



Yield performance of rainfed rice under planting methods and weed control measures

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Received: 2 July 2013; Revised: 20 September 2013

ABSTRACT

A field experiment was conducted at Kotwa, Azamgarh during rainy season of 2008 and 2009 to evaluate the comparative efficacy of various planting methods and weed control measures on weeds density growth, yield attributes, grain yield and economics of rice variety 'Godawari'. Four main rice establishment techniques comprised with six sub-plot weed control practices was laid out in split plot design and replicated thrice. *Echinichloa colona*, *E. crusgalli*, *Cyperus rotundus*, *C. difformis* and *Commelina benghalensis* were predominant weed species. Among the rice establishment techniques, puddled transplanted practices proved best for reducing weed dry matter accumulation and produced significantly highest mean grain yield (3.89 t/ha) along with yield contributing parameters in comparison to rest planting methods. Direct drum-seeded rice under puddled condition were observed to be significantly superior and recorded 2.82 t/ha more mean grain yield over direct-dry seeding. Application of pretilachlor 750 g/ha pre-emergence followed by cyhalofop-butyl 60 g/ha post-emergence at 25 DAS/DAT was found quite effective against mixed weed flora which recorded statistically similar grain yield to that of repeated hand weeding. The integration of herbicide with tools, viz. pretilachlor 750 g/ha supplemented with mechanical weeding at 25 DAS/DAT again found equally effective in increasing the grain yield as pre- and post-emergence applied herbicides.

Key words: Planting techniques, Rice, Weed control, Yield, Yield parameters

Uttar Pradesh in India is important rice growing state with broad-spectrum agro-ecosystems where transplanting method persists as the major practice of rice planting under puddle condition. Often, farmers fail to transplant the seedlings in time either due to prolonged dry spell or intense rainfall resulting lower yields. Paucity of labours and increasing cost of transplanting encouraged many rice growers to switch over from transplanting to other planting methods of rice. Under these circumstances, the direct seedling of sprouted seeds, unpuddled transplanting and unpuddled stale transplanting appears to be the alternate practices. In wet-seeded rice, weed control is the most crucial factor because the soil conditions are favorable for simultaneous of weeds seeds along with rice seeds and also caused complete reduction in yield (Singh and Singh, 1996). Thus, to avoid yield loss and to keep weed under threshold's level, planting methods become of paramount importance. Location specific information is still lacking about the efficacy of weed management practices on the performance of rice grown under various cultures. Hence, the present investigation was carried out under rainfed lowland shallow favorable situations.

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MATERIALS AND METHODS

A field experiment was conducted at Krishi Vigyan Kendra, N.D. University of Agriculture & Technology, Faizabad, Kotwa, Azamgarh during rainy season of 2007 and 2008 in sandy clay loam having 7.3 pH, organic carbon 0.45%, available N, P and K were 210, 14.6 and 230.7 kg/ha, respectively. A set of 24 treatment combinations consisting of four rice establishment techniques, viz. direct sowing with zero till drill under unpuddled wet seed bed, direct drum seeding of pre-germinated seeds under puddle conditions, unpuddled transplanting and transplanting under puddle situation kept as main-plot treatments and coupled with six sub-plot weed control measures like manual weeding at 20, 40 and 60 DAS/DAT, weedy check, mechanical weeding at 25 DAS/DAT, pretilachlor 750 g/ha applied at 48 hours of DAS/DAT, pretilachlor at pre-emergence integrated with mechanical weeding at 25 DAS/DAT and pretilachlor at pre-emergence combined with cyhalofop-butyl at 60 g/ha as post-emergence herbicide was laid out in split plot design with three replications. Rice cultivar 'Godawari' was used 60 and 30 kg/ha for direct-seeding and nursery raising at same day in last week

of June. As per spacing, thinning was done at 15 DAS to keep intra space 10 cm during both the years of study. The N, P₂O₅ and K₂O was applied at 120, 60 and 40 kg/ha through DAP, urea and muriate of potash. The 25% nitrogen and full dose of P₂O₅ and K₂O were applied as basal while remaining, nitrogen was applied in two equal *i.e.* 50% nitrogen was given at active tillering and 25% at panicle initiation stage. For transplanting of seedlings in unpuddled culture, a basic ploughing followed by planking was done by rotavator after which water level was maintained for the purpose. Cyhalofop-butyl was applied at 25 DAS/DAT. Weeds were collected four times for count and dry weight through 0.25 m² quadrat. Observations related to crops, yield attributes, yields and other parameters were recorded carefully to interpret interferences during both the years.

RESULTS AND DISCUSSION

The dominant weeds observed in the experimental field were: *Echinochloa colona* (L.) Link; *E. crusgalli* (L.) Beauv; *Cynodon dactylon* (L.) Pers; and *Paspalum distichum* L. in grasses; *Cyperus rotundus* L. and *C. iria* L. in sedges and *Trianthema monogyna* L. and *Commelina benghalensis* L. in broad-leaved group. These weed groups constitute 25, 60 and 15% of total weed population in experimental plots.

Effect on weeds

All rice establishments brought significant effect on decreasing weed dry matter production. The highest value of weed dry weight (138.5 g/m²) was registered in direct sowing under unpuddled wet seed bed in comparison to rest of the rice cultures. Transplanting under puddle condition had given detrimental impact on weed growth and resulted lowest producer of weed dry weight in both the years (Table 1).

By and large, all the weed control measures were observed to be significantly better than weedy check. In spite of repeated manual weeding, the application of pretilachlor 0.75 kg/ha supplemented with cyhalofop-butyl 0.06 kg/ha post-emergence recorded 85.8% lower weed dry weight over weedy check and found comparable with pre-emergence pretilachlor 0.75 kg/ha integrated with mechanical weeding. Weeds in uncontrolled plots accumulated about two times higher dry matter to that of weeds present in those plots which treated once. This confirms the results of Prasad (1995) that pre- and post-emergence use of anilofos and 2,4-D both 0.4 kg/ha as effective as hand weeding twice at 20 and 40 DAT.

Table 1. Effect of varying planting methods and weed control measures on weeds in rice (mean of two years)

Treatment	Weed density (no./m ²) at 60 DAS	Weed weight (g/m ²)	WCE (%)
<i>Planting method</i>			
Direct-seeded	210.1	138.5	-
Direct-drum seeded	119.9	85.0	-
Unpuddled transplanted	63.5	35.0	-
Transplanted	34.7	17.1	-
LSD (P= 0.05)	1.57	4.77	-
<i>Weed control method</i>			
Mechanical weeding twice	138.0	96.4	45.5
Pretilachlor	100.1	63.4	64.5
Pretilachlor <i>fb</i> mechanical weeding	71.2	46.2	76.9
Pretilachlor <i>fb</i> cyhalofop-butyl	55.3	25.2	85.9
Weed free	24.5	10.5	94.2
Weedy check	253.4	176.8	0.00
LSD (P= 0.05)	2.49	2.80	-

Effect on crop

Paddy transplanted under puddle conditions produced significantly higher effective tillers per meter row length, more filled grains/panicle and longest panicles. However, among the unpuddled culture, transplanting of raised nursery in well ploughed field being irrigated for transplanting had proved its superiority in enhancing yield enhancing parameters than direct seeding. The highest mean grain yield (3.89 t/ha) was recorded under puddle transplanted method, followed by unpuddled transplanting (3.51 t/ha) during 2008 and 2009, respectively. On an average, puddle transplanting increased the grain yield by 84.6, 37.8 and 10.7%, respectively over direct seeding, drum seeding and transplanting under unpuddled situation (Table 2). The highest yield under puddle transplanting culture may be owing to better crop growth, initial crop-weed competition free environment and better yield contributing parameters by efficient utilization of available resources, which had direct impact on increasing the grain yield. The results were well corroborating with the findings of Jaiswal and Singh (2001).

All weed control measures increased yield and yield attributes considerably over control. The crop growth under weed-free environment recorded maximum number of effective tiller, filled grains/panicle and longest panicle as well as highest producer of yield than the remaining practices. Application of pretilachlor 750 g/ha applied at 48 hours of DAS/DAT combined with cyhalofop-butyl at 60 g/ha post-emergence herbicide appeared as the efficient

Table 2. Effect of varying planting methods and weed control measures on rice (mean of 2 years)

Treatment	Effective tillers (running/m)	Filled grains/ panicle	Grain yield (t/ha)	Benefit : cost ratio
<i>Planting method</i>				
Direct-seeded	36.8	99.3	2.11	1.19
Direct-drum seeded	35.3	126.5	2.82	1.17
Unpuddled transplanted	49.7	134.7	3.51	1.25
Transplanted	52.9	159.7	3.89	1.42
LSD (P= 0.05)	2.79	12.6	0.21	-
<i>Weed control method</i>				
Mechanical weeding	36.0	118.1	2.65	1.09
Pretilachlor	43.0	130.2	3.01	1.32
Pretilachlorfb mechanical weeding	48.9	137.4	3.34	1.33
Pretilachlorfb cyhalofop-butyl	51.0	147.4	3.43	1.40
Weed free	51.8	156.0	3.60	1.35
Weedy check	27.5	94.1	2.23	1.00
LSD (P= 0.05)	2.72	6.53	0.20	-

weed control treatment that provided almost equal grain yield to weed-free but did not differ significantly with pre-emergence pretilachlor 750 g/ha integrated with mechanical weeding at 25 DAS/DAT. The relatively higher grain yield under these treatments might be due to detrimental effect on weeds which suppressed weed growth efficiently as a resultant of lower crop-weed competition and weed dry weight in per unit area. The deleterious effect of pre- and post-emergence spraying of anilofos and 2,4-D EE on weeds in different paddy cultures provided best weed control along with higher grain yield (Thomas and Sreedevi 1993).

On the basis of above findings, it may be concluded that higher grain yield of rice can be achieved under puddle transplanting method of paddy establishment coupled with the application of pretilachlor 750 g/ha applied at 48 hours of DAS/DAT combined with cyhalofop-butyl at 60 g/ha post-emergence herbicide. The same culture of rice

production was found more profitable to the rice growers under rainfed lowland rice situations in eastern Uttar Pradesh. The production of weed dry matter was inversely related with subsequent growth and yield of crop.

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