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Productivity, Weed Control and Economics of Transplanted Rice as Influenced by New Post Emergence Herbicide Bispyribac sodium

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Field experiments were conducted at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, to evaluate the new herbicide Bispyribac sodium in transplanted rice on yield and weed control efficiency in transplanted rice varieties ASD 16 and ADT 37 during *Kharif* 2011 and 2012, respectively. Seven treatments were included in a Randomized Block Design and replicated four times. The treatments consisted of pre–emergence application of Butachlor @1500 g a.i. ha^{-1}, post emergence application of Bispyribac -sodium 10 SC at 25, 35 and 50 g a.i. ha^{-1}, weed free, hand weeding twice and unweeded check. The results revealed that the total weed population and dry weight under Bispyribac sodium at 25 g a.i. ha^{-1} were on par with the higher doses of Bispyribac sodium at 35 and 50 g a.i.ha^{-1} during both the years of study. The weed control efficiency and weed index under Bispyribac sodium at lower dose were also comparable with that of higher doses indicating the sufficiency of Bispyribac sodium at 25 g a.i.ha^{-1} for effective weed management in transplanted rice. The effect of Bispyribac sodium at 25 g a.i. ha^{-1} on producing tillers and panicles was also on par with that of higher doses and twice that of hand weeding and found to be significantly superior to Butachlor application. Post emergence application of Bispyribac sodium at 25 g a.i. ha^{-1} recorded a grain yield of 6838 and 6510 kg ha^{-1} during 2011 and 2012, respectively, which were found to be on par with higher doses of Bispyribac sodium, twice hand weeding and weed free; and significantly higher than Butachlor application. Higher economic benefits like net income and benefit-cost ratio were also associated with the application of Bispyribac sodium at 25 g a.i. ha^{-1} than all the other weed managemnet treatments.

Key words : Rice, Bisbyribac sodium, Weed, Grain yield and economics

Rice, the most important staple food crop of India is cultivated under various ecosystems of *viz.*, transplanted, direct sown and rainfed situations. To meet the future food requirements of the ever increasing population and to maintain self sufficiency, the estimated rice production in India should be 350 million tonnes by 2020 A.D. In transplanted rice, weed infestations not only reduce the grain yield up to 45 per cent, but also impair the quality of grain. The share of weed management cost is higher than other operations in transplanted rice. Though many pre emergence herbicides are available for controlling weeds, the need for post emergence herbicide is often realized to combat the weeds emerged during later stages of crop growth. More over, due to increasing problem of labour availability for rice cultivation, use of new post emergence herbicide will have greater potential for effective weed management and higher yield. In this context, the present study was carried out to standardize the Bisbyribac sodium, a new herbicide its dose and efficiency in transplanted rice.

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Materials and Methods

Field experiments were conducted at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai to evaluate the new herbicide Bispyribac sodium on the growth, yield and weed control efficiency in transplanted rice during *Kharif* 2011 and 2012. A total of seven treatments were evaluated in a Randomized Block Design and replicated four times. The treatments consisted of T_1 – Pre–emergence application of Butachlor @1500 g a.i. ha^{-1} at 3 days after transplanting (DAT), post emergence application of Bispyribac -sodium 10 SC at 25 (T_2), 35 (T_3), 50 (T_4) g a.i. ha^{-1} at 20 DAT , T_5 – weed free, T_6 – Two hand weedings and T_7 –Un weeded check. The soil of the experimental field was clay loam with a pH of 6.8 with NPK status of low, medium and high, respectively. The rice varieties ASD 16 and ADT 37 were used during 2011 and 2012 respectively with a spacing of 20 x10 cm. Bispyribac sodium (Nominee Gold 10 % SC) was applied as foliar spray on 20 DAT in the respective treatments as per schedule, while Butachlor was applied as

broadcasting with sand mixing. Hand weeding was carried out on 20 and 40 DAT as a separate treatment and for weed free plot, hand weeding was done as and when required. The data on weed density and dry weight were recorded at 45 DAT. The weed dry weight was expressed as kg ha^{-1}. Weed controlling efficiency and weed index were computed. The yield attributes and grain yield of rice were recorded and economics worked out.

Results and Discussion

Total weed density

The total density of weeds decreased with increase in doses of Bispyribac sodium, but not significantly (Table1). The lowest total weed density was observed under weed free plots. However, this was statistically similar with application of all the doses of Bispyribac sodium during both the years of experimentation. The total weed density under the treatments Butachlor application at 1500 g a.i. ha^{-1} and hand weeding twice were similar and significantly higher than all the doses of Bispyribac sodium. The highest weed density was observed in unweeded control plot. Reduction in weed density due to the application of Bispyribac sodium at 15 and 25 DAT in transplanted rice was reported by Yadav *et al.* (2009). Similar effective control of grasses, sedges and BLW in rice fields was documented by Schmidt *et al*. (1999). The present results are also in conformity with the findings of Kumaran *et al*. (2012), who registered lower weed density under Bispyribac sodium than other weed management treatments in direct seeded rice.

Total weed dry weight

Application of Bispyribac sodium at all the doses resulted in significant reduction in total weed dry weight than Butachlor application, twice hand weeding and unweeded check (Table 1). However, the total weed dry weight under the higher dose of Bispyribac sodium at 50 g a.i. ha^{-1} was on par with lower doses of 25 and 35 g a.i.ha^{-1} indicating the sufficiency of lower dose of 25 g a.i.ha^{-1} for effective weed management in transplanted rice in both the years of study. The weed controlling effect of pre emergence application of Butachlor and two hand weeding was lesser than Bispyribac sodium as evident from significantly higher weed dry weight under above two treatments. The highest weed dry weight of was registered in unweeded control plot. Post emergence application of Bispyribac sodium at 15 or 25 DAT significantly decreased the weed dry weight in transplanted rice (Yadav *et al*. 2009). Similar results of lower weed dry weight with the application of Bispyribac sodium at 40 g a.i. ha^{-1} than Butachlor and Anilophos in transplanted rice was reported by Nalini *et al*. (2012). The significant reduction of weed dry weight by Bispyribac sodium at 30 g a.i.ha^{-1} than pre emergence herbicide application in dry seeded rice was also observed by Walia *et al.*, (2008).

Table 1. Effect of Bispyribac sodium on weed density, DMP, weed control efficiency and weed index in transplanted rice

Treatment	Total weed density at 45 DAT (No.m^{-2})		Total weed DMP(kg ha^{-1})		Weed control efficiency(%)		Weed index	
	2011	2012	2011	2012	2011	2012	2011	2012
Butachlor @1500 g a.i. ha^{-1}	4.75	33.00	356	307	92.1	91.3	11.23	13.70
	(2.29)	(5.79)	(25.09)	(17.54)				
Bispyribac sodium @ 25 g ai ha^{-1}	1.50	12.00	159	105	96.5	97.1	4.21	4.64
	(1.41)	(3.54)	(16.69)	(10.27)				
Bispyribac sodium @ 35 g ai ha^{-1}	1.25	7.67	112	76	97.5	97.8	3.57	2.99
	(1.32)	(2.86)	(14.10)	(8.75)				
Bispyribac sodium @ 50 g ai ha^{-1}	0.75	5.32	87	53	98.1	98.5	1.75	0.35
	(1.11)	(2.32)	(12.38)	(7.31)				
Weed free	0.00	0.00	0	0	100.0	100.0	-	-
	(0.71)	(0.71)	(0.71)	(0.71)				
Two hand weeding	3.75	16.67	289	128	93.6	96.4	6.30	5.57
	(2.06)	(4.14)	(22.62)	(11.34)				
Unweeded check	63.75	110.68	4511	3541	-	-	44.78	51.28
	(8.02)	(10.54)	(90.31)	(59.51)				
SEd	0.14	5.79	2	39	-	-	-	-
CD (p=0.05)	0.28	12.00	4	82	-	-	-	-

Weed control efficiency and weed index

Among the weed control treatments, application of Bispyribac sodium at 50 g a.i. ha^{-1} recorded the highest weed control efficiency of 98.1 and 98.5 per cent during 2011 and 2012 respectively (Table 1), which was followed by the same herbicide with lower doses of 35 g a.i. ha^{-1} (97.5 and 97.8 per cent) and 25 g a.i. ha^{-1} (96.5 and 97.1 per cent). The weed

Table 2. Effect of Bispyribac sodium application on yield and economics of transplanted rice

Treatment	No. of panicles m^{-2}		Panicle length (cm)		No. of grains $panicle^{-1}$		Grain yield (kg ha^{-1})		Net profit (Rs ha^{-1})		Benefit cost ratio	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Butachlor @1500 g a.i. ha^{-1}	380	271	22.6	22.9	118	125	6337	5892	38,743	34,720	2.81	2.43
Bispyribac sodium @ 25 g ai ha^{-1}	404	297	23.6	24.0	129	146	6838	6510	42,452	40,400	2.89	2.61
Bispyribac sodium @ 35 g ai ha^{-1}	408	299	24.0	24.2	139	148	6884	6623	42,086	40,230	2.81	2.54
Bispyribac sodium @ 50 g ai ha^{-1}	415	304	24.3	24.3	142	153	7014	6703	42,246	40,330	2.73	2.51
Weed free	420	312	24.9	24.7	149	158	7139	6827	40,321	37,770	2.47	2.24
Two hand weeding	401	291	24.2	23.4	136	145	6689	6447	38,551	36,470	2.54	2.30
Unweeded check	257	130	18.8	18.1	95	92	3942	3326	15,478	10,260	1.78	1.45
SEd	9	8	1.1	1.1	4	4	194	178	-	-	-	-
CD (p=0.05)	18	16	2.4	2.3	8	9	407	367	-	-	-	-

control efficiency under hand weeding twice and application of Butachlor at 1500 g a.i. ha^{-1} were lesser than that of all the doses of Bispyribac sodium during both the years of study. The weed index which indicate the reduction in grain yield was minimum under Bispyribac sodium applied plots. Post emergence application of Bispyribac sodium at all the doses reduced the grain yield very marginally indicating the superior effect of weed control. Higher weed control efficiency with lower weed index under Bispyribac sodium applied plots were due to effective weed control as evident from lower weed population and lesser weed dry weight than other treatments. Similar result of higher weed controlling efficiency in rice due to the post emergence application of Bispyribac sodium was registered by Yun *et al*. (2005). Higher weed control efficiency with Bispyribac sodium application in both transplanted rice and direct seeded rice ,reported by Nalini *et al*. (2012) is also in favour of the present study.

Yield attributes of rice

All the yield attributes of rice were significantly influenced by the weed management practices (Table 2). Higher number of panicles m^{-2} of 420 and 312 during 2012 and 2011 respectively, were recorded by weed free plot, which was on par with that of all the doses of Bispyribac sodium application in both the years of study. Application of Bispyribac sodium at 25 g a.i. ha^{-1} though registerd numerically lower number of panicles m^{-2}, its effect on producing tillers was on par with that of higher doses and twice hand weeding and significantly higher than Butachlor application. Regarding panicle length, weed free plot though recorded higher values, it was on par with all the doess of Bispyribac sodium and hand weeding twice. Similarly number of grains $panicle^{-1}$ were also higher with weed free plot but on par with Bispyribac sodium at 50 g a.i. ha^{-1}. Post emergence application of Bispyribac sodium at 25 g a.i. ha^{-1} registered 129 and 146 number of grains $panicle^{-1}$ which was on par with that of Bispyribac sodium at 50 g a.i. ha^{-1} (139 and 148) ; and twice hand weeding (136 and 145), and significantly higher than Butachlor application (118 and 125). Similar result of higher yield attributes of transplanted rice under Bispyribac sodium application was reported by Yadav *et al.* (2009).

Grain yield

Significant variation among the weed management practices was found on the grain yield of rice and higher yield was associated with Bispyribac sodium (Table 2). Weed free plot registered the highest grain yield of 7139 kg ha^{-1} 6927 kg ha^{-1} during 2011 and 2012, respectively, which was on par with all the doses of Bispyribac sodium. Post emergence application of Bispyribac sodium at 25 g a.i. ha^{-1} recorded a grain yield of 6838 kg ha^{-1} and 6510 $^{-1}$ during 2011 and 2012, respectively, which was on par with higher doses of Bispyribac sodium and significantly superior than Butachlor application. The effect of all the three doses of Bispyribac sodium on grain yield was significantly higher than Butachlor application and unweeded control. The per cent yield increment due to the application of Bispyribac sodium at the rate of 25 g a.i. ha^{-1} were 7.9, 2.2 and 73.5 during 2011 and 0.8, 9.4 and 95.7 per cent during 2012 than tiwce hand weeding, Butachlor application and unweeded control, respectively. There was a severe yield loss due to weed infestation as evident from 44.78 and 51.28 per cent yield reduction, respectively during the above years of study under unweeded plot over weed free plot. The higher grain yield in Bispyribac sodium applied plots was attributed to lesser weed population and weed dry weight which might have caused lesser weed competition with rice resulting in the production of higher yield attributes, which in turn reflected in higher yield. The favourable reports of effective weed control along with higher grain yield by Bispyribac sodium against mixed weed flora in transplanted rice (Yadav *et al.,* 2009), wet seeded rice (Yadav *et al* 2007) and dry seeded rice (Walia *et al.*, 2008) are in confirmation with the present investigation. Murali Arthanari *et al.* (2012) obtained similar grain yield of transplanted rice under Bispyribac sodium at both the doses of 50 and 35 g a.i. ha^{-1} .

Economics

The economic analysis of weed management practices (Table.2) revealed that higher economic benefits were realized under lower doses of Bispyribac sodium application. Post emergence

application of Bispyribac sodium at 25 g a.i. ha^{-1} registered the highest net profit of Rs. 42,452 ha^{-1} and Rs. 40,400 ha^{-1} during 2011 and 2012 respectively followed by Bispyribac sodium at 50 g a.i. ha^{-1} (Rs.42,086 ha^{-1} and Rs. 40, 330 ha^{-1}). Higher benefit-cost ratio was also associated with Bispyribac sodium at 25g a.i. ha^{-1} (2.89 and 2.61), which was followed by Bispyribac sodium at 35g a.i. ha^{-1} (2.81 and 2.54). Though higher dose of Bispyribac sodium at 50 g a.i. ha^{-1} recorded slightly higher grain yield, economically it is inferior to that of its lower dose of 25g a.i. ha^{-1}.

Thus it may be concluded from the study that application of post-emergence herbicide Bispyribac sodium at the rate of 25 g a.i ha^{-1} on 20 DAT could be a suitable and economical herbicidal weed management practice for transplanted rice for higher productivity.

References

Kumaran, S.T., Kathiresan, G., Chinnusamy, C. and Murali Arthanari, P. 2012. Evaluation of new post emergence herbicide Bispyribac sodium for transplanted rice. Paper presented in Biennial conference on Weed threat to Agriculture, Biodiversity and Environment, 19-20 April, 2012, Kerala Agricultural University, Thrissur, Kerala. P 74

Murali Arthanari, P., Chinnusamy, C., Gowthami, S., Muthukrishnan, P., Veeramani P. and Nalini, K. 2012. Evaluation of new post emergence herbicide Bispyribac sodium for transplanted rice. Paper presented in Biennial conference on Weed threat to Agriculture, Biodiversity and environment, 19-20 April, 2012, Kerala Agricultural University, Thrissur, Kerala. P 78

Nalini, K., Murali Arthanari, P. and Chinnusamy, C. 2012. Evaluation of new post emergence herbicide Bispyribac sodium for transplanted rice. Paper presented in Biennial conference on Weed threat to Agriculture, Biodiversity and environment, 19-20 April, 2012, Kerala Agricultural University, Thrissur, Kerala. P 74.

Schmidt, LA., Scherder EF., Wheeler, CC., Rutledge, JS., Talbert, RE. and Baldwin, FL.1999. Performance of V-10029 (bisbyribac -sodium) in rice weed control programmes. *Proc. South. Weed Sci. Soc*. **52**:49-50.

Yadav, D.B, Yadav, A., Malik, R.K. and Gill, G. 2007. Efficacy of PIH 2023, penoxsulam and azimsulfuron for post-emergence weed control in wet direct seeded rice. In: Proc. ISWS Biennial Conference on New and Emerging Issues in Weed Science. CCS HAU, Hisar, 2-3 Novermber .p. 92.

Yun, M.S., Yogo, Y., Miura, R., Yamasue, Y. and Fischer, AJ. 2005. Cytochrome P-450 monooxygenase activity in herbicide-registant and –susceptible late watergrass (Echinochloa phyllopogon). *Pesticide Biochem and Physiol*. **83**:107-114.

Yadav, D.B, Ashok Yadav and Punia SS. 2009. Evaluation of Bispyribac– sodium for weed control in transplanted rice. *Indian J. of Weed Sci.,* **41** (1&2) : 23-27

Walia, U.S, Onkar Singh, Shelly Nayyar and Vinay Sindhu, 2008. Performance of Post- emergence Application of Bispyribac in Dry-seeded Rice. *Indian J. of Weed Sc.,* **40** (3&4) : 157 – 160 .

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