Indian J. Weed Sci. **40** (3 & 4) : 142-146 (2008)

Efficacy of Penoxsulam Against Weeds in Transplanted Rice

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ABSTRACT

Penoxsulam was evaluated against complex weed flora both as pre-emergence as well as post-emergence herbicide in transplanted rice during **kharif** 2005 and 2006 at Karnal, Haryana, India. *Echinochloa crusgalli*, *E. colona*, *Ammania baccifera, Euphorbia* sp., *Fimbristylis miliaceae* and *Cyperus* sp. were the major weeds. Penoxsulam at 25.0 g/ha as pre-emergence (3 DAT) application and 20.0-22.5 g/ha as post-emergence (10-12 DAT) application provided satisfactory control of weeds consequently resulting in grain yield of transplanted rice similar to the weed free plots. There was no residual toxicity of penoxsulam on succeeding crop of wheat.

Key words : Herbicide efficacy, application time, application rate

INTRODUCTION

Rice is infested with a wide variety of weeds and the losses due to weeds could go as high as 43% (Nandal *et al*., 1999). A range of herbicides (pretilachlor, butachlor, anilofos and oxadiargyl) is being used as pre-emergence application for the effective management of weeds in transplanted rice. However, the window of application of these herbicides is very narrow (1-3 days after transplanting). But under certain situations of poor water and weed management, need of post-emergence herbicides is often realized. Penoxsulam is a new acetolactate synthase (ALS) inhibitor herbicide for post-emergence control of annual grasses, sedges and broadleaf weeds in rice culture (Jabusch and Tjeerdema, 2005). The present study was undertaken to standardize the dose and time of application of penoxsulam against complex weed flora in transplanted rice.

MATERIALS AND METHODS

A field experiment was conducted to evaluate the efficacy of penoxsulam 24 SC (Dow India Ltd.) at CCS Haryana Agricultural University Regional Research Station, Karnal during **kharif** 2005 and 2006. The soil of experimental field was clay loam in texture, low in available nitrogen, medium in available P_2O_5 and high in available K_2O with slightly alkaline in reaction (pH 8.1). Thirty-five days old seedlings of rice cultivar HKR-47 were transplanted on July 04, 2005 and July 07, 2006 at a spacing of 20 x 15 cm in a plot size of 4.5 x 3.0 m. The experiment consisted of 10 treatments viz., penoxsulam at 20.0, 22.5 and 25.0 g/ha at three days after transplanting (DAT), 17.5, 20.0 and 22.5 g/ha at 10-12 DAT, butachlor at 1250 g/ha in 2005 and 1500 g/ha in 2006 at 3 DAT and pretilachlor 750 g/ha in 2005 and 1000 g/ha in 2006 at 3 DAT alongwith weedy and weed free checks. The experiment was laid out in a randomized block design with three replications. Herbicides were sprayed with knapsack sprayer fitted with flat fan nozzle using 300 litres of water/ha. Crop was raised as per the recommendations of the State University. Weed density and dry weight were recorded at 60 DAT and yield and yield attributes at maturity. In general, the BLW and sedges were very low under all the treatments during 2005 as compared to 2006 due to continuous water stagnation during the initial crop stages. As the pressure of grassy weeds was very high, hence BLW and sedges did not appear in the weedy check plots during 2005. Moreover, where grassy weeds were controlled by herbicides, some BLW and sedges appeared in those plots. Therefore, data on per cent control (visual) were recorded at 60 DAT in comparison to the control levels of 90% in weed free checks. Data on crop phyto-toxicity were recorded at 15 and 30 days after treatment. The crop was harvested on October 16, 2005 and October 19, 2006.

Residual toxicity of penoxsulam was also recorded on succeeding crop of wheat. Since, there was

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Table 1. Effect of penoxsulam on weed density and per cent weed control in transplanted rice

Treatment	Dose (g a.i./ha)	Time (DAT)	Weed density (No./m^2)						Per cent control (visual)			
			Grassy		BLW		Sedges		Grassy		BLW+ Sedges	
			2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Penoxsulam	20.0	3	1.82 (2.7)	4.81 (26.0)	6.72 (45.3)	9.53 (90.7)	2.36 (5.33)	6.75 (46.0)	75	65	72	27
Penoxsulam	22.5	3	1.77 (3.3)	4.68 (21.3)	3.83 (18.0)	9.05 (82.7)	1.49 (1.33)	6.92 (48.0)	75	75	83	43
Penoxsulam	25.0	3	1.82 (2.7)	3.05 (8.7)	3.92 (18.7)	8.77 (76.7)	1.87 (4.0)	4.23 (17.3)	87	82	77	47
Penoxsulam	17.5	10-12	1.24 (0.7)	3.38 (10.7)	4.80 (24.0)	8.68 (82.0)	2.88 (10.0)	6.70 (45.3)	85	77	75	37
Penoxsulam	20.0	10-12	1.24 (0.7)	2.87 (8.0)	3.37 (13.3)	8.96 (81.3)	3.23 (10.67)	5.55 (33.3)	85	85	78	43
Penoxsulam	22.5	10-12	1.24 (0.7)	2.26 (4.7)	3.20 (9.3)	8.02 (64.0)	1.66 (2.0)	5.34 (28.7)	88	88	83	57
Butachlor	1250/1500*	3	1.00 (0.0)	1.66 (2.0)	2.42 (6.0)	10.01 (101.3)	1.67 (2.67)	6.29 (42.0)	90	88	78	37
Pretilachlor	750/1000*	3	1.55 (2.0)	1.73 (2.0)	3.83 (15.3)	8.18 (66.7)	3.14 (9.33)	6.90 (48.0)	83	88	80	40
Weed free	-	-	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	90	90	90	90
Weedy check	-	-	6.88 (55.3)	8.88 (78.0)	1.00 (0.0)	8.56 (73.3)	1.00 (0.0)	4.37 (18.7)	0	0	-	0
LSD (P=0.05)			1.88	1.50	2.11	2.61	1.47	2.25	-	-	-	-

Original data in parentheses were subjected to square root transformation ($\sqrt{X+1}$) before statistical analysis.
DAT–Days after transplanting, BLW–Broadleaf weeds. *Dose of herbicides during 2005 and 2006, respectively.

Table 2. Effect of penoxsulam on weed dry weight, yield and yield attributes of transplanted rice

Treatment	Dose (g a. i./ha)	Time (DAT)	Weed dry weight (g/m^2)				Plant height (cm)		Effective tillers/ mrl		Panicle length (cm)		Grain yield (kg/ha)	
			Grassy		BLW+Sedges									
			2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Penoxsulam	20.0	3	36.7	115.2	13.39	21.4	91.2	87.3	59.3	57.7	22.2	22.2	5777	4487
Penoxsulam	22.5	3	22.2	100.8	8.96	23.7	92.5	88.3	60.7	61.2	21.2	21.8	6049	4654
Penoxsulam	25.0	3	11.4	53.1	8.91	24.9	91.4	88.1	61.0	62.8	21.7	22.0	6413	4954
Penoxsulam	17.5	10-12	9.8	66.0	13.53	19.9	94.3	90.7	56.5	61.0	21.5	22.2	6296	4606
Penoxsulam	20.0	10-12	13.6	48.8	13.51	26.5	94.1	90.9	59.5	63.2	21.8	21.7	6216	5107
Penoxsulam	22.5	10-12	9.1	41.7	8.87	25.7	92.9	89.3	61.5	63.7	21.5	22.3	6537	5412
Butachlor	1250/1500*	3	0.0	36.0	13.46	24.8	92.2	89.8	56.2	64.3	21.3	21.7	6839	5528
Pretilachlor	750/1000*	3	13.5	38.3	13.63	20.3	94.0	89.8	55.0	66.7	21.6	21.7	6099	5738
Weed free	-	-	0.0	0.0	0.0	0.0	93.9	89.9	60.2	65.7	21.9	22.9	6469	5898
Weedy check	-	-	313.9	328.4	0.0	23.7	88.4	86.6	44.7	37.3	20.1	20.3	2864	1358
LSD (P=0.05)			29.2	30.8	5.74	7.7	NS	NS	7.9	8.8	0.8	1.0	1023	960

mrl –metre row length, DAT–Days after transplanting, BLW–Broadleaf weeds. *Dose of herbicides during 2005 and 2006, respectively.

no phyto-toxicity on rice, and no residual toxicity on succeeding crop of wheat, data on these aspects are not presented.

RESULTS AND DISCUSSION

Effect on Weeds

Weed flora of the field consisted of *Echinochloa crus-galli* (L.) P. Beauv. and *E. colona* (L.) Link among grasses; *Ammania baccifera* L. and *Euphorbia* sp. among broadleaf weeds (BLW) and *Fimbristylis miliaceae* (L.) Vahl and *Cyperus* sp. among sedges.

Grassy weeds density and dry weight decreased with increase in dose of penoxsulam at both the stages of application during both the years (Tables 1 and 2). During 2005, density and dry weight of grassy weeds under all treatments of penoxsulam being at par with each other were also at par with the standard herbicides (butachlor and pretilachlor) and the weed free check, except weed dry weight under penoxsulam 20 g/ha at 3 DAT which was inferior to butachlor 1250 g/ha. During 2006, all post-emergence applications being at par with each other were significantly better than all pre-emergence application of penoxsulam except 25 g/ha, in respect of grassy weeds dry weight. Weed density under penoxsulam at 22.5 g/ha at 10-12 DAT was at par with the weed free and post-emergence application of penoxsulam 20.0-22.5 g/ha was better than respective doses at 3 DAT, but at par with pre-emergence application at 25 g/ha.

Dry weight of broadleaf weeds and sedges under all the penoxsulam treatments was at par with butachlor and pretilachlor during both the years (Table 2). During 2005, penoxsulam 22.5 g/ha at both the stages of application resulted in maximum reduction in density of BLW and sedges (Table 1). During 2006, density of broadleaf weeds under all the penoxsulam treatments being at par with each other was also at par with butachlor and pretilachlor. Density of sedges was lowest under penoxsulam 25.0 g/ha at 3 DAT which was at par with post-emergence application of penoxsulam at 20.0-22.5 g/ha.

In general, the control of weeds increased with corresponding increase in the dose of penoxsulam. Per cent control of grassy weeds (Table 1) was in the range of 75 to 87% and 65 to 82% during 2005 and 2006, respectively, under pre-emergence application of penoxsulam. Post-emergence application resulted in grassy weeds control of 85 to 88% and 77 to 88% during 2005 and 2006, respectively. The control of broadleaf weeds and sedges was in the range of 72 to 77% at 3 DAT and 75 to 83% at 10-12 DAT during 2005, while it was 27 to 47% with pre-emergence application, and 37 to 57% with post-emergence application during 2006 as compared to 90% under weed free check. Better control of weeds by penoxsulam in 2005 than 2006 was probably due to continuous stagnation of water during early crop phase in 2005. Post-emergence application of penoxsulam has been reported to have an edge over pre-emergence application earlier also (Singh *et al*., 2007). Yadav *et al*. (2007) have also reported penoxsulam as an effective post-emergence herbicide against mixed weed flora in rice.

Effect on Crop

Rice plant height was not affected by herbicidal treatments (Table 2). There was no phyto-toxicity of penoxsulam on rice. Effective tillers and panicle length under all the herbicidal treatments were at par with each other and weed free check, and significantly higher than weedy check. Rice grain yield increased with increase in dose of penoxsulam with both stages of application, but was statistically at par with each other. During 2005, all the herbicidal treatments produced significantly higher rice grain yield than weedy check but at par with weed free and pretilachlor. During 2006, penoxsulam 25.0 g/ha applied at 3 DAT and 20.0-22.5 g/ha applied at 10-12 DAT was at par with the butachlor, pretilachlor and weed free check with respect to rice grain yield. Efficacy of penoxsulam in controlling weeds and increasing rice grain yield was also reported by Jason *et al*. (2007) and Mishra *et al*. (2007). Singh *et al*. (2007) reported that comparatively lower doses of penoxsulam could be used when it was applied at early post-emergence (8-12 DAT).

It may be concluded that penoxsulam application at 25.0 g/ha as pre-emergence (3 DAT) and 20.0-22.5 g/ha as post-emergence (10-12 DAT) is needed for satisfactory weed control in transplanted rice and to realize better rice yields without any residual toxicity of penoxsulam on succeeding crop of wheat.

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