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GROWTH AND YIELD OF DIFFERENT RICE VARIETIES IN COASTAL SALINE SOIL

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Abstract: A field experiment was carried out in a slightly to moderately coastal saline soil of the Khulna district. The area is mostly under monocropped practices having cropping intensity of >114%. Topsoil, river and ground water salinity in these area range from 1.7-2.6, 0.25-0.39 and 1.4-3.2 dS/m during July to December respectively. Soil and tidal river water salinity doesn't severely affect the growth and yield of both HYV and local rice varieties in this period. BR-23 performed better growth and yield than BR-30 and local varieties. The degree of yield performance were BR-23>BR-30>Jutabalam>Kachra when the other relevant parameters remained constant.

Key words: Growth; Yield; Rice; Coastal; Saline soil

Introduction

A field experiment was carried out at Salinity Management and Research Centre (SMRC) site of Soil Resource Development Institute (SRDI), Batiaghata, Khulna during kharif-2, 1996-98. The area is mostly under monocropped practices having cropping sequences of Fallow-Fallow-T. *aman* with cropping intensity of > 114% (SRDI, 1997). The topsoil salinity ranges from 1.7 to 2.6 dS/m during July to December (SRDI, 1997). The ground water and adjacent river water salinity ranges from 1.4 to 3.2 and 0.25 to 0.39 dS/m during the same period, respectively (SRDI, 1997 and 1999). The farmers of this area are mostly dependent on low yield monocrop local rice varieties for their staple food of the whole year. Therefore, it was seriously felt to disseminate locally tolerable one or more best high yielding rice variety in these slightly to moderately coastal saline soils (Karim *et al.*, 1990) area for maximizing the yield and production as well as to minimize the country's food shortage. Keeping these view in mind the experiment was undertaken to fulfil the following objectives: (i) to introduce one or more best high yielding rice variety at local saline soil conditions, (ii) to verify the adaptability of HYV (BR-23 and BR-30) for maximizing the crop production in coastal saline soils, (iii) to find out the growth and yield performance of these varieties in these soils and (iv) to motivate the attitude of the local farmers for those high yielding rice varieties.

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Materials and Methods

The experiment was laid out in randomized complete block (RCB) design with 3 replications having an area of 958.5 sq. m. Each block consisted of 8 plots and individual plot sizes were 6m X 5m, at a distance plant-plant 15 cm and row-row 25 cm for HYV and that of 30 cm apart (for local) in both the distances, respectively. 1m and 0.5m separated the adjacent blocks and neighboring plots respectively. There were 4 selected treatments in the experiments. They were BR-23 (V₁), BR-30 (V₂), *Kachra* (V₃) and *juta balam* (V₄). To achieve 4.5-5.5 t/ha (HYV) and 2.75-3.0 t/ha (local) yield it was required 90-80-40-0-3kg/ha N-P-K-S-Zn (HYV) and 50-40-0-0-0 kg/ha (local) fertilizers respectively. Broadcasting incorporated full amounts of TSP, MP and zinc sulfate fertilizers during final land preparation. Urea was top dressed in 3 equal installments at 15, 30 and 45 DAT (Days After Transplant). Both HYV (BR-23 and BR-30) and local (*Kachra* and *Jutabalam*) varieties were harvested at 105-110 and 120-130 DAT, respectively.

Results and Discussion

Before cultivation, topsoil was collected and analyzed in the SRDI regional laboratory Daulatpur, Khulna. As shown in Table 1, the soil belongs to Bajoa series having a P^H of 6.5 and ECe at 5.5 (dS/m). As compared to *Thana Nirdeshika* guide (SRDI, 1989) the soils were low in N, P, K, Zn but excess in S and Cu with medium content of Mn. Doses of fertilizers were calculated and applied accordingly.

Table 1. Some physico-chemical characteristics of SMRC Soils.

Soil series	Texture	EC (dS/m)	p ^H	OM (%)	N (ppm)	P (ppm)	K (meq/100g)	S (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
Bajoa	SiCL	5.5	6.5	2.8	19.1	8.3	0.18	101.5	1.8	23.5	15.1

Table 2. Variation of different sources of soil and water salinity (EC-dS/m) with rainfall (1998-99).

Criteria	J '98	A	S	O	N	D	J '99	F	M	A	M	J '99
Rainfall (mm)	339	258	300	147	132	0	0	0	0	14	175	185
Topsoil	3.00	258	2.50	2.70	3.00	3.60	3.80	4.20	6.50	13.8	9.60	7.50
River water	0.25	2.10	0.23	0.24	0.31	0.39	1.35	2.87	10.4	14.8	14.9	1.05
Pond water	2.45	0.22	2.40	2.44	2.46	2.52	2.69	3.06	3.37	4.53	6.78	5.06
Tube well water	1.05	2.36	1.02	1.02	1.01	1.15	1.19	1.20	1.35	2.96	*	*

* Data not available

Rainfall data was collected from the Meteorological department of Khulna for comparing the salinity variation with rainfall characteristics. As can be seen from Table 2, that as a normal trend river water salinity decreased from June to September with the increase of rainfall and increased during October to May when rainfall is minimum. It may also be seen that with the inception of drought period, the salinity of soil and pond water increases and attains to the peak during April-May and become hazardous for most of the crops. Deep tube well water (± 300 m deep) contains low salinity and was feasible for irrigation.

Table 3. Growth performance of different rice varieties.

Combination	Criteria	Weeks				
		2nd	4th	6th	8th	10th
V ₁ F ₁	Plant ht (cm)	31.33	39.99	73.94	96.23	105.26
	No. of tiller/hill	2	5	8	9	9
	Soil EC (dS/m)	2.5	2.2	2.0	2.0	1.5
V ₂ F ₁	Plant ht (cm)	24.11	32.22	54.75	79.01	92.00
	No. of tiller/hill	3	4	7	9	9
	Soil EC (ds/m)	2.5	2.0	2.0	2.0	1.5
V ₃ F ₁	Plant ht (cm)	43.22	61.22	88.90	118.53	128.37
	No. of tiller/hill	4	6	12	14	15
	Soil EC (dS/m)	2.5	2.2	2.0	2.0	1.5
V ₄ F ₁	Plant ht (cm)	41.77	56.44	102.07	106.84	127.00
	No. of tiller/hill	2	5	12	14	14
	Soil EC (dS/m)	2.5	2.2	2.0	2.0	1.5

From Table 3 it may be observed that the local varieties were taller than HYV and exerted lodging during the growth period. BR-23 grew better than BR-30 rice variety. The lodging in local varieties may be due to the application of soil test based higher nitrogenous fertilizer doses.

Table 4. Yield performance of different rice varieties (1996-97).

Combination	No. of penicle/hill	Grain wt. (Kg)	Straw wt. (Kg)	Grain: Straw	1000 grain wt. (g)	Unfilled spikelet (%)	Yield (t/ha)
V ₁ F ₁	11 ^c	15.99 ^a	17.77 ^a	0.9:1 ^{ab}	27.92 ^b	22.08*	5.338 ^a
V ₂ F ₁	10 ^d	15.96 ^a	14.91 ^b	1.1:1 ^a	21.76 ^c	17.31*	5.15 ^a
V ₃ F ₁	19 ^a	8.82 ^b	13.17 ^b	0.7:1 ^b	36.09 ^a	11.01*	2.294 ^c
V ₄ F ₁	15 ^b	10.17 ^b	18.49 ^a	0.6:1 ^b	27.36 ^b	22.32*	3.39b
LSD (≤0.05)	1.373	1.577	1.830	0.328	3.929	15.33	0.357

^{a b c d} Means followed by same letters in a column are not significantly different at 5% level by DMRT. * Not significant

Table 5. Yield performance of different rice varieties (1997-98).

Combination	No. of penicle/hill	Grain wt. (Kg)	Straw wt. (Kg)	Grain: Straw	1000 grain wt. (g)	Unfilled spikelet (%)	Yield (t/ha)
V ₁ F ₁	8 ^b	18.39 ^a	28.55*	0.6:1 ^a	31.04 ^b	14.00 ^b	6.12 ^a
V ₂ F ₁	9 ^b	18.21 ^a	28.44*	0.7:1 ^a	25.81 ^c	7.00c	6.06 ^a
V ₃ F ₁	16 ^a	9.05 ^c	27.57*	0.3:1 ^b	36.03 ^b	13.67 ^b	3.01 ^c
V ₄ F ₁	14 ^a	10.40 ^b	24.21*	0.4:1 ^b	34.72 ^b	18.00 ^a	3.46 ^b
LSD (≤0.05)	2.283	1.333	10.760	0.199	3.125	3.106	0.442

^{a b c d} Means followed by same letters in a column are not significantly different at 5% level by DMRT. * Not significant

The data (Tables 4,5 and 6) on yield performance reveals that the number of penicles and grain weight were higher in both the local varieties than HYV. But they (penicle and grain weight) were higher in case of BR-23 than BR-30 variety. As a normal trend grain yield of HYV were always higher than local varieties, whereas BR-23 responded better yield than BR-30 variety. The better yield may be due to increment of penicles and variety characteristics. Maji *et al.* (1990) stated that dry matter yield did not make any significant difference through the foliar application of micronutrients (Fe, Mn and Zn) in

a coastal saline soil but the grain yield was higher with this foliar spray of those micronutrients.

Table 6. Yield performance of different rice varieties (1998-99).

Combination	No. of panicle/hill	Grain wt. (Kg)	Straw wt. (Kg)	Grain:S traw	1000 grain wt. (g)	Unfilled spikelet (%)	Yield (t/ha)
V ₁ F ₁	9 ^b	15.33 ^a	24.67*	0.6:1 ^a	23.67 ^b	12.33*	5.11 ^a
V ₂ F ₁	9 ^b	15.00 ^a	23.50*	0.7:1 ^a	27.17 ^c	7.67*	5.00 ^a
V ₃ F ₁	16 ^a	8.27 ^b	29.17*	0.3:1 ^b	38.33 ^a	13.00*	2.75 ^b
V ₄ F ₁	14 ^a	9.33 ^b	28.00*	0.3:1 ^b	37.33 ^a	17.00*	3.11 ^b
LSD (≤0.05)	2.079	1.401	6.254	0.179	3.929	7.901	0.464

^{a,b,c} Means followed by same letters in a column are not significantly different at 5% level by DMRT. * Not significant.

Table 7. Yield of different rice varieties (3 years average).

Combination	Year			Average yield (t/ha)
	1996-97	1997-98	1998-99	
V ₁ F ₁	5.33	6.12	5.11	5.52
V ₂ F ₁	5.15	6.06	5.00	5.40
V ₃ F ₁	2.94	3.01	2.75	2.90
V ₄ F ₁	3.39	3.46	3.11	3.32

From trials over the last 3 years, it may be concluded that BR-23 rice variety performed better (Table 7) than other 3 varieties. The degree of yield performance were BR-23>BR-30> *Jutabalam*>*Kachra* in coastal saline soils when the other relevant parameters remained constant.

Conclusion

Among the four varieties of local and HYV rice it may be concluded that the BR-23 and BR-30 can be disseminated in coastal saline soils when the soil and water salinity remains 1.7-2.6 and 0.25-0.39 dS/m during July to December. More research and demonstration is needed to disseminate the technology elsewhere in the country.

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