



Effective post-emergence herbicides for weed control in rice nurseries

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ABSTRACT

On farm experiments were conducted during *Kharif* seasons of 2011 and 2012 to study efficacy of post-emergence herbicides bispyribac-sodium 25 g/ha for broad-spectrum weed control in rice nursery. Among the different treatments, post-emergence application of bispyribac-sodium 25 g/ha applied at 15 DAS (days after sowing) significantly reduced total weed density with weed control efficiency of 90.9 to 97.6% for *Echinochloa crus-galli*, *Trianthema portulacastrum* and *Cyperus iria*. Among other treatments, pre-emergence application of pretilachlor + safener 0.15 kg/ha also recorded significantly lower weed density as compared to control (unweeded). Although weed control efficiency of this treatment was relatively higher for *E. crus-galli* (84.7%) but for *T. portulacastrum* and *C. iria*, this treatment recorded weed control efficiency of 75.9 and 71.2%, respectively. Farmers practice (increased seed rate 100 g/m²) also recorded significantly lower weed density as compared to control (unweeded) but the weed control efficiency was quite low against *E. crus-galli* (36.8%) and *C. iria* (28.1%); however, it was relatively higher for *T. portulacastrum* (66.0%) with mean of 43.7%.

Key words: Bispyribac-sodium, Post-emergence herbicides, Rice Nursery, Sedges, Weed

Rice is an important summer crop of Punjab grown over an area of 28.9 lakh hectares. mostly crop is raised by puddle transplanting. Approximately one lakh hectares of rice nursery is raised for transplanting the above area in the state. Organic manures like farm yard manure are used for raising rice nursery and saturated conditions are maintained throughout (Anonymous 2016). These conditions are very favorable for germination and establishment of the weed. These weeds compete with the nursery plants and results in poor rice transplants. If not controlled, these weed seedlings are transplanted along with rice seedlings and these grown up weed plants compete with crop plants and result in more than 50% reduction in crop yields causing big financial loss to the growers (Walia *et al.* 2005). Hence, in transplanted rice cultivation, maintenance of weed free nursery is a pre-requisite, in order to ensure good seedling vigour and ultimately optimum stand in rice and also to reduce early weed competition in main field. The farmers use pre-emergence herbicides, *viz.* butachlor, thiobencarb and pretilachlor which are effective only against grassy weeds like *Echinochloa crus-galli* and *E. colona*. Sedge weeds such as *Cyperus iria* and *C. difformis* and broad-leaf weeds like *Trianthema portulacastrum* are not controlled with these

chemicals and hence the left over weeds pose severe competition to tender nursery. Thus, there is an urgent need for some post-emergence herbicide which can be used as need based tool to tackle the complex weed flora of rice nurseries. In past, several workers reported about the possible use of pre- and post-emergence herbicides in rice nurseries (Narasimha-Reddy *et al.* 1999, Venkataraman 2000, Rao 2005). Hence, on farm investigations were planned with the objective to evaluate the bio-efficacy of post-emergence herbicide bispyribac-sodium against complex weed flora of paddy nurseries.

MATERIALS AND METHODS

On farm trials to study the efficacy of post-emergence herbicide bispyribac-sodium 25 g/ha were conducted for two consecutive seasons at two locations in districts Faridkot (*Kharif* 2011) and Moga (*Kharif* 2012) of Punjab. The details of conduct and address of farmers selected for conducting trials are given (Table 1).

The soil of experimental fields was sandy loam in texture during both the years. Soil rated low in available nitrogen during 2011 but was medium during 2012. However, available phosphorus and potassium status of the soils were high during both the years. Rice nursery was fertilized with 60 kg/ha nitrogen, 25 kg/ha of phosphorus and 100 kg/ha of zinc sulphate (21%) besides the application of 25 t/ha of FYM. The treatments included the pre-emergence

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Table 1. Details of location, variety and sowing date of trials during Kharif 2011 and 2012

Name and Address of farmer	Variety	Date of sowing
Sh. Gagan Bajaj, Machaki Road, Faridkot	PR 116	12 May, 2011
Sh. Gurvinder Singh, Talwandi Road, Faridkot	PR 116	16 May 2011
KVK Farm, Budh Singh Wala (Moga)	Pusa Basmati 1121	2 June 2012
Sh. Gurpreet Singh Village Tare wala (Moga)	Pusa basmati 1121	3 June 2012

application of pretilachlor + safener 0.15 kg/ha (standard), post-emergence application of bispyribac-sodium 25 g/ha, farmers practice (increased seed rate 100 g/m²) and unweeded (control). However, during Kharif 2011, only two treatments *i.e.* post-emergence application of bispyribac-sodium 25 g/ha and unweeded (control) were evaluated. The herbicide (bispyribac-sodium) was sprayed 15 days after sowing of rice nurseries. The herbicide was sprayed with knapsack sprayer using flat fan nozzle with 375 litres of water per hectare. Application of pre-emergence herbicide was made within 48 hours of sowing of rice nursery by broadcasting after mixing in 60 kg of sand per hectare in standing water.

Data on weed count was recorded from two randomly selected spots per plot by using a quadrat measuring 50 x 50 cm. Weed count data were taken before herbicide spray and also 15 days after spraying the post-emergence herbicide. Weed control efficiency was calculated as given below:

Weed control efficiency (%) = (weed count in control plot - weed count in treatment plot / weed count in control plot) x 100

Statistical analysis of data was done using SAS 9.1 software packages. To test the significance of means, t-test was used during 2011; however, the ANOVA was worked out in RCBD design during 2012.

RESULTS AND DISCUSSION

Effect on weeds

The population of *Echinochloa crus-galli*, *Trianthema portulacastrum* and *Cyperus iria* recorded in randomly selected spots at 14 DAS ranged between 15-18, 9-11 and 7.5-11 plants/m², respectively during 2011; and 8-11, 3-7 and 9-12 plants/m², respectively during 2012 in the plots allocated to unweeded control and bispyribac sodium treatments. However, plots treated with pre-emergence application of pretilachlor + safener 0.15 kg/ha (standard) recorded the population ranging between 1.5-2.0, 1.0-1.5, 2.5-3.0 plants/m², respectively and farmers practice (*i.e.* increasing seed rate) recorded the population ranging between 4.0-4.5, 1.0-1.5 and 2.0-4.0 plants/m², respectively of *Echinochloa crus-galli*, *Trianthema portulacastrum* and *Cyperus iria*. The less weed population under the treatment of pretilachlor + safener 0.15 kg/ha (pre-emergence) and farmers practice as compared to control may be ascribed to the effect of pre-emergence herbicides as well as the role of high seed rate in smothering of weeds.

Data (Table 3) indicated that all the weed control treatments resulted in significant reduction in weed density as compared to unweeded control. Pretilachlor + safener 0.15 kg/ha and farmers practice resulted in significant reduction in weeds as compared to control but were significantly poor as compared to post-emergence application of bispyribac-sodium 25 g/ha, which was highly effective in controlling complex weed flora of rice nurseries during both the years of study as is evident from significant reduction in weed density as compared to unweeded control and other weed control treatments. Bispyribac-sodium 25 g/ha resulted in effective control of all weeds and recorded weed control efficiency of 97.6, 92.3 and 90.9% during Kharif 2011 and 95.0, 91.8 and 94.6% during Kharif 2012 against *E. crus-galli*, *T. portulacastrum*,

Table 2. Weed density before the application of post-emergence herbicide (14 DAS) in rice nurseries

Treatment	Weed density (no./m ²)							
	Kharif 2011				Kharif 2012			
	<i>E. crus-galli</i>	<i>T. portulacastrum</i>	<i>C. iria</i>	Total weed count	<i>E. crus-galli</i>	<i>T. portulacastrum</i>	<i>C. iria</i>	Total weed count
Pretilachlor + safener 0.15 kg/ha (pre-emergence)	-	-	-	-	1.25	1.25	2.75	5.25
Bispyribac-sodium 25 g/ha (post-emergence)	16.5	10.5	9.0	36.0	10.0	3.75	9.5	23.25
Farmers practice (increased seed rate - 100 g/m ²)	-	-	-	-	4.25	1.25	3.0	8.50
Unweeded control	17.0	9.5	8.25	34.75	9.25	5.75	10.75	25.75
t-test significance/ LSD (P=0.05)	NS	NS	NS	NS	1.95	2.47	2.36	3.29

Table 3. Weed density after the application of post-emergence herbicide (30 DAS) in rice nurseries

Treatment	Weed density (no./m ²)							
	Kharif 2011				Kharif 2012			
	<i>E. crus-galli</i>	<i>T. portulacastrum</i>	<i>C. iria</i>	Total weed count	<i>E. crus-galli</i>	<i>T. portulacastrum</i>	<i>C. iria</i>	Total weed count
Pretilachlor + safener 0.15 kg/ha (pre-emergence)	-	-	-	-	2.25	5.0	4.0	11.25
Bispyribac-sodium 25 g/ha (post-emergence)	0.5	1.0	1.0	2.5	1.25	1.0	0.75	2.50
Farmers practice (Increased seed rate- 100 g/m ²)	-	-	-	-	9.0	3.75	10.0	22.75
Unweeded control	23.0	17.0	13.0	53.0	14.75	11.5	14.0	40.25
t-test significance/ LSD	**	**	**	**	2.65	1.88	1.65	6.12

** significant at 1% ; LSD value at 5%

Table 4. Weed control efficiency (WCE) of different treatments in rice nurseries

Treatment	Weed control efficiency (%)								
	Kharif 2011				Kharif 2012				Average of two years
	<i>E. crus-galli</i>	<i>T. portulacastrum</i>	<i>C. iria</i>	Mean WCE	<i>E. crus-galli</i>	<i>T. portulacastrum</i>	<i>C. iria</i>	Mean WCE	
Pretilachlor + safener 0.15 kg/ha	-	-	-	-	84.7	75.9	71.3	77.3	77.3
Bispyribac-sodium 25 g/ha	97.6	92.3	90.9	93.6	95.0	91.8	94.6	93.8	93.7
Farmers practice (Increased seed rate-100 g/m ²)	-	-	-	-	36.9	66.0	28.1	43.7	43.7
Unweeded control	-	-	-	-	-	-	-	-	-

C. iria, respectively (Table 4). The pre-emergence application of pretilachlor + safener 0.15 kg/ha also recorded significantly lower weed density as compared to control. Although the weed control efficiency of this treatment is relatively higher for *E. crus-galli* (84.7%) but for *T. portulacastrum* and *C. iria*, this treatment recorded weed control efficiency of 75.9 and 71.2%, respectively. Farmers practice (increased seed rate 100 g/m²) also recorded significantly lower weed density as compared to control but the weed control efficiency was quite low against *E. crus-galli* (36.6%) and *C. iria* (28.1%) but relatively higher for *T. portulacastrum* (66.0%). Apparently, increasing seed rate is an effective method to reduce the weed density of *T. portulacastrum*. These results corroborate the earlier findings of Rao and Ratnam (2010).

Effect on crop

The visual observation at 7 and 14 days after spray of post-emergence herbicide revealed no phytotoxicity of herbicide on rice nurseries.

It was concluded that post-emergence application of bispyribac-sodium 25 g/ha applied at

15 DAS is very effective due to its effective broad-spectrum weed control and high selectiveness to rice nursery without any phytotoxicity.

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