

Effect of post- emergence herbicides after pre-emergence application of Pendimethalin in aerobic rice (*Oryza sativa* L) in north-western himalayas

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Abstract

Benzyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoropyridine-2-carboxylate is a new arylpiconilate systemic broad spectrum post emergence herbicide with trade name Rinskor, is mainly absorbed by foliage, translocated through the xylem and phloem tissues to meristematic regions where it exhibits unique molecular interaction with auxin receptors and thereby killing weeds. A field experiment was conducted at CSK HP Krishi Vishvavidyalaya Rice and Wheat Research Centre, Malan under All India Co-ordinated Rice Improvement Project during *kharif* 2016 to find out the bio-efficacy of post emergence herbicide Rinskor 2.5% EC after pre-emergence application of Pendimethalin in aerobic rice (sowing of seeds in well aerated soil at optimum moisture conditions and maintaining soil moisture near to field capacity). Treatments comprised of pre-emergence herbicide Pendimethalin 30% EC followed by (*fb*) post-emergence herbicide Rinskor 2.5% EC (750 *fb* 31.25 g a.i/ha), Pendimethalin 30% *fb* Rinskor 2.5% EC (750 *fb* 37.5 g a.i/ha), Pendimethalin 30% followed by Bispyribacsodium 10 SC (750 *fb* 30 g a.i./ha) and Pendimethalin 30% EC followed by Metsulfuronmethyl + Chlorimuronethyl 20% WP (750 *fb* 4 g a.i./ha) along with weed free and un-weeded control. Rinskor was applied at 4-7 leaf stage of weeds & Bispyribacsodium & Metsulfuronmethyl+chlorimuronethyl at 3-4 leaf stage of weeds. Reduction in dry matter and density of weeds was observed by the herbicides applied. The density and dry matter of weeds in weed free condition was statistically at par with pre emergence application of Pendimethalin *fb* Rinskor @ 37.50 g or 31.25 g/ha. Rinskor is safe to the rice crop. Weedy check recorded significantly poor growth (plant height) yield attributes (panicles per unit area), panicle weight and thus, on an average 121.4 per cent increase in yield was recorded due to weed control treatments; highest being with Pendimethalin *fb* Rinskor 37.50 g/ha (139.2%). Post emergence application of Rinskor (3.66 Mg/ha) and Bispyribac sodium (3.56 Mg/ha) recorded statistically equal productivity and yield attributes. Thus, pre-emergence application of Pendimethalin 30% EC followed by Rinskor 2.5% EC @ 37.5 g/ha 4-7 leaf stage of weeds is efficient for control of mixed weed flora in aerobic rice.

Key words: Herbicides, weed management, aerobic rice, pre-emergence, post-emergence

Introduction

In the present scenario of increasing water scarcity, aerobic rice is the one of the contingent crop production systems. Weed menace is the major biological constraint in aerobic rice cultivation causing huge grain yield losses up to 50 to 90 per cent. Meager information is available on the weed management practices and weed-crop dynamics, which influence grain yield, energy use pattern in aerobic rice cultivation. Sharma *et al.* (2016) have reported huge losses in terms of productivity and nutrients. Rice is the second most important crop in Himachal Pradesh and is grown under various topo-sequences at various elevations (300 to 2200 m above mean sea level. Of late, the increased emphasis is being laid on the use of low dose high efficacy herbicides capable of controlling diverse weed flora

(Shekhar *et al.*, 2004). Continuous application of same herbicide leads to shift in weed flora and development of resistance to herbicides (Singh *et al.*, 2013). Keeping these in view, the present investigation was undertaken to find the bio-efficacy of new herbicide in sequential application after Pendimethalin in aerobic rice. Benzyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoropyridine-2-carboxylate is a new arylpiconilate systemic broad spectrum post emergence herbicide with trade name Rinskor. It is new arylpiconilate systemic broad spectrum post emergence herbicide mainly absorbed by foliage, translocated through the xylem and phloem tissues to meristematic regions where it exhibits unique molecular interaction with auxin receptors and thereby is lethal to weeds.



Materials and Methods

A field experiment was conducted in *kharif* 2016 at CSK Himachal Pradesh Krishi Vishvavidyalaya Rice and Wheat Research Centre, Malan located at 76°2'E, 32°1' N and 950 m above mean sea level. Pre-emergence herbicide Pendimethalin 30% EC followed by (*fb*) post-emergence herbicide Rinskor 2.5% EC (750 *fb* 31.25 g a.i/ha), Pendimethalin 30% *fb* Rinskor 2.5% EC (750 *fb* 37.5 g a.i/ha) was evaluated against Pendimethalin 30% followed by Bispyribacsodium 10 SC (750 *fb* 30 g a.i./ha) and Pendimethalin 30% EC followed by Metsulfuronmethyl + Chlorimuronehtyl 20% WP (750 *fb* 4 g a.i./ha) treatments were tested along with weed free (three hand weedings at 20, 40 & 60 days after sowing- DAS), two hand weeding (20 & 40 DAS) and weedy check. The treatments were tested in randomized block design replicated thrice.

The soil of the experimental site was salty clay loam in texture, acidic (pH 5.7) in reaction and medium in available nitrogen (296 kg/ha), phosphorus (29 kg/ha), potash (246 kg/ha) and organic carbon. Rice cultivar 'HPR 1068' was sown in lines 20cm apart using 60 kg seed/ha, on June 21, 2016. Basal application of 45 kg N (through neem coated urea), 40 kg P₂O₅ (through 16%SSP) and 40 kg K₂O (through 60%MOP) was done and 45 kg N was top dressed in two equal splits at maximum tillering and panicle initiation stages. In 64 rainy days from June to October, a total of 1716.8 mm rainfall occurred; supplementary irrigations were given whenever required to keep the soil near full saturation. The monthly ambient temperature varied from 8.5 - 13.1 (minimum temp.) to 28.6-33.4 (maximum temp.) during June to October. The herbicides were applied with knapsack sprayer with flat fan nozzle using 750 L water / ha. The data on weed density and dry matter were recorded at flowering stage of crop. Weed index was calculated as percentage increase in yield over weedy check. Herbicide toxicity rating was done on 1-10 scale.

Results and Discussion

The major weed flora comprised of *Digitaria sanguinalis*, *Eleusine indica*, *Paspalum paspalodes*, *Setaria glauca*, *Aeschynomene indica*, *Echinochloa colona*, *E. crusgalli*, *Phyllanthus niruri*, *Commelina benghalensis*, *Monochoria vaginalis*. Weed density and biomass of grasses & broadleaved weeds were varied significantly by the weed control treatments (Table 1). Reduction in dry matter and density of grass and broad leaf weeds was observed by the herbicides applied (Table 1).The density and dry

matter of weeds in weed free condition (weeding at 20, 40 & 60 DAS) was statistically at par with pre emergence application of Pendimethalin *fb* Rinskor @ 37.50 g or 31.25 g/ha 4-7 leaf stage of weeds. Pendimethalin 30% followed by Metsulfuronmethyl + Chlorimuronethyl -20%WP was observed to control more of broad leaves and recorded less dry weight of broadleaf weeds whereas this treatment controlled less of grasses. All the herbicides were observed to be safe to the crop (toxicity rating 1-10 scale).

Different weed control treatments had significant effect on weeds and the same was reflected in the growth of crop (plant height), panicle length, number of panicles per unit area, panicle weight (Table 2). Significantly lower values of these parameters were observed in weedy , on an average 121.4 per cent increase in yield was recorded due to weed control treatments. Plants were observed to be taller with pre-emergence application of Pendimethalin 30% followed by Metsulfuronmethyl + Chlorimuronethyl -20%WP, followed by the treatment Pendimethalin 30% *fb* Rinskor 2.5% EC (750 *fb* 37.5 or 31.25 g.a.i/ha). All the four herbicide treatments recorded number of panicles, panicle weight at par with weed free treatment. After pre emergence application of Pendimethalin, post emergence application of Rinskor or Bispyribac sodium recorded grain productivity at par with weed free condition. Significant variation in 1000 seed weight of the crop was not observed by weed control treatments. Weed index i.e. increase in yield over the weedy check by different treatments varied from 94.8 to 139.2 per cent; highest being with Pendimethalin *fb* Rinskor 37.50 g/ha. Similar results have been reported by Anonymous (2016).

Conclusion

Pre-emergence application of Pendimethalin 30% 750 g a.i./ha followed by Benzyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoropyridine-2-carboxylate with trade name Rinskor 2.5% EC @ 37.5 g/ha 4-7 leaf stage of weeds provides efficient control of mixed weed flora in aerobic rice in mid hill conditions of Himachal Pradesh.

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Table 1. Effect of different treatments on weed density and dry matter in aerobic rice

Treatment	Time of application	Weed density (No./m ²)		Weed dry matter at flowering (g/m ²)		Herbicide toxicity
		Grass	BLW	Grass	BLW	
Pendimethalin 30% <i>fb</i> Rinskor 2.5% EC (750 <i>fb</i> 31.25 g.a.i/ha)	Within 2 days of sowing (DAS) <i>fb</i> 4-7 leaf stage of weeds	8.11 (65.33)	8.20 (68.00)	11.29	15.84	1
Pendimethalin 30% <i>fb</i> Rinskor 2.5% EC (750 <i>fb</i> 37.5 g.a.i/ha)	With in 2 DAS <i>fb</i> 4-7 leaf stage of weeds	8.39 (72.00)	7.67 (58.67)	10.34	15.14	1
Pendimethalin 30% <i>fb</i> Bispyribacsodium 10SC (700 <i>fb</i> 30)	Within 2 DAS <i>fb</i> 3-4 leaf stage of weeds	10.15 (102.67)	6.64 (44.00)	18.79	12.87	1
Pendimethalin 30% <i>fb</i> Metsulfuronmethyl + Chlorimuronethyl -20% WP (750 <i>fb</i> 30)	Within 2 DAS <i>fb</i> 3-4 leaf stage of weeds	8.91 (81.33)	8.56 (73.33)	17.03	14.39	1
Weed free Condition	Weedings at 20, 40, 60 DAS	6.80 (46.67)	4.90 (24.00)	8.8	13.79	
Hand weeding twice	Weedings at 20,40 DAS	10.85 (118.67)	8.96 (81.33)	12.68	23.55	
Weedy Check		12.43 (154.67)	9.80 (96.00)	26.87	35.72	
CD(0.05)		2.45	1.59	5.74	1.23	-

fb = followed by; Figures in parentheses are means of original values

Table 2. Effect of treatments on yield attributes and yield of aerobic rice

Treatment	Time of application	Plant height (cm)	Panicle (No./m ²)	Panicle length (cm)	Panicle weight (g)	Test wt. (g)	Grain yield (Mg/ha)	Straw yield (Mg/ha)	Weed index
Pendimethalin 30% followed by (<i>fb</i>) Rinskor 2.5% EC (750 <i>fb</i> 31.25 g.a.i/ha)	Within 2 days of sowing (DAS) <i>fb</i> 4-7 leaf stage of weeds	72.3	343	18.7	1.92	28.07	3.48	4.03	127.4
Pendimethalin 30% <i>fb</i> Rinskor 2.5% EC (750 <i>fb</i> 37.5 g.a.i/ha)	Within 2 DAS <i>fb</i> 4-7 leaf stage of weeds	72.6	342	18.4	1.86	28.38	3.66	4.23	139.2
Pendimethalin 30% <i>fb</i> Bispyribacsodium 10SC (750 <i>fb</i> 30)	Within 2 DAS <i>fb</i> 3-4 leaf stage of weeds	74.7	331	18.6	1.82	28.71	3.56	4.22	132.7
Pendimethalin 30% <i>fb</i> Metasulfuronmethyl + Chlorimuronethyl -20% WP (750 <i>fb</i> 30)	Within 2 DAS <i>fb</i> 3-4 leaf stage of weeds	71.3	367	17.4	1.79	28.57	3.29	3.96	115.3
Weed free Condition	Weedings at 20, 40, 60 DAS	71.3	333	17.8	1.83	28.8	3.35	3.95	118.9
Hand weeding twice	Weedings at 20,40 DAS	71.2	287	18.0	1.81	28.76	2.98	3.45	94.8
Weedy Check		70.5	217	16.8	1.45	27.78	1.53	2.45	-
CD(0.05)		0.7	66.9	0.9	0.16	NS	0.35	0.47	

fb = followed by

References

- Anonymous. 2016. Progress Report, All India Co-ordinated Rice Improvement Project 3: 4.230-4.337 p.
- Sharma R, Rana MC, Rana SS and Sharma GD. 2016. Effect of herbicide combination on nutrients depletion by weeds in wheat. *Himachal Journal of Agricultural Research*. 42(1):78-81.
- Shekhar J and Mankotia BS. 2005. Efficacy of some new herbicides in wet seeded rice (*Oryza sativa* L.). *Indian Journal of Weed Science* 37:58-60.
- Shekhar J, Mankotia BS and Bindra AD. 2004. Bio-efficacy of some new herbicides against weeds in transplanted rice (*Oryza sativa* L.). *Indian Journal of Weed Science*. 36:50-53.
- Sharma RP, Pathak SK and Singh RC. 2013. Effect of nitrogen and weed management in direct-seeded rice (*Oryza sativa*) under upland conditions. *Indian Journal of Agronomy*. 52 (2): 114-119.