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Impact of Lime, Gypsum and Organic Matter on Rice Grown in Saline Soils of Bangladesh

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Application of lime, gypsum and organic matter (cowdung and straw) alone and in combination produced significant increase in grain yield of rice grown in three saline soils in the greenhouse. Yield of grain and content of K, Ca and Mg were generally higher in leached soil than in non-leached soil. Contrary to this, Na content of grain was higher in non-leached soils. Treatments improved the content of Ca and decreased that of Na significantly with no significant change in Mg and K irrespective of the soils. However, the variation among the treatments was not significant either in yield or nutrient content in most of the cases. Application of gypsum (0.5 t/ha) together with cowdung (10 t/ha produced the best yield (39 62 and 31 42 g/pot) in saline soil both under leaching and no leaching. Similarly, maximum yield (37.44 and 27.2 g/pot) in saline sodic soil was obtained by addiion of cowdung However, in acid saline soil, cowdung plus gypsum and combination of cowdung and lime showed the best performance in yield (40.62 and 28.54 g/pot under both conditions.

Salt affected soils of Bangladesh cover about 1 m ha of coastal land Karim *et al.*, 1990) which is frequently intruded by marine water causing salt accumulation, especially in dry season, rendering the rice cultivation difficult (Aich and Khan, 1992 and Aich *et al.*, 1995). Transplanted *amon* is generally grown with poor yield in monsoon as a main crop and during the rest of the year, the lands remain fallow due to high soil salinity and scarcity of sweet water (Karim *et al.*, 1990 and Aich *et al.*, 1994). Amendments for such problem soils with organic manures, gypsum, lime and use of internal drainage system have been found to be beneficial to crop yield (Bandyopadhyay and Bandyopadhyay, 1984 ; Tanton *et al.*, 1990 ; Saravanam *et al.*, 1991 and Shivakant and Rajkumar, 1992). However, information on suitability of these amendments in improving salt affected soils of Bangladesh is lacking. Therefore, an experiment wae designed to assess the effect of organic manure, gypsum and lime on rice yield in saline soils under leaching and no leaching conditions in *boro* season.

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MATERIALS AND METHODS

A green house experiment was conducted at Benerpota Salinity Research Station, Satkhira with rice (CV. Purbachi) grown on coastal saline soils collected from two locations. Soils were collected upto a depth of 20 cm in each. The bulk soils sample was weighed up to 12 kg and carefully placed in the earthen pot (size 35 cm × 30 cm) in such a way that it fitted into the pot tightly. To ensure no seepage along the sides gaps between the soil and pot wall were filled up by ground soil. Half of the pots were leached with fresh water (EC 0.7 dSm^{-1}) (leaching) for four times and the rest half were not (no leaching). Amendment treatments applied were control (C,O), gypsum (GP. 0.5 t/ha), decomposed cowdung (C, 10 t/ha), decomposed straw (S, 10 t/ha). GP + C, GP + S, lime (L, 0.5 t/ha), L + C and L + S. Lime, gypsum and organic matter were added on the surface of the soil seven days prior to transplanting and field moisture capacity was maintained. One-third of N (80 kg/ha) alongwith P (60 kg/ha) and K (40 Kg/ha) were applied as basal. The rest of N was applied in two equal splits at tillering and just before panicle initiation.

Sixteen seedlings of 35 days age were transplanted at four hills on the 10th February, 1992 and irrigated with slightly saline water (EC 1.2 dSm^{-1}) throughout. The grain yield was recorded. Grain samples were chemically analyzed for Na, K, Ca and Mg. Determinations of Ca and Mg were made by Atomic Absorption Spectrophotometer and those of Na and K by Flame Photometer. Some physico-chemical properties of the soils before plantation were analyzed by standard methods (Table 1).

Table 1. *Some physico-chemical properties of the soils*

Soil Characteristies	Locations		
	S_1	S_2	S_3
Sand (%)	31.8	12.5	31.
Silt (%)	37.2	24.8	31.4
Clay (%)	31.0	62.7	37.4
pH	8.4	5.8	8.4
ECe (dSm^{-1})	8.48	11.4	4.4
Total N (%)	0.15	0.16	0.15
Olsen's P (mg kg^{-1})	10.5	14.0	12.5
CEC (me/100g)	23.8	31.3	29.2
Exchangeable cations (me/100g)			
Na	3.5	3.8	5.2
Ca	11.3	11.2	11.8
Mg	8.-	14.9	11.4
K	0.5	0.7	0.5
ESP	14.7	12.1	17.8

RESULTS AND DISCUSSION

In S_1 maximum yield was obtained under gypsum applied with cowdung for both leached (39.62 g/pot) and non-leached (31.42 g/pot) soils (Table 2). These were at par with the treatment of gypsum combined with straw in both leached (38.94 g/pot) and non-leached (30.40 g/pot) soils. In non-leached soils, however, gypsum or cowdung alone also produced similar grain yield. In S_2 having initial pH of 5.8 application of lime and gypsum with or without cowdung or straw, or cowdung alone, produced maximum yields. Grain yield of rice increased under leaching as compared to no-leaching treatment for each amendment (Table 2).

Table 2. *Effect of gypsum, lime and organic matter on yield of rice in saline soils*

Treatments	S_1		S_2	
	Leaching (g/pot)	No leaching (g/pot)	Leaching (g/pot)	No leaching (g/pot)
O (control)	25.34	22.72	32.62	22.83
GP (0.5 t/ha)	36.60	30.22	38 66	26.20
C (10 t/ha)	35.60	30.22	38.60	27.64
S (10 t/ha)	30.40	24.28	33.35	23.01
GP+C	39.62	31.42	40.62	27.88
GP+S	38.94	30.40	40.11	28 40
L (0 5 t/ha)	33.40	25.68	40.60	27 60
L+C	36.83	25.60	42.20	28.54
L+S	34.24	26.88	41.20	27.94

Data on chemical composition of grain showed decrease in Na concentration under leaching as compared to no-leaching treatment for each amendment, while that of K remained practically unchanged, resulting in increase in K/Na ratio under leaching as compared to no-leaching treatment (Table 3). Higher relative movement of Na, as compared to K, through soil beyond the root zone might have possibly resulted in lower uptake of Na by the crop under leaching as compared to no-leaching treatment. Na concentration was always higher, and consequently K/Na ratio lower, in grain under control as compared to the amendment treatments for both soil with or without leaching. Data thus explain lower uptake of Na and higher grain yield, in general, under different amendments, as compared to control and under leaching as compared to no-leaching treatment.

Table 3. *Effect of gypsum, lime and organic matter on Na and K content (%) in rice grain*

Treatments	S_1						S_2					
	Le ching			No leaching			Leaohing			No leaching		
	Na	K	K/ a	Na	K	K/ a	Na	K	K/Na	Na	K	K/Na
O (control)	0.039	0.24	6.15	0.058	0 23	3.96	0.036	0.25	6.94	0.046	0.23	5.00
GP (0.5 t/ha)	0,032	0.24	7.50	0.038	0.22	5.78	0.025	0.24	9.60	0.032	0.24	7.50
C (10 t/ha)	0.034	0.28	8. 3	0.040	0.28	7.00	0.024	0.28	11 66	0.038	0,27	7.10
S (10 t/ha)	0,034	0.27	7.94	0 042	0.26	6.13	0.025	0.26	10.40	0.036	0.26	7.22
GP+C	0.035	0,28	8.00	0.037	0.27	7.29	0.026	0.26	10.00	0.026	0.25	6.94
GP+S	0.034	0.27	7.94	0.040	0.25	6.25	0.038	0.26	6.84	0.035	0,25	7.35
L (0.5 t/ha)	0.030	0 25	8.33	0.030	0.25	6.75	0.028	0.24	8.57	0.034	0.24	7.05
L+C	0,034	0.27	7.94	0.038	0.26	6.84	0.028	0.27	9 64	0.032	0.28	8.75
L+S	0,037	0.25	6 75	0.042	0,26	6.19	0,034	0 27	7.94	0.033	0 27	8.18

REFERENCES

Aich, A. C, Iqbal, A. and Sarker, O. H. (1994). Integrated resource utilization through paddy-cum-brackishwater shrimp culture in the coastal saline zone of Bangladesh. *J. Noami* **11** (1) : 22-26.

Aich, A, C., Iqbal, A. and Sarker, O. H. (1995). Salt tolerance limit of some high yielding rice cultivers (*Oryza sativa* L.) as influenced by varying salinity. *Bangladesh J. Nucl. Agri.* **10** (in press).

Aich, A. C. and Khan, E. H. (1992), Salt tolerance limit, growth and yield performance of some modern and LIV Aman rice grown in varying salinity level. *Proc. Intercongress Conference of Commission IV,* held at Dhaka, Bangladesh, Dec. 1-3, 1992. pp. 367-373.

Bandyopadhyay, B, K. and andyopadhyay, A. K- (1984). Effect of application of farmyard manure on soil properties and yield of crops in coastal saline soil. *J. Indian Soc. Coastal agric Res.* **2** (2) : 63-70.

Karim, Z., Hussain, G. S. and Ahmed, M. (1990). Salinity problems and crop intensification in the coastal regions of Bangladesh. *Soils Pub.* No. 33, BARC, Dhaka, pp. 1-6.

Saravanan, A., Malarvizhi, P. and Ramanathan, K. M. (1991). Use of organic amendments for improving rice yields in sea water intruded soils of Cauvery delta *J. Indian Soc. Coastal agric. Res.* **9** (1/2) : 203-207.

Shivakant and Rajkumar (1992). Effect of gypsum, pyrities, pressumd and farm yard manure on soil properties and yield of rice *(Oryza sativa* L.). *Indian J. agric. Sci* **62** (3) : 194-195.

Tanton, T W , Abmstrong, A. S. B. and Dervis, O. (1990). Leaching of salts from saline clays by subsoiling and induced lateral drainage. *Soil Use and Management* **6** : 30-40.