

Productivity of rice as affected by planting method and weed management

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ABSTRACT

A field experiment was conducted during *kharif* seasons of 2008 and 2009 at the research farm of Birsa Agricultural University, Ranchi with the objective to study the effect of establishment and weed control methods on weed dynamics and productivity of rice. Results indicated that transplanting of rice recorded reduced weed population as well as dry matter with higher weed control efficiency resulting in higher grain yield. Among weed control methods, application of pyrazosulfuron as pre emergence 20 g/ha + mechanical weeding (40 days after sowing) with lower weed population and weed dry matter had higher weed control efficiency as well as grain yield. Transplanting associated with application of pyrazosulfuron + mechanical weeding produced maximum and significantly higher grain yield (4244 kg/ha) of rice.

Key words : Planting method, Weed dynamics, Weed control, Yield, Rice.

Rice is one of the most important cereal crops, which plays a key role for food security. In India, rice is grown in an area of 42.5 million ha with a production of 87.5 million ton. The country has to produce about 130 million ton of rice by 2025 to feed the ever growing population (Hugar 2009) which is a challenging task. There are three principal methods of rice establishment *viz.*, dry seeding, sowing pre-germinated seeds in wet puddled soils, transplanting 21 days old seedlings and system of rice intensification (SRI). Pandey and Velasco (1999) reported that high labour requirement and cost for transplanting have narrowed the profit margin resulted in a general shift in production systems from transplanted to direct-seeded, of which wet seeding reduces substantially the amount of labour needed for growing a rice crop. Wet seeding has been accompanied by an increase in weed problems. Sometimes farmers do not get chance for weeding at appropriate time due to preoccupied. Hand weeding in wet seeded rice is more time consuming and not as easy as in transplanted rice (Moody 1983). The use of weeding tools damage the rice as they move through the field, especially during early crop growth, and they also fail to remove some of the grassy weeds. Therefore, the success of wet seeded rice is dependent upon weed control with herbicides.

MATERIALS AND METHODS

A field experiment was conducted at research farm of Birsa Agricultural University, Ranchi during *kharif* 2008 and 2009 to evaluate the efficacy of planting method and weed management on productivity of rice. The soil of the experimental field was sandy loam in texture, low in available nitrogen (220kg/ha), medium in P (19.5kg/ha) and K (115 kg/ha) with slightly acidic in reaction (pH 6.2).

An experiment consisted 4 methods of rice establishment *viz.*, transplanting, System of Rice Intensification (SRI), drum seeding and wet seeding in main plot and 4 weed control methods *viz.*, pyrazosulfuron 20g/ha pre-emergence + mechanical weeding by Dutch hoe (40 days after sowing), weeding by cono weeder at 20 and 40 days after sowing, 2 hand weeding at 20 and 40 days after sowing and weedy check in sub plot, was laid out in a split plot design and replicated thrice. Weed density and dry-matter were recorded at 30 and 60 days after seeding with the help of quadrat and then converted in per square meter. Data on weed density and dry weight were subject to square root transformation ($\sqrt{x+0.5}$) before statistical analysis to normalize their distribution. The data were pooled and analyzed statistically as per standard method (Panse and Sukhatme 1978)

RESULTS AND DISCUSSION

Effect on weeds

The experimental field was dominated by broad leaf weeds at 30 and 60 days after sowing (240, 203/m²) followed by grassy (110, 65.75/m²) and sedges (93, 39.75/m²). The major grasses weeds were *Digitaria sanguinalis*, *Echinochloa colona*, *Paspalam distichum*, *Ischaemum rugosum*. The major broad leaf weeds were *Ludwigia parviflora*, *Eclipta alba*, *Commelina benghalensis*, *Commelina nudifolia*, *Marsilia quadrifolia*, *Eichhornia crassipes*. The sedges were *Cyperus iria*, *Cyperus esculantus* and *Fimbristylis miliacea*.

Transplanting and System of Rice Intensification (SRI) method of rice establishment recorded virtually no weeds at 30 days after sowing as the crop was of 9 and 14 days only (Table 1). Total weed population under drum

seeded and direct seeded rice were 793 and 979/m², respectively out of which the relative population of grassy, broad leaved and sedges were 26.98, 51.95, 21.06% and 23.29, 55.80 and 20.84%, respectively at 30 days after sowing. Total weed density under transplanted, SRI, drum seeded and wet seeded rice were 213, 520, 248 and 254/m² at 60 days after sowing. The weed density in transplanted, drum seeded and wet seeded rice was lower by 40.96, 47.7 and 48.8%, respectively, over SRI. The higher weed density under SRI method of establishment might be due to transplanting of tender (14 days old) seedling at wider spacing (25 cm) making room for prolific weed growth as compared to other method of establishment. The relative density of grassy weeds in transplanted, SRI, drum seeded, wet seeded rice were 27.23, 18.60, 26.20 and 16.93%, broad leaved 60.56, 71.53, 54.84 and 69.29%, sedges 12.20, 9.81, 18.95 and 13.77% of total weeds at 60 days after sowing. This indicated that relative density of grassy weed in wet seeded rice was minimum close to SRI while broad leaved weeds were minimum in drum seeded rice and sedges in SRI. Transplant and SRI method of rice establishment did not record dry matter accumulation by weeds, however, drum seeded and wet seeded rice recorded similar weed dry matter at 30 days after sowing. At 60 days after sowing, SRI method of establishment recorded significantly reduced weed dry matter (42.3g/m²)

as compared to drum seeded and wet seeded rice, remaining at par with transplanted rice (39.5 g/m²). Transplanting and SRI methods recorded significantly higher weed control efficiency at 30 days after sowing as compared to drum seeded and wet seeded rice, however, at 60 days after sowing all establishment methods were similar. Higher weed control efficiency in SRI method might be due to comparatively more weed dry matter in weedy check and lower weed dry matter due to effective weed control in treated plots (Table 1).

Application of pyrazosulfuron 20 g/ha pre-emergence + mechanical weeding by Dutch hoe (40 days after sowing) recorded 77.14 and 85.67% lower weed density at 30 and 60 days after sowing as compared to weedy (735 and 642/m²) thereby recording maximum weed control efficiency. Density of grasses, broad leaved and sedges weeds were lowered by 81.17, 71.35, 87.50% at 30 days and 70.37, 88.23 and 95.95% at 60 days after sowing compared to weedy thus controlling all weed species almost equally.

Effect on crop

Transplanting of rice produced 23.0, 24.0, 42.6% higher grain yield than SRI (2802 kg/ha), drum (2778 kg/ha) and wet (2476kg/ha) seeded, respectively owing to higher effective tillers 310/m² and higher filled grains/

Table 1. Weed dynamics and weed control efficiency in rice influenced by establishment and weed control method (mean of 2 years)

Treatment	Weed density/m ²						Weed dry matter (g/m ²)		Weed control efficiency (%)	
	30 DAS			60DAS			30 DAS	60 DAS	30 DAS	60 DAS
	Grassy	Broad leaf	Sedges	Grassy	Broad leaf	Sedges				
Establishment method										
Transplant	0.7 (0)	0.7 (0)	0.7 (0)	6.8 (58)	8.9 (129)	4.4 (26)	0.7 (0)	6.3 (47.4)	75.00	59.94
SRI	0.7 (0)	0.7 (0)	0.7 (0)	9.1 (97)	16.1 (372)	5.8 (51)	0.7 (0)	5.4 (34.4)	75.00	61.20
Drum Seeded	13.7 (214)	19.8 (412)	12.2 (167)	8.0 (65)	11.4 (136)	6.3 (47)	8.8 (91.7)	7.0 (56.98)	55.08	56.52
Wet Seeded	14.3 (228)	22.3 (547)	13.1 (204)	6.3 (43)	12.3 (176)	4.9 (35)	8.5 (84.1)	8.3 (76.6)	55.24	45.95
LSD (P=0.05)	1.3	0.9	0.5	0.2	1.7	0.3	0.4	0.3	8.31	NS
Weed Control										
Pyrazosulfuron + mechanical weeding	4.1 (32)	7.7 (116)	3.2 (20)	6.17 (40)	5.9 (48)	1.8 (4)	4.6 (9.4)	5.0 (25.8)	95.02	78.15
Cono weeder	8.7 (143)	10.3 (204)	6.9 (89)	6.08 (40)	8.2 (82)	4.7 (29)	7.2 (44.9)	5.7 (33.1)	77.20	72.00
2 Hand weeding	7.2 (97)	11.1 (235)	7.4 (102)	6.63 (49)	15.9 (275)	5.2 (28)	5.0 (22.9)	5.3 (31)	88.10	73.41
Weedy	9.4 (170)	14.4 (405)	9.2 (160)	11.3 (135)	18.7 (408)	9.8 (99)	10.0 (98.7)	11.0 (125)	0	0
LSD (P=0.05)	0.5	0.7	0.5	0.5	0.7	0.31	0.3	0.4	5.12	13.77

Original data in parenthesis were subjected to vx+0.5 before analysis; DAS-days after sowing, SRI-system of rice intensification

panicle, 76 (Table 2). However, tallest plant (70 cm) and bolder grins (24.36g) were recorded under system of rice intensification compared to other planting methods. This confirms findings of Singh *et al.* (2005).

Among weed control methods, application of pyrazosulfuron along with mechanical weeding produced similar grain yield (3640kg/ha) to that of cono weeders (3115 kg/ha) and 2 hand weeding (3163 kg/ha) recorded higher than weedy check owing to taller plant (71 cm), longer panicle(20cm), higher effective tillers (324/m²) and filled grains/ panicle (95). Interaction of rice establishment and weed control method was also found significant with respect to grain yield. Transplanting associated with application of pyrazosulfuron + mechanical weeding produced maximum and significantly higher grain yield (4244 kg/ha) of rice than all other combinations of establishment method and weed control except transplanting with 2 hand weeding (Table 3). This confirms the findings of Singh *et al.* 2003.

It may be concluded that transplanting associated with application of pyrazosulfuron 20 g/ha pre-emergence + mechanical weeding by Dutch hoe at 40 days after

sowing can be adopted for effective weed control and higher rice yield.

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Table 2. Yield and yield attributes of rice influenced by interaction of establishment and weed control method (mean of 2 years)

Treatment	Plant height(cm)	Panicle length(cm)	Effective tillers/m ²	Grains /panicle		1000 grain weight (g)	Yield (kg/ha)	
				Filled	Un-filled		Grain	Straw
Establishment method								
Transplant	67	20	310	76	23	22.76	3446	7264
SRI	70	20	293	74	30	24.36	2802	7146
Drum Seeded	66	18	305	65	26	21.95	2778	7041
Wet Seeded	66	20	276	56	29	22.86	2416	6373
LSD (P=0.05)	NS	1	22	14	5	0.72	246.8	NS
Weed Control								
Pyrazosulfuron + mechanical weeding	71	20	324	75	28	22.98	3640	8073
Cono weeder	67	19	312	70	27	23.34	3115	7978
2 Hand weeding	68	20	312	68	28	23.10	3163	7718
Weedy	63	19	236	57	26	22.49	1523	4056
LSD (P=0.0 5)	4	1	21	7	NS	NS	300	726.8

Table 3. Grain yield (kg/ha) of rice as influenced by interaction of establishment and weed control method (mean of 2 years)

Treatment	Transplanting	Establishment method		
		SRI	Drum seeded	Wet seeded
Pyrazosulfuron + mechanical weeding	4244	3429	2949	3941
Cono weeder	3456	2795	3611	2599
2 Hand weeding	3794	3220	3333	2307
Weedy	2288	1765	1218	819.6
LSD (P=0.05)	600 (interaction value)			

SRI-System of rice intensification