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Effect of irrigation and weed management on weed growth and yield performance of transplanted hybrid rice

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ABSTRACT

A field experiment was conducted during *Boro* season of 2002 – 2003 and 2003 – 2004 to study the effect of irrigation and weed management on weed growth and relative yield performance of transplanted hybrid rice. Continuous submergence of 5±2 cm depth of water considerably reduced the weed crop competition, and increased the grain yield and decreased the dry matter production of total weeds over 3 days after disappearance of ponded water. Hand weeding twice (25 and 45 DAT) and chemical weed control through herbicides are equally effective like weed free plots in reducing population and dry matter of weeds, improving grain yield, besides being significantly superior over unweeded check treatment. An increase in 14.75 to 24.03% grain yield was recorded due to adoption of weed management practices.

Key words: Transplanted hybrid rice, weed management, irrigation management.

Puddling followed by continuous submergence of land, effectively controls the weeds, in transplanted rice field. In rice fields, varying soil moisture regimes are followed like continuous submergence to drier saturation. Singh and Singh (1988) recorded least weed growth and maximum crop yield under continuous submergence than drier treatments. The germination and emergence of weed seeds are closely related with the moisture status and the depth of water standing on the soil. Thus a full proof irrigation management is important for controlling weeds in transplanted hybrid rice cultivation during *boro* season. Irrigation management not only controlled the weed growth but also decided the efficiency of applied herbicides to the crop (Moody, 1978). Hand weeding, though laborious, expensive and time consuming one still one of the most effective method for controlling weeds in our country. However, the chemical method of weed control is better alternative and also advantageous over hand weeding particularly under intensive cropping systems. The main objective of the present investigation was to find out the effects of different water regimes and irrigation management practices on weed growth and yield of transplanted hybrid rice.

MATERIALS AND METHODS

A field study was carried out for two consecutive winter seasons of 2002-03 and 2003-04 at Instructional Farm, Jaguli, Nadia, West Bengal. The soil was sandy loam in texture having pH 6.8. Initially the soil was low in nitrogen, medium in phosphorus and high in potassium content. The total N(%) was 0.05 and 0.05, available P_2O_5 (Kg ha^{-1}) was 21.12 and 20.98 and the available K_2O (Kg ha^{-1}) was 160.28 and 161.30 during 2002-03 and 2003-04 respectively. The experiment was laid out in split plot design with water management practices in main plots and weed management in sub-plots with three replications. The hybrid rice variety Pro-Agro 6444 was grown as test crop. The treatments consisted four events of irrigation (Main) viz. 5±2 cm continues submergence (I_0), 1 day after disappearance of 5 cm ponded water (I_1), 2 days after disappearance of 5 cm ponded water (I_2) and 3 days after disappearance of 5 cm ponded water (I_3) and four weed management practices viz. unweeded check (W_0), weed free continuous weeding (W_1), Pyrazo sulfuran ethyl@ 25 g a.i. ha^{-1} at 7 DAT (W_2), Pretilachor @ 400 g ha^{-1} at 3 DAT (W_3) and Hand weeding twice at 25 and 45 DAT (W_4). The fertilizers were applied @ 120 : 60 : 60 kg ha^{-1} of N, P_2O_5 and K_2O respectively. Full doses of P_2O_5 and K_2O were applied as basal. Nitrogen was applied half the dose during tillering stage and rest half in two equal splits at 10 days after transplanting and panicle initiation stage. Population and dry weight of weeds were recorded from 0.5 x 0.5 m^2 area from each plot at 30, 60, 90 DAT and harvest. The crop received 166.3 mm and 208.6 mm rainfall during growth period of 2002 – 2003 and 2003 – 2004 respectively. Weed control efficiency (WCE) and weed index (WI) were computed using the following standard formulae:

$$WCE\ (\%) = \frac{\text{Weed dry wt. in unweeded check plot} - \text{Weed dry wt. in treated plot}}{\text{Weed dry wt. in unweeded check plot}} \times 100$$

$$WI\ (\%) = \frac{\text{Grain yield of weed free plot} - \text{Grain yield of treated plot}}{\text{Grain yield of weed free plot}} \times 100$$

RESULTS AND DISCUSSIONS

Effect of Irrigation

There was significant reduction in population and dry matter production of weeds when continuous submergence of 5±2 cm condition was maintained in the field as compared to other drier treatments at all the stages of observation except at harvest on weed population and 60 and 90 DAT on dry matter production respectively (Table 1). Among the drier treatments, minimum drier treatment (1 day after disappearance of ponded water) significantly reduced the population and dry weight of weeds at all the stages of observations over extreme drier treatment (3 day after disappearance of ponded water) except at harvest on weed population and 60 and 90 DAT on dry matter production respectively. Due to lack of oxygen under submerged condition, most of the weeds could not germinate and there by both weed population and dry matter production of weeds were low at different stages of investigation. Bhan (1983) also stated that lower emergence of weeds were due to continuous submergence.

Yield of hybrid rice significantly influenced by the water management practices (Table 2). Under continuous submergence of 5±2 cm condition produced significantly higher yield over other drier treatments except minimum drier treatment (1 day after disappearance of ponded water) where it was statistically at par. Among the direr treatments, minimum drier condition (1day after disappearance of ponded water) responded significantly over maximum drier treatment (3 days after disappearance of ponded water). Continuous submergence produced 16.49% higher grain yield over maximum drier treatment. Higher grain yield under continuous submergence and minimum drier condition was due to lower weed crop competition. Similar findings were also reported by Prihar and Sandhu (1989).

Weed Flora : The predominant weed flora associated with the crop was Echinochloa crus-galli, Cynodon dactylon, Leersia hexandra, Cyperdus rotundus, Cyperus deformis, Fimbristylis littoralis, Ludwigia octovalvis, Monochoria vaginalis, Marselia minuta.

Weed management practices

Compared to unweeded check, substantial reduction in population and dry matter production of weed was observed under different weed control treatments at all the stages of observation (Table 1). Such effects were more pronounced under weed free check followed by hand weeding twice (25 and 45 DAT) at all the stages of observation. Among the herbicidal treatments, pyrazo sulfuran ethyl (W_2) @ 25 g a.i. ha^{-1} were equally effective and significantly superior to pretilachlor (W_3) for controlling population and dry matter production of weed at all the stages of observation. Weed control efficiency was also the highest (81.55%) in weed free cheek (W_1) treatment followed by hand weeding twice (W_4), pyrazo sulfuran ethyl (W_2) and pretilachlor (W_3) respectively.

Grain yield of hybrid rice was significantly influenced by the different weed management practices (Table 2). Significantly higher grain yield was recorded in weed free check (W_1) treatment followed by hand weeding twice (W_4), W_2, W_3 and recorded 24.03, 19.88, 16.01 and 14.75 per cent increased grain yield respectively over unweeded check. However all these four weed management treatments were statistically at par in respect of grain yield. These findings coroborated the findigns of Choubey *et al* (1998). Among the herbicidal treatments, pyrozo sulfuran ethyl (W_2) was found to be marginally superior to pretilachlor. Increase in grain yield was mainly due to low weed crop competition in different weed management treatments and the highest weed index (24.09%) was recorded in unweeded check treatment.

The results indicated that higher grain yield of hybrid rice can be obtained by adopting continuous submergence of 5±2 cm depths of water in combination with hand weeding twice (25 and 40 DAT) followed by chemicals like pyrazo sulfuran ethyl @ 25 g/ha.

Table 1 Effect of water and weed management practices on weed population and dry matter weight of weed a 30, 60, 90 DAT and at harvest in transplanted hybrid rice (pooled of 2 years)

Treatments	Weed population (m^{-2})				Dry matter weight ($g\ m^{-2}$)				W.C.E. (%
	30 DAT	60 DAT	90 DAT	Harvest	30 DAT	60 DAT	90 DAT	Harvest	at harvest
Irrigation management practices									
I_0	12.23	18.27	24.80	27.73	5.42	6.17	12.82	14.79	
I_1	13.03	19.23	25.50	28.20	5.55	7.12	12.78	14.96	
I_2	13.20	19.77	26.07	28.70	5.77	7.15	12.89	15.29	
I_3	13.87	20.57	26.37	29.47	5.88	7.40	13.17	15.82	
S.Em(±)	0.34	0.35	0.31	0.41	0.09	0.13	0.16	0.14	
CD(p=0.05)	0.85	0.88	0.38	N.S.	0.24	N.S.	N.S.	0.36	
Weed management practices									
W_0	18.92	38.33	50.04	53.54	12.00	17.95	28.62	33.93	
W_1	6.42	10.79	14.708	16.83	3.01	3.50	6.15	6.26	81.55
W_2	8.75	13.17	19.25	22.50	3.90	4.13	8.89	12.98	61.74
W_3	10.50	23.96	27.75	30.83	4.86	6.76	13.70	15.49	54.35
W_4	9.08	11.21	16.67	18.92	3.52	3.71	7.22	7.41	78.16
S.Em(±)	0.37	0.40	0.40	0.36	0.16	0.15	0.26	0.21	
CD(p=0.05)	0.89	0.98	0.98	0.88	0.38	0.37	0.63	0.52	

Table 2 Effect of water and weed management practices on weed index (WI) and grain yield (t/ha) of transplanted hybrid rice (pooled of 2 years).

	Grain yield ($t\ ha^{-1}$)	Weed index (%)	$Cent^{-1}$ increase over control
Irrigation management practices			
I_0	8.97	-	
I_1	8.43	-	
I_2	8.20	-	
I_3	7.79	-	
S.Em(±)	0.386		
CD(p=0.05)	0.969		
Weed management practices			
W_0	5.72	24.04	-
W_1	7.53	-	24.03
W_2	6.81	9.56	16.01
W_3	6.71	10.88	14.75
W_4	7.14	5.17	19.88
S.Em(±)	0.377		
CD(p=0.05)	0.907		

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