



Effect of different planting geometry and herbicides for controlling the weeds in direct seeded rice

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Abstract: The efficacy of selected herbicides along with the planting geometry for weed control in direct seeded rice was evaluated under tropical conditions of Pantnagar during rainy season of 2013. Pendimethalin (1kg active ingredient (a.i.) ha⁻¹ 3 days after sowing) + bispyribac-Na (25g a.i. ha⁻¹ 28 days after sowing) + one hand weeding at 45 days after sowing and bispyribac-Na (25g a. i. ha⁻¹ 28 days after sowing) + one hand weeding at 45days after sowing had a mean grain yield of 47.95 and 37.68 while continuous drilling at 20cm and 20 x 10cm had a mean grain yield 34.72 and 34.14 qha⁻¹, respectively which is significantly superior than wider (25 x 25cm) spacing. Wider spacing (25 x 25cm) among planting geometry and weedy check among the weed control treatments resulted in higher uptake of nitrogen. Among the spacing, continuous drilling at 20cm and Pendimethalin (1kg a.i. ha⁻¹) + bispyribac-Na (25g a.i. ha⁻¹) + one hand weeding at 45 days after sowing among weed control practices proved most profitable with net returns of ₹ 40576 ha⁻¹ and ₹ 40633 ha⁻¹ and benefit:cost ratio of 1.7 and 1.8, respectively. It was revealed that all the weed control treatments were superior to weedy conditions.

Keywords: Direct seeded rice, Herbicides, Net returns, Planting geometry, Weed control efficiency

INTRODUCTION

Weed infestation in direct seeded rice (DSR) fields remains the single largest constraint limiting their productivity. A DSR crop generally lacks a "head start" over weeds due to dry tillage, absence of flooding and alternate wetting and drying conditions making it particularly vulnerable to weed competition during early part of its growth (Rao *et al.*, 2007). As the weeds and rice emerge simultaneously in DSR, the proper time and method of weed control remains a complex phenomenon (Khaliq and Matloob, 2011). Hence study was undertaken to determine the efficacy of alone or combination of herbicides with hand weeding along with different planting geometry for effective control of weeds in direct seeded rice.

MATERIALS AND METHODS

The field experiments were conducted during the wet season of 2013 at Crop Research Centre of GBPUAT, Pantnagar. The pH (Jackson, 1973), organic carbon (Black, 1965) and available N (Subbiah and Asija, 1956), P (Olsen *et al.*, 1954), K (Jackson, 1973) content were 7.3, 0.86%, 226.2, 22.8 and 145.4 kg ha⁻¹, respectively. The treatments comprised of planting geometry (continuous drilling at 20cm, 20 x 10cm and 25 x 25cm) in the main plots and pendimethalin at 1kg ha⁻¹, 3 days after sowing (DAS) + hand weeding at 30 DAS; bispyribac- Na at 25 g ha⁻¹, 30 DAS + hand

weeding at 45 DAS; pendimethalin at 1kg ha⁻¹, 3 DAS + bispyribac- Na at 25 g ha⁻¹, 30 DAS + hand weeding at 45 DAS and weedy check among weed control treatments in sub-plots in a factorial randomized block design with four replications. Direct seeding of Pant dhan -12 was done in field in three different spacings at the seed rate of 40, 26 and 8.5 kg ha⁻¹. Crop was supplied with a fertility dose of 120, 60 and 40 kg N, P₂O₅ and K₂O ha⁻¹, respectively. Full dose of P₂O₅ and K₂O and one third of N were applied as basal and rest two-third was top dressed in two equal splits, one at active tillering and other at panicle initiation stage. Full dose of P₂O₅ and K₂O and half of N was applied through NPK mixture and rest half through urea. Weed samples were collected by using a quadrat (0.5m X 0.5m) randomly at two places inside a plot and then converted to per square meter. Crop samples were collected from one meter row length and then converted to per square meter. Nitrogen use efficiency (NUE) was computed by using the formula (kg grains per kg nitrogen applied) X 100, whereas weed control efficiency was computed on population basis.

RESULTS AND DISCUSSION

The most dominant weed species found in the weedy plots were *Echinochloa crusgalli*, *E. colona*, *Leptochloa chinensis*, *Caesulia axillaris*, *Ammania spp.*, *Cyperus spp.* It was found that all the weed control treat-

Table 1. Grain yield, yield attributes, nitrogen uptake, N-use efficiency and economics in direct seeded rice under different weed control treatments.

Treatments	Panicles m ⁻²	Grains panicle ⁻¹	Grain yield(q ha ⁻¹)	N Uptake weeds (kg ha ⁻¹)	Crop Weeds	N-use efficiency (kg grain kg ⁻¹ N applied)	Net returns (Rs ha ⁻¹)	Benefit: cost ratio
Planting geometry (spacing in cm)								
Conti. drilling at 20 cm	204.0	213.3	34.72	111.4	12.5	73.3	40576	1.7
20 x 10	191.8	204.0	34.14	103.5	13.1	71.3	38215	1.6
25 x 25	152.7	211.0	28.99	99.3	13.8	67.6	32048	1.5
SEm±	8.4	2.9	1.40	2.3	0.3	0.6	-	-
C.D. at 5%	24.3	NS	4.04	6.6	NS	1.9	-	-
Weed control practices								
Pendi fb 1HW (30DAS)	196.3	216.0	36.25	125.1	10.6	55.8	30498	1.4
Bispyri fb 1HW (45DAS)	205.9	218.0	37.68	112.9	11.5	69.0	32135	1.5
Pendi fb Bispyri fb 1HW(45DAS)	238.1	227.0	47.95	97.0	6.0	76.4	40633	1.8
Weedy check	91.1	176.1	8.58	83.8	26.6	81.7	2073	0.11
SEm±	9.7	3.4	1.62	2.6	0.4	0.7	-	-
C.D. at 5%	28.1	9.8	4.66	7.7	1.2	2.2	-	-

Original values are given in parenthesis; Pendi: Pendimethalin, Bispyri: Bispyribac-Na, HW: Hand weeding

Table 2. Weed count, weed dry matter and weed control efficiency in direct seeded rice under different weed control treatments at harvest stage.

Treatments	Total weed population (no m ⁻²)	Total weed dry matter (g m ²)	Weed control efficiency (%)
Planting geometry(spacing in cm)			
Conti. Drilling at 20cm	5.5(35.5)	6.8(59.0)	66.3
20 x 10	5.8(42.8)	7.6(65.5)	65.5
25 x 25	5.9(43.2)	7.9(70.0)	63.8
SEm±	0.07	0.08	1.9
C.D. at 5%	0.2	0.2	NS
Weed control practices			
Pendi fb 1HW(30DAS)	5.4(29.0)	6.3(39.8)	82.2
Bispyri fb 1HW(45DAS)	4.0(15.6)	5.5(30.7)	86.2
Pendi fb Bispyri fb 1HW (45DAS)	3.0(8.6)	5.0(24.7)	87.4
Weedy check	10.4(108.8)	12.8(164.3)	0
SEm±	0.08	0.1	2.2
C.D. at 5%	0.2	0.3	6.4

Original values are given in parenthesis; Pendi: Pendimethalin, Bispyri: Bispyribac Na, HW: Hand weeding.

ment combinations were significantly (5%) superior to the weedy check and wider spacing (25 x 25cm) was significantly (5%) superior than other spacings with respect to yield attributes viz. panicles m⁻², no. of grains panicles⁻¹ (Table 1). Among the treatments, continuous drilling at 20cm and Pendimethalin (1kg a. i. ha⁻¹) + bispyribac-Na (25g a.i. ha⁻¹) + one hand weeding at 45 days after sowing recorded the lowest weed count and dry weight (Table 2) and the highest number of panicles m⁻², grains panicle⁻¹ and grain yield (Table 1). This might be due to efficient hand weeding which restrict the growth of weeds in the field of aerobic rice. Singh *et al.* (2006) reported that both pre-emergence and post-emergence herbicides can be used in aerobic

rice fields along with hand weeding and they effectively control the weeds, if properly used.

The weed control measures resulted in higher N uptake by crops and helped in realizing higher grain yield of rice (Jacob and Syriac, 2005). Among the herbicidal treatments, maximum grain yield and favourable yield attributes were obtained with the application of pendimethalin (1kg a. i. ha⁻¹) + bispyribac-Na (25g a. i. ha⁻¹) + one hand weeding at 45 DAS and recorded an increase of 82.1% yield over weedy check and significantly (5%) superior than other weed control treatments while among planting geometry, continuous drilling at 20cm recorded an increase of 16.5% yield over wider (25 x 25cm) spacing. Narrow row spacing

can shift the competitive balance in favour of rice by achieving faster canopy closure and reducing light availability to weeds (Chauhan and Johnson, 2010). This increase in yield could be due to lower weed count that resulted in efficient utilization of available resources by the crop (Sundari and Kathiresan, 2002). All the weed control treatments registered a significant reduction in total weed population and total weed dry matter compared with the weedy check throughout the crop growth (Table 2). It was further observed that among spacings, continuous drilling at 20cm and among weed control treatments, Pendimethalin (1kg a. i. ha⁻¹) + bispyribac-Na (25g a. i. ha⁻¹) + one hand weeding at 45 days after sowing reduced total weed density and weed dry matter significantly (5%) by 17.8, 15.7% and 73.3, 75.7%, respectively, compared to weedy check.

It was also found that the highest N-use efficiency was recorded under continuous drilling at 20cm, among the planting geometry and Pendimethalin (1kg a. i. ha⁻¹) + bispyribac-Na (25g a. i. ha⁻¹) + one hand weeding at 45 days after sowing, among weed control practices. Crop also exhibited improvement in N uptake with the adoption of combined weed control measures and spacing. Lowest N uptake was under weedy conditions. The N uptake by weeds followed the reverse trend. Effective combined weed control measures reduced the weed biomass which in turn reduced weed competition and there by resulted in the improvement of N uptake by crop (Bali *et al.*, 2006). Crop yield and weed control efficiency were positively correlated. One percent increase in weed control efficiency caused increase in grain yield by 38 kg. This increase in grain yield by increasing weed control efficiency (WCE) was also reported by Singh and Singh (2006). However, the uptake of nitrogen was negatively correlated with grain yield. Regression analysis ($y=5790-188.1x$) also indicated that one kg increase in N uptake by weeds causes reduction in grain yield by 188.1kg ha⁻¹. The competitive effect of weeds for nutrient was also reported by Bali *et al.* (2006) for direct seeded rice.

The maximum net returns and benefit:cost ratio was obtained with continuous drilling at 20cm with pendimethalin (1kg a. i. ha⁻¹), 3 days after sowing+ bispyribac-Na (25g a. i. ha⁻¹), 28 days after sowing + 1 hand weeding at 45 days after sowing (Table 1). The corresponding values being ₹ 40576 and 1.7 and ₹ 40633 and 1.8, which are very much higher than weedy condition. This might be due to application of pre emergence herbicide fb post emergence herbicide application along with one hand weeding (45 DAS) due to inhibition of weed dry weight as well as reduced crop weed competition which ultimately increased the grain yield. Bhurer *et al.* (2013) reported that the use of pre-emergence herbicide f b post-emergence along with

one hand weeding in rice crop produced maximum crop dry matter accumulation and increase the crop yield.

Conclusion

Combination of planting geometry and different weed control measures i.e. continuous drilling at 20 cm with pendimethalin (1kg a. i. ha⁻¹), 3 days after sowing+ bispyribac-Na (25g a. i. ha⁻¹), 28 days after sowing + 1 hand weeding at 45 days after sowing proved to be effective and a profitable alternative to the existing recommendation of alone application of herbicide with hand weeding in direct seeded rice.

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