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Short communication

Penoxsulam as post-emergence herbicide for weed control in transplanted rice

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Among the several factors responsible for low rice productivity, weeds are considered to be one of the major limiting factors due to their manifold harmful effects (Singh *et al*. 2009). Most of the traditional herbicides in use are applied at higher doses *i.e*., 0.8 to 1.5 kg/ha, hence the continuous use would end in high residual effect in soil and water. Recent trend of herbicide use is to find out an effective weed control by using low dose herbicides, which will not only reduce the total volume of herbicide use but also the application becomes easier and economic (Kathiresan 2001). Penoxsulam is one of the low dose high efficacy broad spectrum herbicide which offers eco-friendly weed control. Therefore, this study was conducted to assess the bio-efficacy of post-emergence application of penoxsulam (24 SC) in transplanted rice.

The field experiment was conducted at a farmer's field in Kanjirathady Padasekharam in Nemom block, Thiruvananthapuram district (Kerala) located at 8.5º N latitude and 76.9º E longitudes at an altitude of 29 m above mean sea level (MSL). The soil of the experimental site was sandy clay loam in texture (coarse sand 47.65%, fine sand 10.90%, silt 9.05% and clay 32.40%) and the soil order was 'Oxisol'. The soil pH was 6.0 and it was high in organic carbon (1.16%), available P (22.4 kg/ha) and medium in availableN (500 kg/ha) and K (170.1 kg/ ha). The experiment was laid out in randomized block design (RBD) with eight treatments and replicated thrice. The gross plot size was 20 m^2 (5 x 4 m). Medium duration rice variety '*Uma (MO 16)*' having duration of 120-125 days was used for the study. Twenty days old seedlings were transplanted in the main field at two to three seedlings per hill and the water level was maintained at about 1.5 cm during transplanting with a spacing of 20 x 10 cm. Penoxsulam was applied at 10 to 12 days after transplanting (DAT), whereas bispyribac-sodium and 2,4–D sodium salt were applied at 20 DAT. Hand operated knapsack sprayer fitted with a flat fan type nozzle (WFN 40) was used for spraying the herbicides adopting a spray volume of 500 l/ha. For manually weeded plots two weeding were given at 20 and 40 DAT. To study the weed dynamics, quadrate of size 0.5 m^2 was placed at random in two sites in each plot and the weeds within the frames of the quadrate were identified and recorded at 20 and 40 DAT. Data were statistically analyzed using Analysis of Variance techniques (ANOVA).

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Weed species and density

The dominant broad-leaved species were *Limnocharis flava*, *Monochoria vaginalis*, *Ludwigia parviflora*, *Marsilea quadrifolia* and *Lindernia rotundifolia*. Among sedges, *Cyperus difformis* and *Scirpus grossus* were the dominant ones. *Echinochloa colona* and *Panicum repens* were dominant grassy weeds.

Lower density of sedges, grasses and broad-leaved was recorded (Table 1 and 2) at higher doses of penoxsulam (25.0 and 22.5 g/ha).

Weed control efficiency

Higher doses of penoxsulam 25.0 g/ha and 22.5 g/ha recorded significantly lower total dry matter production compared to its lower doses (Table 2).This result was confirmed by Singh *et al.* (2009). The weed control efficiency of penoxsualam 25 g/ha was 96.2% at 40 DAT, which was comparable with its lower doses and bispyribac-sodium (Table 2).

Effect on crop

Penoxsulam 22.5 g/ha registered the highest value for productive tillers/m^2 and filled grains/ panicle (Table 3). However, with regard to number of productive tillers/m^2, penoxsulam 25.0 g/ha and bispyribac-sodium 30.0 g/ha also recorded comparable values. With respect to number of filled grains/panicle, along with these treatments 2,4-D sodium salt 1.0 kg/ha also recorded comparable values.

Table 1. Effect of different weed management practices on absolute density (no./m^2) of grasses, broad-leaved weeds and sedges in transplanted rice

Treatment	Grasses		BLWs		Sedges	
	20 DAT	40 DAT	20 DAT	40 DAT	20 DAT	40 DAT
Penoxsualam 17.5 g/ha	1.33 (1.48)	6.00 (2.43)	16.0 (4.12)	7.33 (2.70)	14.7 (3.94)	10.0 (3.20)
Penoxsualam 20 g/ha	2.66 (1.90)	4.66 (2.21)	12.7 (3.69)	6.00 (2.42)	14.0 (3.86)	5.33 (2.34)
Penoxsualam 22.5 g/ha	0.66 (1.24)	2.00 (1.65)	13.3 (3.78)	4.33 (2.42)	8.00 (2.98)	1.33 (1.17)
Penoxsualam 25 g/ha	0.66 (1.24)	0.66 (1.24)	7.33 (2.64)	2.66 (1.60)	4.66 (2.37)	0.00 (1.00)
Bispyribac-sodium 30 g/ha	14.0 (3.85)	6.66 (2.76)	94.7 (9.78)	16.0 (3.98)	94.0 (9.74)	6.66 (2.63)
2,4-D sodium salt 1000 g/ha	16.0 (4.11)	12.0 (3.59)	91.3 (9.60)	19.3 (4.38)	102 (10.1)	14.7 (3.88)
Hand weeding twice	14.7 (3.94)	15.3 (4.04)	94.7 (9.75)	27.3 (5.22)	95.0 (9.79)	15.3 (3.97)
Weedy check	12.0 (3.59)	97.3 (9.91)	94.0 (9.75)	192 (10.2)	104 (10.19)	90.0 (10.4)
LSD (P=0.05)	0.62	1.23	0.98	0.60	0.99	0.73

Values in parentheses are transformed values, DAT- Days after transplanting

Table 2. Effect of different weed management practices on total weed density, dry weight and weed control efficiency in transplanted rice

Treatment	Total weed density (no./m^2)		Total weed dry weight (g/m^2)		WCE (%)	
	20 DAT	40 DAT	20 DAT	40 DAT	20 DAT	40 DAT
Penoxsualam 17.5 g/ha	27.3 (5.22)	24.2(4.81)	2.04 (1.42)	2.62 (1.62)	86.4	95.5
Penoxsualam 20 g/ha	29.3 (5.40)	18.6 (4.18)	1.23 (1.11)	2.62 (1.62)	91.6	94.2
Penoxsualam 22.5 g/ha	26.3 (5.13)	9.6 (2.93)	0.55 (0.74)	2.43 (1.56)	93.6	94.5
Penoxsualam 25 g/ha	25.2 (5.01)	8.5 (2.75)	0.44 (0.66)	2.28 (1.51)	96.9	96.2
Bispyribac-sodium 30 g/ha	202.5 (14.2)	33.3(5.77)	12.9 (3.60)	2.43 (1.56)	15.7	92.1
2,4-D sodium salt 1000 g/ha	209.1 (14.5)	46.9 (6.88)	12.5 (3.54)	2.40 (1.55)	17.9	76.1
Hand weeding twice	204.2 (14.3)	58.9 (7.61)	13.8 (3.71)	5.48 (2.34)	10.7	75.1
Weedy check	209.4 (14.5)	311.5 (17.6)	15.4 (3.93)	46.1 (6.79)	-	-
SE m (±)	0.27	0.22	0.06	0.04		
LSD (P=0.05)	0.86	0.84	0.19	0.12		

Values in parentheses are transformed values, DAT- Days after transplanting

Table 3. Effect of weed management practices on yield attributes and grain yield

Treatment	Panicles/m^2	Filled grains/ panicle	Yield (t/ha)	Net income (x10^3 `/ha)	B: C ratio
Penoxsualam 17.5 g/ha	567	106	5.14	45.01	1.61
Penoxsualam 20 g/ha	577	110	5.14	44.35	1.60
Penoxsualam 22.5 g/ha	683	120	5.40	49.06	1.67
Penoxsualam 25 g/ha	656	116	5.27	45.83	1.63
Bispyribac sodium 30 g/ha	610	116	5.26	45.75	1.62
2,4-D sodium salt 1000 g/ha	508	114	5.14	45.98	1.62
Hand weeding twice	458	109	4.91	35.01	1.46
Weedy check	421	101	4.21	29.36	1.31
LSD (P=0.05)	113	8.50	0.52	7.48	0.12

Among the different treatments, penoxsulam 22.5 g/ha recorded the highest yield (5.40 t/ha) and it was statistically at par with all the herbicide treatments and hand weeding. Penoxsulam applied at 22.5 g/ha registered the highest net returns and B:C ratio compared to other treatments.

SUMMARY

Penoxsulam at 22.5 and 25.0 g/ha was found effective to control weeds in transplanted rice on the basis of vegetation analysis. However, based on economic analysis, penoxsulam at 22.5 g/ha could be adjudged as the best treatment for effective and economic weed management.

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