Indian J. Weed Sci. **39** (1 & 2) : 24-27 (2007)

Efficacy of Penoxsulam on Weeds and Yield of Transplanted Rice (*Oryza sativa*)

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ABSTRACT

A field experiment was conducted during rainy (**kharif**) seasons of 2005 and 2006 at Jabalpur to assess the efficacy of penoxsulam as pre-emergence (5 days after transplanting–DAT) and early post-emergence (10 DAT) in transplanted rice (*Oryza sativa* L.). The major weeds were *Echinochloa colona*, *Cyperus* spp., *Ammania baccifera*, *Lindernia crustacea*, *Eriocaulon* spp., *Caesulia axillaris*, *Alternanthera sessilis* and *Commelina* spp. Infestation of weeds reduced grain yield of rice by 25.9%. Penoxsulam 22.5 g/ha applied at 10 days after transplanting was found most effective in controlling weeds and maximizing rice grain yield (6287 kg/ha). Early post-emergence application (10 DAT) of penoxsulam was better than its pre-emergence application (5 DAT) in increasing grain yield. Grain yield of rice was significantly and negatively correlated (r = -0.82) with weed dry matter.

INTRODUCTION

Transplanted rice (*Oryza sativa* L.) is infested with heterogeneous group of weeds, consisting of grassy, broad-leaved and sedges. Competition of weeds brought about 15-76% reduction in grain yield of rice (Singh and Bhan, 1986; Mishra, 1997; Singh *et al.*, 2004). Effective control of these weeds had increased the grain yield by 85.5% (Mukherjee and Singh, 2005). The use of herbicides offers selective and economical control of weeds right from the beginning, giving crop an advantage of good start and competitive superiority. For the last many years butachlor, pretilachlor and anilofos are in use for pre-emergence control of early flushes of grassy and 2, 4-D and almix for post-emergence control of broad-leaved weeds in transplanted rice. These herbicides are effective against weed species, but most of them are specific and are effective against narrow range of weed species (Narayana *et al.*, 1999). Continuous use of these herbicides year after year may also lead to weed flora shift and development of herbicide resistance in weeds. Therefore, it is essential to develop and evaluate new and alternate herbicides to widen application window and weed control spectrum. Keeping these facts in view, the present investigation was undertaken to study the effect of penoxsulam on weeds and yield of transplanted rice.

MATERIALS AND METHODS

The field experiment was conducted during rainy seasons of 2005 and 2006 at National Research Centre for Weed Science, Jabalpur. The soil of the experimental field was clay loam (Typic Haplustert), low in available nitrogen (239 kg/ha), medium in organic carbon (0.66%), available phosphorus (17.7 kg/ha) and potassium (298 kg/ha) with neutral pH (7.2) and E.C. (0.37 dS/m). The treatments comprising penoxsulam (24 SC) 20, 22.5 and 25 g/ha (applied at 5 days after transplanting–DAT), penoxsulam 17.5, 20.0 and 22.5 g/ha (applied at 10 DAT), butachlor (50 EC) 1250 g/ha at 5 DAT, pretilachlor (50 EC) 750 g/ha at 5 DAT, hand weeding at 20 and 40 DAT and weedy check were replicated three times in a randomized block design. Twenty-five-day old seedlings of rice variety 'Kranti' were transplanted on 19 and 5 July 2005 and 2006, respectively, at 20 x 20 cm spacing. One-third of recommended dose of N (40 kg/ha) and full dose of P_2O_5 (60 kg/ha) and K_2O (40 kg/ha) were applied before transplanting and remaining N was top-dressed in two equal splits, half at active tillering and half at panicle-initiation stage. Herbicides were applied using 500 litres water/ha with the help of knapsack sprayer, fitted with flat-fan nozzle. There was sufficient water submergence (5+2 cm) in the plots at the time of herbicide spraying. The crop was raised under irrigated condition with recommended package of practices. Population and dry matter of weeds were recorded at 40 DAT with the help of random quadrate (0.5 x 0.5 m) at four places in a plot and then converted into per square metre. These were subjected to square root transformation to normalize their distribution before analysis. Crop received 1620 and 950 mm rainfall during 2005 and 2006, respectively, as against average annual rainfall of 1250 mm.

Table 1. Effect of different treatments on weed population (No./m^2) at 40 days after transplanting

Treatment	Dose (g a. i./ ha)	Time of application (DAT)	*Echinochloa colona*		*Cyperus* spp.		*Ammania baccifera*		*Lindernia crustacea*	*Eriocaulon* spp.	*Caesulia axillaris*	*Alternanthera sessilis*	*Commelina* spp.
			2005	2006	2005	2006	2005	2006	2005	2005	2006	2006	2006
Hand weeding	Twice	20 and 40	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Penoxsulam 24 SC	20.0	5	1.3 (1.1)	2.3 (4.7)	3.2 (10.0)	6.4 (40.7)	2.7 (7.0)	3.3 (10.3)	0.7 (0.0)	7.9 (62.5)	3.9 (14.7)	3.9 (14.7)	1.1 (0.7)
Penoxsulam 24 SC	22.5	5	0.7 (0.0)	2.2 (4.3)	2.7 (7.0)	4.0 (15.7)	2.8 (7.4)	3.9 (14.7)	1.2 (1.0)	10.0 (99.1)	3.7 (13.3)	2.3 (5.0)	1.2 (1.0)
Penoxsulam 24 SC	25.0	5	0.9 (0.3)	2.3 (5.0)	1.9 (3.2)	5.3 (27.7)	2.9 (7.7)	3.0 (8.7)	1.6 (1.9)	12.5 (154.7)	3.2 (9.7)	1.9 (3.0)	0.9 (0.3)
Penoxsulam 24 SC	17.5	10	1.3 (1.3)	2.7 (6.7)	1.2 (0.9)	5.4 (28.7)	1.9 (3.0)	2.5 (5.7)	0.9 (0.3)	7.8 (59.7)	3.3 (10.7)	2.1 (4.0)	1.1 (0.7)
Penoxsulam 24 SC	20.0	10	0.7 (0.0)	2.2 (4.3)	0.9 (0.3)	4.2 (17.0)	1.9 (3.0)	4.1 (16.7)	1.8 (2.6)	6.1 (36.6)	2.8 (7.0)	2.4 (5.3)	0.7 (0.0)
Penoxsulam 24 SC	22.5	10	0.9 (0.3)	1.4 (1.3)	1.1 (0.6)	3.8 (13.7)	1.6 (1.9)	3.3 (10.7)	0.7 (0.0)	4.8 (22.6)	2.5 (5.7)	1.5 (1.7)	0.7 (0.0)
Butachlor 50 EC	1250	5	1.5 (1.6)	3.0 (8.7)	1.5 (1.6)	2.7 (7.0)	1.9 (3.2)	3.9 (14.7)	2.1 (4.0)	10.1 (100.1)	4.2 (17.0)	2.0 (3.7)	1.1 (0.7)
Pretilachlor 50 EC	750	5	0.9 (0.3)	3.0 (8.7)	1.1 (0.6)	5.7 (31.7)	1.9 (3.3)	5.1 (25.0)	1.2 (0.9)	5.9 (33.7)	4.1 (16.0)	1.3 (1.3)	0.9 (0.3)
Weedy check			2.0 (3.3)	3.2 (10.0)	3.3 (10.3)	5.6 (31.0)	3.8 (14.1)	3.6 (12.7)	2.83 (7.5)	12.6 (159.3)	4.3 (17.7)	3.0 (8.7)	1.3 (1.3)
LSD (P=0.05)			0.4	1.4	0.5	2.2	0.6	1.0	0.5	2.6	1.0	1.9	NS

Data subjected to square root transformation. Values in parentheses are original.
NS–Not Significant.

Table 2. Effect of different treatments on weed dry weight, yield attributes and yield of rice

Treatment	Dose (g a. i./ ha)	Time of application (DAT)	Weed dry weight (g/m^2) at 40 DAT*		Panicles/ hill		Panicle length (cm)		Grains/ panicle		1000- grain weight (g)		Grain yield (kg/ha)	
			Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Hand weeding	Twice	20 and 40	0.7 (0.0)	0.7 (0.0)	9.1	11.1	24.2	24.7	227	230	28.7	24.0	6,874	5,129
Penoxsulam 24 SC	20.0	5	3.0 (8.3)	4.9 (23.1)	9.0	10.6	24.0	22.2	214	189	27.9	24.7	6,118	4,174
Penoxsulam 24 SC	22.5	5	3.8 (13.7)	4.1 (16.5)	10.0	10.5	23.6	22.4	224	183	27.8	25.7	6,326	4,262
Penoxsulam 24 SC	25.0	5	4.3 (17.6)	3.1 (8.8)	9.1	10.5	24.1	24.4	228	219	28.2	25.2	6,743	4,351
Penoxsulam 24 SC	17.5	10	2.8 (7.5)	4.4 (19.1)	8.9	10.3	24.0	22.7	199	179	27.3	25.8	6,326	3,885
Penoxsulam 24 SC	20.0	10	2.1 (4.1)	3.1 (9.4)	9.0	10.9	24.1	23.5	227	221	28.4	22.9	6,821	4,840
Penoxsulam 24 SC	22.5	10	2.1 (4.0)	3.0 (8.4)	10.5	11.5	23.6	23.5	245	228	26.6	25.1	7,055	5,519
Butachlor 50 EC	1250	5	5.3 (27.9)	6.8 (46.1)	8.8	10.1	23.9	23.3	227	196	26.6	24.3	6,763	3,613
Pretilachlor 50 EC	750	5	2.1 (3.7)	7.1 (50.0)	8.4	9.7	24.3	22.6	213	181	30.1	25.5	6,638	3,375
Weedy check			6.0 (35.4)	7.7 (59.0)	8.1	8.5	23.7	23.3	187	169	26.0	25.2	6,092	3,228
LSD (P=0.05)			0.7	2.1	1.8	2.6	NS	2.2	38	37	NS	NS	571	893

*Data subjected to square root transformation. Values in parentheses are original, Y_1–2005, Y_2–2006.
NS–Not Significant.

RESULTS AND DISCUSSION

Effect on Weeds

The important weeds observed in weedy check plots at 40 DAT during both the years were *Echinochloa colona* (L.) Link, *Cyperus* spp. and *Ammania baccifera* (L.). Few weeds viz., *Lindernia crustacea* (L.) F. Mull and *Eriocaulon* spp. in 2005 and *Alternanthera sessilis* (L.) DC, *Caesulia axillaris* Roxb. and *Commelina* spp. in 2006 were also recorded. Among *Cyperus* spp., *C. difformis* (L.) was dominant in 2005 and *C. iria* (L.) in 2006. Higher rainfall (1620 mm) during 2005 led to water submergence for a longer period and resulted in lower weed density as compared to 2006 (Table 1). During 2005, penoxsulam, irrespective of its dose and time of application, significantly reduced the population of *E. colona*. Butachlor 1250 g/ha and pretilachlor 750 g/ha were also effective against *E. colona*. However, during 2006, except penoxsulam 22.5 g/ha applied at 10 DAT, none of the herbicides provided significant control of this weed. Penoxsulam 25 g/ha at 5 DAT and 17.5 to 22.5 g/ha at 10 DAT significantly reduced the population of *Cyperus* spp. in 2005. Penoxsulam 17.5 to 22.5 g/ha at 10 DAT was at par with butachlor and pretilachlor but significantly superior to its application at 5 DAT in controlling *A. baccifera* during 2005, however, in 2006, none of the herbicidal treatments provided effective control of this weed. Better weed control during 2005 might be due to prolonged water submergence owing to higher rainfall. All the herbicidal treatments significantly reduced the population of *Lindernia crustacea*. Penoxsulam 22.5 g/ha at 10 DAT significantly controlled *Eriocaulon* spp. and was comparable to pretilachlor but significantly superior to its application at 5 DAT. Irrespective of the time of application, penoxsulam at higher doses was better in reducing the population of *Alternanthera sessilis*.

In general, higher weed dry matter accumulation was recorded during 2006 than 2005 due to lower weed population during first year. Irrespective of dose and time of application, penoxsulam significantly reduced the weed dry matter as compared to weedy check during both the years (Table 2). Its early post-emergence application (10 DAT) was better than pre-emergence application (5 DAT) in reducing weed dry matter.

Effect on Crop

Yield attributes and grain yield were significantly affected due to application of herbicides (Table 2). Application of penoxsulam 22.5 g/ha at 10 DAT had the maximum number of panicles/hill and grains/panicle during both the years and was comparable to hand weeding treatment (20 and 40 DAT). The lowest number of panicles/hill and grains/panicle were recorded in weedy check during both the years. On an average, infestation of weeds reduced grain yield of rice by 25.9% as compared to the best treatment. Higher grain yield was recorded in 2005 than 2006 due to more favourable weather conditions and lower weed problem. Maximum grain yield was obtained with penoxsulam 22.5 g/ha applied at 10 DAT followed by hand weeding twice and penoxsulam 20 g/ha at 10 DAT. In general, early post-emergence application (10 DAT) of penoxsulam was better than its pre-emergence application (5 DAT) in increasing grain yield. Grain yield of rice was significantly and negatively correlated (r= -0.82) with weed dry matter.

ACKNOWLEDGEMENT

The authors are highly grateful to the Dow AgroScience India Pvt. Ltd. for providing the financial support and supplying new molecule to carry out the present study.

REFERENCES

Mishra, J. S. 1997. Critical period of weed competition and losses due to weeds in major field crops. *Farmer & Parliament* **23** : 19-20.

Mukherjee, D. and R. P. Singh, 2005. Effect of micro-herbicides on weed dynamics, yield and economics of transplanted rice (*Oryza sativa*). *Ind. J. Agron.* **50** : 292-295.

Narayana, A. L., V. Veerabadram and R. Poonguzhalan, 1999. Performance of low doses high efficacy herbicide for weed control in transplanted rice. *Oryza* **36** : 290-292.

Singh, O. P. and V. M. Bhan, 1986. Effect of herbicides and water submergence levels on control of weeds in transplanted rice. *Ind. J. Weed Sci.* **18** : 226-230.

Singh, V. P., G. Singh and M. Singh, 2004. Effect of fenoxaprop-p-ethyl on transplanted rice and associated weeds. *Ind. J. Weed Sci.* **36** : 190-192.