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Effect of varieties and weed-control practices on rice (*Oryza sativa*) productivity and weed growth

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ABSTRACT

A field experiment was conducted during rainy season of 1995 and 1996 to evaluate the competitive ability of traditional and high-yielding rice (*Oryza sativa* L.) varieties and to find out suitable weed-control practices for transplanted rice. 'Akisali', a tall traditional variety, was found to reduce the weed dry-matter accumulation significantly compared with the other varieties tested. Different weed-control practices significantly reduced dry-matter accumulation of weed and increased the yield of rice over unweeded check in 1 out of 2 years of experimentation. Butachlor +2,4–D (1.0 kg/ha) in 60:40 proportion and Anilofos (0.4 kg/ha) were equally effective in controlling weeds and increasing the yield of rice.

Key words : Rice, Weed control, Rice productivity, Weed growth

One of the major reasons of low productivity of rice in Assam is the severe weed infestation. Modern rice varieties with their upright canopy architecture allow more solar radiation to penetrate through their canopy and encourage increased growth of weed biomass compared to many traditional ones with their broad and droopy leaf architecture. Mechanical or manual weeding is difficult many a times due to continuous rains prevailing during rainy season and also due to scarcity of labour. Chemical weeding although cheaper (Singh and Mani, 1981) but its efficiency is substantially reduced due to heavy rains and also due to their narrow spectrum of weed control. The selection of variety having weed-suppressing ability is important to reduce the cost of weeding vis-a-vis dependence on herbicides. Application of more herbicide is useful, particularly in the absence of an effective broad-spectrum herbicide in rice to control highly diverse weed population (Rao and Singh, 1997). The choice of competitive varieties along with suitable pre-emergence herbicide or herbicide mixture may reduce the weed growth substantially and increase the productivity of rice. Since information in this regard is scanty, the present study was undertaken.

MATERIALS AND METHODS

The field experiment was conducted during the rainy season of 1995 and 1996 at

research farm of the university. The treatments comprised evaluation of variation of varieties, viz. 'Akisali' (long duration, tall, coarse grain), 'Badshabhog' (medium duration, tall, fine grain), 'Manoharsali' (long duration, tall, moderate tillering, coarse grain) and 'Kôlajaha' (medium duration, tall, low, tillering, fine, scented grain), and 4 weed-control practices, viz, paddy weeder (at 25 DAT), Butachlor + 2,4–D herbicide mixture (1.0 kg/ha) at 60 : 40 proportion, Anilofos 0.4 kg/ha and weedy check. The experiment was laid out in split-plot design replicated thrice with varieties in the main plots and weed-control practices in the subplots.

The soil of the experimental field was sandy loam in texture having pH 5.5 with 270 kg/ha available N, 19.2 P_2O_5 and 187 kg/ha K_2O. A uniform fertilizer dose of 40, 20 and 20 kg/ha and 20, 10 and 10 kg N P_2O_5 and K_2O/ha was applied to the high-yielding and traditional varieties respectively. Full dose of P_2O_5 and K_2O and half dose of N were applied basal and the remaining N was top-dressed in 2 equal splits, at maximum tillering and penicle-initiation stage of the crop. Thirty days old seedlings of rice were transplanted with a spacing of 20 cm × 10 cm for high yielding and 20 cm × 20 cm for traditional varieties in the third week of July. The paddy weeder was used at 25 DAT and pre-emergence herbicides were applied at 3 DAT. The required quantity of herbicide were mixed with water @ 800 litres/ha and applied with the manually operated knapsack sprayer. A thin film of water was maintained in the field at the time of application of herbicides. Weed counts (number/m^2) and weed dry weight (g/m^2) were sampled at 45 DAT and at harvest with the help of 0.5 m^2 quardrate and the data were analysed after subjecting to square root ($\sqrt{X + 0.5}$) transformation for both weed count and dry weight. Yield and yield attributes of rice were recorded at crop harvest. Weed-control efficiency was also calculated.

RESULTS AND DISCUSSION

Weed flora

The major weeds observed in the experimental field were: *Echinochloa crus-galli* (L.) Beauv., *Sagitaria guayansis* H.B. & KSSP lappula, *Scirpus juncoides* Roxb., *Monochoria vaginalis* Presl, *Fissendocarpa linifolia* Vahl, *Hydrolea zeylenica* Vahl, *Isachne himalaica* Hook.f. and *Paspallum conjugatum* Bergius. The composition of grasses, sedges and broad-leaved weeds was 31.4, 36.3 and 32.3% respectively. *Monochoria vaginalis* emerged earlier and competed with the crop initially. However, the grasses and sedges emerged after 3–4 weeks of transplanting with the disapperence of ponded water. The broad-leaved weeds were found to compete with the crop from tillering to harvesting stage of the crop.

Weeds

Dry weight and density of weeds were significantly influenced by different weed-control practices over the control in 1 out of 2 years. At both the stages of observation, unweeded check recorded significantly higher weed density and dry weight than other treatments (Table 1). Among the weed-control practices, lowest weed density was recorded with the application

Table 1. Effect of varieties and weed-control practices on weed growth

Treatment	Weed density (No./m²)				Weed dry weight (g/m²)			
	1995		1996		1995		1996	
	45 DAT	Harvest	45 DAT	Harvest	45 DAT	Harvest	45 DAT	Harvest
Variety								
'Akisali'	5.9	6.3	11.8	12.5	5.8	6.2	3.9	6.5
	(35)	(40)	(140)	(157)	(33)	(38)	(16)	(43)
'Manoharsali'	6.2	6.6	11.7	107	6.1	6.5	4.4	6.3
	(38)	(44)	(140)	(115)	(37)	(42)	(20)	(40)
'Badshabhog'	6.2	6.6	11.9	13.3	6.3	6.7	4.2	6.2
	(38)	(44)	(142)	(177)	(39)	(45)	(18)	(39)
'Kolajaha'	6.3	6.5	12.4	12.7	6.6	7.1	4.7	6.1
	(39)	(42)	(154)	162)	(43)	(50)	(22)	(38)
LSD (P = 0.05)	NS	NS	NS	2.2	0.7	0.8	NS	NS
Weed control								
Paddy weeder (25	6.2	6.6	11.6	12.4	5.8	6.3	4.5	6.2
DAT)	(38)	(44)	(139)	(154)	(34)	(40)	(21)	(39)
Butachlor + 2, 4–D	5.8	6.1	11.7	12.3	5.9	6.3	4.4	6.1
mixture 1.0 kg/ha	(33)	(36)	(140)	(152)	(35)	(40)	(20)	(38)
Anilofos 0.4 kg/ha	5.7	5.8	11.9	12.4	5.9	6.3	4.1	6.4
	(32)	(34)	(142)	(154)	(34)	(39)	(18)	(42)
Weedy	6.8	7.4	12.6	12.0	7.1	7.5	5.4	7.5
	(46)	(55)	(161)	(145)	(49)	(56)	(29)	(56)
LSD (P = 0.05)	0.3	0.3	NS	NS	0.6	0.6	NS	NS

Data within parentheses are original value

of Anilophos 0.4 kg/ha and was at par with the treatment receiving Butachlor + 2,4-D 1.0 kg/ha. Weed dry weight also followed the similar trend.

All the 4 tested varieties were at par for their influence on weed density except in the second year, where the variety 'Manoharsali' recorded significantly lower weed density at harvest. This may be due to broad and droopy leaf architecture of traditional varieties. Significant variation in weed dry weight due to different varieties tested was observed during 1995. 'Akisali' significantly lowered the weed dry weight over the other varieties. Broader and droopy crop canopy may reduce the growth of weed population by reducing the penetration of solar radiation associated with 'Manoharsali'. The results corroborate the findings of Gogoi and Kalita (1990).

Weed-control efficiency

Weed-control efficiencies of different weed-control practices were almost at par. However, comparatively higher weed-control efficiences were recorded with Butachlor + 2,4-D (1.0 kg/ha) mixture and Anilophos 0.4 kg/ha over paddy weeder at 25 DAT (Table 2). During the second year Anilophos 0.4 kg/ha recorded higher weed-

control efficiency at 40 DAT.

Crop

All the weed-control treatments significantly influenced the yield components, grain and straw yields compared with unweeded check. Panicle number, panicle length, grains/panicle, 1,000-grain weight were increased significantly due to different weed-control treatments over unweeded check (Table 3). This may be due to reduced crop–weed competition particularly at early growth stages of the crop growth promoting better nutrition of the crop which ultimately resulted in increased yield attributes. The results are in accordance with the findings of Rao and Singh (1997). Varieties differed significantly for their yield components. In general, different yield components were higher during 1996 than during 1995 which might be due to uniform distribution of rainfall during the second year. Among the varieties, 'Manoharsali' recorded the highest panicle number, panicle length, grains/panicle and 1,000-grain weight and

Table 2. Effect of varieties and weed-control practices on weed-control efficiency

Treatment	Weed-control efficiency (%)			
	45 DAT	Harvest	45 DAT	Harvest
Weed control				
Paddy weeder (25 DAT)	30.6	28.6	27.6	30.4
Butachlor + 2,4–D (1.0 kg/ha)	28.6	28.6	31.0	32.1
Anilofos 0.4 kg/ha	30.6	30.4	37.9	25.0
Weedy				
LSD (P = 0.05)				

Table 3. Effect of varieties and weed-control practices on yield attributes of rice

Treatment	Panicles/m²		Panicle length (cm)		Grains/panicle		1,000-grain weight (g)	
	1995	1996	1995	1996	1995	1996	1995	1996
Variety								
'Akisali'	127	181	18.8	21.5	103	106	21.2	21.5
'Manharsali'	134	196	19.5	21.6	107	105	22.0	21.6
'Badshabhog'	127	172	18.3	19.0	106	108	19.0	19.5
CD (P=0.05)	7.0	13.0	1.3	0.8	5.0	3.0	0.7	0.8
Weed control								
Paddy Weeder (25 DAT)	134	183	19.6	21.3	109	108	21.0	21.2
Butachlor + 2,4–D (1.0 kg/ha)	131	193	20.5	21.5	109	111	21.2	21.4
Anilofos 0.4 kg/ha	135	197	18.3	20.7	108	112	20.9	21.3
Weedy	105	143	17.3	17.8	81	83	17.7	17.5
CD (P=0.05)	9.0	12.0	1.9	1.3	6.0	7.0	1.5	1.4

Table 4. Effect of varieties and weed-control practices on yield of rice

Treatment	Grain yield (tonnes/ha)		Straw yield (tonnes/ha)		Sterility (%)	
	1995	1996	1995	1996	1995	1996
Varitety						
'Akisali'	2.5	2.3	4.7	4.5	13.5	13.8
'Manoharsali'	2.9	2.5	4.4	4.7	15.2	15.9
'Badshabhog'	2.7	2.1	4.6	4.1	15.8	16.1
'Kolajaha'	2.2	1.8	4.8	3.9	17.1	17.5
LSD (P=0.05)	0.3	NS	NS	0.1	3.0	2.8
Weed control						
Paddy Weeder (25 DAT)	2.7	2.1	4.6	4.4	11.9	12.1
Butachlor+2,4–D (1.0 kg/ha)	3.1	2.0	5.2	4.4	13.2	13.4
Anilofos 0.4 kg/ha	3.0	2.3	5.0	4.5	14.9	14.7
Weedy	2.2	2.3	3.7	3.9	22.5	22.4
LSD P=0.05)	0.3	NS	0.4	0.2	2.4	2.5

was at par with the variety 'Akisali' and 'Badshabhog' but significantly superior to 'Kolajaha'. Sterility percentage was significantly lower with 'Akisali' than with the other varieties (Table 4). Grain yield of rice varied significantly due to different treatments in 1 out of 2 years. Highest grain yield of rice was obtained from the 'Manoharsali' and was at par with 'Badshabhog' but significantly higher than 'Akisali' and 'Kolajaha'. Among the weed-control practices, Butachlor + 2,4–D mixture (1 kg/ha) and Anilofos (0.4 kg/ha) recorded the similar and significantly higher grain yield than paddy weeder and unweed check. The increased grain yield in these treatments was due to reduced weed density, weed dry weight and better weed-control efficiency and improvement in yield attributes like panicle number, panicle length and grains/panicle. The minimum yield and yield compoments in unweeded check were the results of severe weed competition by uncontrolled weed growth. Similar results were also reported by Gogoi (1995) and Srinivasan *et al.* (1989). Straw yield of rice also varied significantly due to different treatments only in 1996. Significantly higher straw yield was recorded with 'Manoharsali' followed by 'Akisali' and 'Badshabhog', while the lowest with 'Kolajaha. For weed-control practices, all the treatments showed similar effects and resulted in significantly higher straw yield over unweeded check.

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