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PADDY YIELD AS AFFECTED BY PLANTING TECHNIQUES IN A SALT-AFFECTED SOIL

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A field experiment was conducted on rice variety IR-6 to determine the most appropriate planting technique for saline sodic soils. Tillering and strawyield was improved with direct seeding or increasing the number of seedlings to 4 hill-I in a saline sodic soil as compared to normal practice of planting 2 seedlings hill-I. Paddy yield and paddy straw ratio also improved by direct seeding. Concentration of Na^+ and Cl^- decreased progressively with increasing the number of seedlings hill-t and because of direct seeding. Various treatments did not affect the concentration of P, K and Zn in rice tissues, Nevertheless, K:Na and Zn:P ratios were better due to increased plant density on a unit area.

INTRODUCTION

Soil salinity/sodicity is a major problem in arid and semi-arid regions of the world. Crop production is signilicantly reduced or entirely inhibited on 6.2 million hectares of potential crop land in Pakistan (Asla m *et al.,* 1993a). Almost 56% of the salt affected area in Pakistan is saline sodic (Muhammad, 1983). About one million hectares of such lands are under rice cultivation (Aslam *et al.,* 1993a). The tract famous for rice production has moderate to high soil salinity, sodicity, high pH and scarcity of good quality ground water (Chaudhri, 1978), causing 32, 63 and 79% reduction in paddy yield in slightly, moderately and highly salt affected soils, respectively (Qayyum and Malik, 1988).

Economic utilization of these marginal lands by cultivating salt-tolerant crops along with suitable site specilic cultural practices is the only alternative (Qureshi *et al.,* 1990). Rice is salt-tolerant at germination but quite sensitive to salinity of the rooting medium at the seedling stage (Aslam *et al.,*]!)HH) and often much loss in yield has been observed because of high plant mortality at early seedlings establishment stage (even in ~the case of tolerant rice cultivars). If salt-tolerance of rice at germination stage could be exploited for seedling establishment, a good crop stand might be obtained which may ensure better yield from the adverse lands. Need to develop a planting technique, in order to reduce plant mortality at the very early stages of its growth, is thus badly required. The present investigation is therefore an effort to:

i. Compare the different planting techniques of nee for seedling establishment under adverse soil conditions.
ii. Enhance paddy yield from salt-affected lands employing site specific management practices.
iii. Reduce cost of production without any yield loss.

MATERIALS AND METHODS

A field experiment was conducted to compare the planting techniques of rice in a dense clay loam saline sodic soil (ECe 6.7 dS m-I., pHs 8,57., SAR, 39.6) at Bio-Saline Experimental Research Station, Sadhoke. Randomized complete block design of layout with four replications was employed. The various treatments were:

TI = Two seedlings hill-^{1} (control)
T2 = Three seedlings hil1-^{1}
T3 = Four seedlings hil1-^{1}
T4 = Direct seeding.

Seeds of rice (IR 6) were soaked in water for 24 hours and incubated for 48 hours in wet gunny bag to assure the quick and even germination.

These pregerminated seeds were sown to raise the nursery in a normal soil for seedling transplanting treatments, and broadcasted directly in the puddled salt-affected field in the case of direct seeding treatment on the same day @ 50 kg seed ha·l. Where transplanting of rice was desired, 3Q.day old rice seedlings were transplanted according to the plan in the puddled salt-affected field keeping inter and intra row distance of 20 cm. Recommended doses of NPK and ZnS04 fertilizers, at the rates of 120-75-0 and 12 kg ZnS04 ha-^{1} respectively were applied. Tubewel1 water (EC 0.6 dS m-I, RSC 1,3 me L-I, SAR 2,4) was used for irrigation throughout the growing season. Plant samples were col1ected 45 days after transplanting and 75 days after sowing and analysed for P, K, Zn, Na and Cl concentrations. At maturity, crop was harvested and data on yield and yield components were recorded and statistical1y analyzed (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

1. Yield Components.

Plant height and tillering capacity increased due to increased plant desity i.e. because of increasing the number of seedlings hill-^{1} and/or direct seeding (Table 1). However, increase in plant height was non-significant whereas tillering capacity was increased significantly due to increasing the number of seedlings hill-^{1} and direct seeding. Similar results have been reported by Maekawa *et al.* (1987), Aslam *et al.* (1990) and Dingkuhn *et al. (1990).*

Data regarding panicle length and sterility percentage are presented in Table 1.

Table 1. Effect of planting techniques on yield and yield components or rice grown in a salt-affected soil (cv: IR 6).

Treatment	Plant height (cm)	Tillering capacity (m^{-2})	Panicle length (cm)	Sterility (%)	Paddy yield (t ha^{-1})	Straw yield (t ha^{-1})	Paddy:Straw ratio
TI	84.0a	317.5c	22.1 NS	31,2	2.2NS	7.6b	0.29 NS
T2	85.5a	324,4c	22.0	30.4	2,4	7.Th	0.31
T3	86,4a	338.1b	21,6	34.1	2.5	8.0ab	0.31
T4	87.0a	367,5a	21,5	33.0	2.7	8.5a	0.32

Mean followed by the same letter (s) are statistically similar at P = 0.05
NS = non-significant

Panicle length tended to decrease whereas sterility percentage increased with increasing the plant population on a unit area but statistically there were no differences amongst the treatments.

2. Yield

Paddy and straw yield as well as paddy straw ratio was ameliorated by changing the planting strategy of rice under salt affected conditions (Table 1). A consistent increase in all these characteristics was observed by increasing the number of seedling hill-! or direct seeding of rice. However, significant results were obtained only in the case of straw yield which could be due to better tillering on a unit area basis. Another reason may be the less sensitivity of rice during vegetative (tillering) phase (Pearson 1961, Aslam *et al.,* 1988., 1993a). Increase in the paddy yield, though non-significant, was recorded from the direct seeded rice (19%) and transplanting of 4 seedlings hill-! (12%) as compared to control treatment in the salt-affected soil. This could be' due to the absence of transplanting shock or better seedling establishment under adverse conditions as well as reduced entry of toxic saline ions into the shoot because of high plant density per unit area (Shad and De Datta, 1988., Park *et al.,* 1989., Aslam *et al.;* 1990).

3. Shoot Analysis (45 d)

Concentration of sodium and chlorid sharply decreased by increasing the number of seedling hill-! or direct seeding of rice under adverse soil conditions (Table 2). Consistent decrease in the concentration of Na + and CI- with increasing plant density may be attributed to the dilution effect at root level. This further suggests that adverse effects of Na + and Cl- could be reduced by increasing the number of seedling hill-! or direct seeding of rice in salt-affected soils. Results are in line with the findings of Aslam *et al.* (1990). No effect on the concentration of K, P and Zn was found by increasing the number of seedling hill-) or in the case of direct seeding of rice in a salt-affected soil. However, an improving trend though statistically non-significent, in the ratios of K:Na and Zn:P was observed because of increased plant population in a

Table 2. Effect of planting techniques on the chemical composition of rice shoot (45d) grown in a salt-affected soil (cv. IR 6).

	Na+	K+	CI-	K:Na	P	Zn	Zn:P
		M mol If! d.wt.				M mol If! d.wt.	
T!	274a	272 NS	103a	1.36	126	0.811 NS	0.006 NS
T2	256b	361	10la	1.41	118	0.786	0.007
T3	248bc	342	97b	1.38	113	0.797	0.007
T4	237c	331	93c	1.40	118	0.748	0.007

Means followed by the same letter(s) are statistically similar at P = 0.05

NS = Non-significant

because of increased plant population in a salt-affected soil.

Though results are encouraging in terms of paddy yield by changing the planting strategy of rice in a salt-affected soil but still more research is needed to standardise the technique from agronomic and economic point of view.

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