-1} and pendimethalin 30% EC at 1500 g ha^{-1} resulted in effective control of broad leaved weeds, grasses and to some extend sedge duo to its broad spectrum action. Application of Bispyribac Sodium at 30 g a.i. ha^{-1} resulted 76.04 and 78.05 per cent WCE (Table1 and 2) at 45 and 60 DAS, respectively which was highest among herbicidal treatment. Halder and Patra (2007) reported similar higher weed control through Bispyribac Sodium as post emergence.

From the table 2, it is very clear that unweeded control treatment (T_7) gave the highest pooled value (26.59) of Weed Index whereas, T_6 recorded the lowest pooled value (0.00) which was closely followed by T_3 (0.30), T_2(1.21) and T_5(3.63). Herbicide treatments showed the better weed controlling ability as compared to other treatments and so they facilitated better crop growth and ultimately higher yield in rice and lower weed index value. Similar results were reported by Bera *et al.*, 2012.

Highest grain yield was recorded in weed free check (table 3) which is statistically *at par* with T_3. Among herbicidal treatment, Bispyribac Sodium 10% SC @ 30 g ha^{-1} recorded higher pooled grain yield of 3.30 t ha^{-1}, due to better control of weeds at critical stages thus providing the favourable environment for better growth and development leading to enhanced grain yield. The higher doses of Bispyribac Sodium 10% SC @ 20, 30 g ha^{-1} showed higher yield and statistical parity among them in grain yield. The productivity of rice is mainly decided by the weed control efficiency of weed management methods as earlier observed by Singh and Singh (2004). Grain yield reduction in rice is directly related to increasing weed density, dry weight and intensity of weed interference throughout the crop period. Due to heavy competition of weeds for nutrients, space, water and light lower grain yield in unweeded control plot was obtained. The biological yield also showed similar variation among the treatments as found in grain yield of direct seeded rice. Phytotoxicity of the direct seeded rice plants did not show any leaf epinasty and hyponasty, yellowing, chlorosis, wilting and scorching.

Highest NPV was noted under Bispyribac sodium 10 SC @ 30 g ha^{-1} (pooled NPV = 2.22) owing to higher seed yield and comparatively lower cost under this treatment (Table 2). Whereas the lowest NPV was noted in control (pooled NPV = 0.72). Though weed free check treatment recorded highest yield but it failed to obtain most profitable result with respect to net production value (pooled NPV = 1.58) due to higher labour wages and this might be due to twice hand weeding is laborious, costly and non-availability of labours at the critical crop-weed competition period.

It can be concluded that post emergence application of Bispyribac Sodium 10% SC @ 30 g a.i ha^{-1}recorded better control of all the recorded weeds and weed control efficiency in comparison to other testing herbicides. Although weed free check recorded highest yield (3.31 t ha^{-1}), but the dose of Bispyribac Sodium 10% SC @ 30 g a.i ha^{-1} recorded highest NPV (2.22) along with significantly higher control of the weeds and grain yield over the testing herbicides. No phytotoxicity in direct seeded rice plants was observed in any of the doses of the Bispyribac Sodium 10% SC in their application.

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