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Effect of weed management in direct-seeded, upland rice (*Oryza sativa*) at varying nitrogen levels

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ABSTRACT

In an experiment conducted during the rainy season of 1992 and 1993 'SBR 34-69-1' rice (*Oryza sativa* L.) having a denser crop canopy proved better than 'ES 18-11-2' in terms of weed growth, weed-control efficiency, weed index and grain yield. Nitrogen at 80 kg/ha recorded the highest grain yield. Among the weed-management practices, minimum weed growth was obtained in weed-free check followed by butachlor.

Key words: Upland rice, Weed control, N levels, Grain yield

In India, in direct-seeded, upland rice, weeds pose serious problems and if not controlled cause severe reduction in rice yield. In the upland rice-growing areas, the available nutrients are limited and costly and therefore warrant their judicious use for obtaining greater efficiency. Nitrogen is the key nutrient in determining the level of crop productivity. Weed control facilitates higher absorption of applied fertilizers, thus increases the efficiency of fertilizers applied to the crops. The present study was carried out to elicit the effect of weed-management practices in direct-seeded, upland rice at varying nitrogen levels.

MATERIALS AND METHODS

The field experiment was conducted at Research Farm of Rajendra Agricultural University, Pusa, Bihar, during rainy season (*kharif*) of 1992 and 1993. The soil was sandy loam with pH 8.4 and low in organic carbon (0.28%), available N (185 kg/ha), available P_2O_5 (21.4 kg/ha) and available K_2O (75.3 kg/ha). The treatments consisted of 2 rice varieties ('SBR 34-69-1' and 'ES 18-11-2'), 3 levels of nitrogen (0, 40 and 80 kg/ha) and 3 weed-control treatments (weedy check, weed-free check and buachlor @ 1.0 kg a.i./ha). The experiment was laid out in randomized block design (factorial) with 3 replications. The rice varieties were sown @ 80 kg seed/ha at 15-cm-row spacing. The entire quantity of phosphorus (40 kg P_2O_5/ha) and potassium (20 kg K_2O/ha) was applied basal, whereas nitrogen was applied as per treatments in splits, i.e. one-fourth at the time of final land preparation, half N at active tillering stage

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Table 1. Effect of varieties, nitrogen levels and weed-management treatments on weed growth, weed-control efficiency, weed index, yield attributes and grain yield of rice (mean data of 2 years)

Treatment	Weed population/ m^2	Dry weight of weeds (g/m^2)	Weed-control efficiency (%)	Weed index (%)	Plant height (cm)	Panicles/ m^2	Panicle length (cm)	Spike-lets/ panicle	1,000-grain weight (g)	Grain yield (q/ha)
Variety										
'SBR 34-69-1'	10.86 (34.84)	41.28	80.82	28.26	63.77	281.40	19.55	75.38	20.32	21.52
'ES 18-11-2'	11.65 (39.96)	62.80	79.06	33.04	68.01	264.75	18.46	68.77	20.33	19.16
CD (P = 0.05)	0.24	4.02			3.16	6.81	0.54	1.70	NS	1.15
N (kg/ha)										
0	10.78 (34.83)	44.64	80.49	29.93	61.40	281.57	17.39	63.52	18.82	13.56
40	11.32 (37.71)	53.53	80.01	30.75	66.65	280.66	19.37	73.48	20.43	21.39
80	11.67 (39.66)	57.95	79.31	31.27	69.61	320.00	20.26	79.23	20.73	26.08
CD (P = 0.05)	0.30	4.92			3.87	8.35	0.66	2.08	0.51	1.41
Weed control										
Weedy check	17.87 (79.55)	111.11		45.47	62.55	209.31	17.77	68.80	19.89	13.85
Weed free check	6.01 (8.61)	7.28	93.46	0	68.38	324.31	19.89	73.03	20.66	25.62
Butachlor @ 1.0 kg a.i./ha	9.88 (24.05)	37.77	66.41	15.82	66.73	285.62	19.36	74.39	20.42	21.56
CD (P = 0.05)	0.30	4.92			3.87	8.35	0.66	2.08	0.51	1.41

Table 2. Weed dry weight (g/m²) as affected by interaction between varieties and weed management treatments (mean data of 2 years)

Treatment	Variety		
	'SBR 34-69-1'	'ES 18-11-2'	Mean
Weed control			
Weedy check	89.42	132.80	111.11
Weed-free check	5.64	8.93	7.28
Butachlor @ 1.0 kg a.i./ha	28.80	46.67	37.77
Mean	41.28	62.80	
CD (P = 0.05)		6.96	

and the remaining one-fourth at panicle-initiation stage. Butachlor was applied 4 days after sowing and hand-weedings were done thrice 20, 40 and 60 days after sowing to provide weed-free condition in the concerned treatments.

RESULTS AND DISCUSSION

Weed growth

Rice varieties exerted significant influence on weed population and weed dry-matter accumulation. In 'SBR 34-69-1' significantly lower weed population and weed dry weight were recorded. This might be due to thick crop canopies of 'SBR 34-69-1' which prevented the usurpation of space by weeds. Different levels of N significantly affected weed population and weed dry weight. The weed populattion and weed dry weight increased with increasing levels of N. This may be due to better establishment and vigorous growth and development of weeds under higher rate of N application. The minimum weed population and weed dry weight were obtained under hand-weeding, followed by butachlor (Table 1). Singh and Bhandari (1986) observed significant reduction in weed dry matter at growth stages under herbicidal and hand-weeding treatments. Interaction effect between variety and weed-control treatments on weed dry weight was significant in 'SBR 34-69-1'. The lowest weed dry weight was recorded under hand-weeding, whereas butachlor reduced the weed dry weight to one-third only (Table 2). Interaction effect between N and weed-control treatments significantly lowered weed dry weight under hand-weeding in absence of N, while butachlor showed its effectiveness in lowering weed dry weight at each level of N application. Maximum weed-control efficiency was of hand-weeding, followed by butachlor at harvest. In 'SBR 34-69-1' weed index was lower than that of 'ES 18-11-2'. Weed index was not much affected by increasing N levels. The higher weed index was recorded in weedy check.

Yield-contributing parameters

In 'SBR 34-69-1' higher value of yield-attributing characters like panicles/m², panicle length, spikelets/panicle were recorded than 'ES 18-11-2' (Table 1). This might be due to more efficient uilization of nutrients either due to the genetic potential of the cultivar or due to more weed-free environment. Higher level of N caused significant increase in panicle length, panicles/m² and spikelets/panicle. This may be due to higher availability of N to plants leading to its higher uptake and translocation from vegetative parts to the reproductive parts, resulting in increased panicle length, higher number of filled grains and higher 1,000-grain weight. The 1,000-grain weight increased significantly only up to 80 kg N/ha. This is in accordance with tthe finding of Dubey *et al.* (1983). Hand-weeding caused significant increase in panicles over other treatments. Severe weed infestation depressed the panicle number per unit area.

Grain yield

'SBR 34-69-1', having denser crop canopy resulted in distinct weed suppression and recorded higher grain yield than 'ES 18-11-2' with sparce denser crop canopy (Table 1). The grain yield increased significantly

Table 3. Weed dry weight (g/m²) and rice panicles/m² as affected by interaction between nitrogen levels and weed management treatments (mean data of 2 years)

Treatment	Weed-management treatments						Mean	
	Weedy check		Weed free check		Butachlor @ 1.0 kg a.i./ha			
N (kg/ha)								
0	95.93	173.13	6.46	(255.73)	31.53	226.86	44.64	218.53
40	114.60	212.00	7.26	(235.80)	38.73	294.20	53.53	280.66
80	122.80	242.80	8.13	(381.40)	42.93	335.80	57.95	320.00
Mean	111.11	209.31	7.28	(324.31)	37.77	285.62		
CD (P = 0.05)		8.53		(14.46)				

Data in parentheses belong to rice panicles/m²

with the increasing levels of N up to 80 kg/ha. Favourable effect of nitrogen was also reported by Sudhakar *et al.* (1986). Weed-free treatment provided favourable condition for proper utilization of plant nutrients, moisture and solar radiation, resulting better photosyntheic efficiency owing to weed-free environment. The interaction effect between nitrogen and weed-control methods was significant (Table 3). Weed-free condition without N application yielded as much grain as was obtained at 80 kg N/ha under no weeding. Similarly, weed-free crop yield at 40 kg N/ha was equal to the yield obtained from herbicide- treated plot at 80 kg N/ha.

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