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A STUDY ON THE GROWTH AND YIELD OF EXOTIC *MUNGBEAN* IN A COASTAL SALINE SOIL WITH DIFFERENT FERTILIZER DOSES

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Abstract: The coastal area of Bangladesh lying in the southern deltaic zones of the country covers about 3.2 million hectares. About 0.833 million hectares of land in the coast is affected by varying degrees of salinity. Major limitations of saline soils are high salinity of soil, river and ground water; ionic and osmotic imbalance; low to very low soil fertility and scarcity of quality irrigation water during drought season. A field experiment was conducted in the coastal saline soil of the Khulna district. The area is mostly under monocropped local *T. aman* practices having cropping sequence of Fallow-Fallow-*T. aman*. Topsoil, river, pond and ground water salinity in this area ranges from 3.8-13.8, 1.35-14.9, 2.6-6.7 and 3.5-8.3 dS/m respectively during January to May. At the advent of summer, the topsoil initiates the cracking and extends to a few cm during the peak period both horizontally and vertically. Soil is incapable of retaining irrigation or rainwater as per crop demand at the beginning of the season. Frequent irrigation with pond water increases the germination (>20%) of exotic *BINA Mung-2*. *BINA Mung-2* can exist at soil salinity (EC_e) of 6.5-9.8 dS/m and with irrigated water (EC_w) of 3.0-4.8 dS/m up to 45 days after sowing during drought period. Soil test based fertilizer dose responded better growth and yield than other recommended doses.

Key words: Coastal area; Saline soil; Exotic *Mungbean*; *Kharif-1*; *BINA Mung-2*

Introduction

The coastal area of Bangladesh is about 3.2 million hectares and the net cultivable area is around 2.0 million hectares (Miah and Islam, 2000). About 0.833 million hectares of land in the coast is affected by varying degrees of soil salinity (Karim *et al.*, 1990). The coastal region of Bangladesh consists of southern deltaic zones of the country where tidal inundation, salinity, acidity, waterlogging and swelling/cracking of clays etc. are the main soil-related constraints that restrict crop production significantly.

Soil salinity is the most limiting factor that affects crop production and in severe cases the total yield is lost. Major constraints of saline soil are high salinity due to tidal flooding during wet season, direct inundation of land by saline or brackish sea/river water and upward or lateral movement of saline ground water during the dry season; ionic and

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osmotic imbalance; low to very low soil fertility and scarcity of quality irrigation water during dry season (November-May). River water salinity starts to rise in December and continue to June/July with its highest value in April/May and remain non-saline during October/November. Local transplanted *aman* and shrimp are the dominant land use. In this region, the winter season is very short and cultivation of *rabi* crops is restricted by late harvest of *aman* rice and late draining condition.

Several management options have been suggested for agricultural development of the coastal region. Choice of crop sequences, land levelling, tillage and a package of cultural practices including fertilizer management for establishing a good crop stand have been suggested. Among them, the adaptive trails of promising breeding lines of rice, strengthening of breeding programme for developing salt tolerant rice and other crop varieties, study on nutrient interaction and mechanism of K/Na selectivity etc. have been prioritized, for the agricultural development of the coastal region of Bangladesh (Miah and Islam, 2000). Keeping these views in mind, an experiment was undertaken to fulfill the following objectives: (i) to find out the adaptability of the exotic *Mungbean* (*Vigna radiata* L. Wilczek) as a salt tolerant variety at slightly to moderately saline soil conditions during *Khariif-1*; (ii) to observe the germination, growth and yield performance of this variety locally at different salinity level and (iii) to determine the optimum fertilizer dose for this variety.

Materials and Methods

The experiment was carried out at Salinity Management Research Centre (SMRC) of Soil Resource Development Institute (SRDI), Batiaghata, Khulna during *Khariif-1* (March-May), 1999. The experimental field with its surrounding area is mostly under monocrop practices, having cropping sequence of Fallow-Fallow-T. *aman* (local) (SRDI, 1997). The topsoil salinity range from 3.8 to 13.8 dS/m during January to May (SRDI, 1997), having a few mm thick salt encrustation on the topsoil during drought period. The ground water and adjacent river water salinity range from 3.5 to 8.3 and 1.35 to 14.9 dS/m, respectively, during the same period (SRDI, 1999). At the advent of summer, the topsoil begins to crack and tends to increase gradually to a few centimeters during the peak period both horizontally and vertically. The soil become unable to retain the irrigation or rainwater as per crop demand at the beginning of the season.

Followed by complete randomised block design with 3 replications, the experiment was laid out in an area of 399 sq.m. Each block consisted of 3 plots and individual plot size was 6m X 5m at a distance of 40 cm from row to row. The distance was 1m and 0.5m to the adjacent block and neighboring plot respectively. The 3 selected treatments were soil test based fertilizer dose-F1 (N-P-K-S-Zn: 15-50-40-0-0 kg/ha), Bangladesh Institute of Nuclear Agriculture (BINA) recommended fertilizer dose-F2 (N-P-K-S-Zn: 25-35-45-0-0 kg/ha) and no fertilizer (control)-F3 was used in the experiment. Exotic *BINA Mung-2* (*Vigna radiata* L. Wilczek) variety was taken as an index crop (V_1). To achieve 0.50 t/ha yield, the experiment was laid out on 03.03.1999 and the crop was harvested during 13.05.99 to 16.05.99 depending on the maturity and ripening. Topsoil samples were

collected for chemical analysis. Full amount of all fertilizers were incorporated by broadcasting during final land preparation. Intercultural operations and insecticide (Malathion-57) was applied duly. Using hand spray, the plot was irrigated (to moist level) frequently by pond water (EC_w 3.0-4.8 dS/m) up to 45 days after sowing for hastening the germination as well as to limit the severe detrimental effect of high soil salinity.

Salinity and other physico-chemical properties of soils were determined in the laboratory. Rate of germination and growth at different stages were recorded at 15 days interval and yield data were calculated after harvesting.

Results and Discussion

Before cultivation, topsoils were collected and analysed in the Soil Resource Development Institute (SRDI) regional laboratory Daulatpur, Khulna and the results are shown in Table 1. Recommended doses of fertilizers were calculated and applied accordingly.

Table 1. Some physico-chemical characteristics of analysed soils.

Soil series	Texture	EC_c (dS/m)	pH	OM (%)	N (ppm)	P (ppm)	K (mg/100g)	S (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
Bajoa	Silty clay loam	6.1	7.2	2.8	11.1	3.3	0.20	124.3	2.0	21.6	13.4

OM= Organic matter.

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

	July '98	Aug	Sep	Oct	Nov	Dec '98	Jan '99	Feb	Mar	Apr	May	June '99
Rainfall (mm)	339	258	300	147	132	0	0	0	0	14	175	185
Topsoil (EC_c)	3.0	2.1	2.5	2.7	3.0	3.6	3.8	4.2	6.5	13.8	9.6	7.5
River water (EC_w)	0.3	0.2	0.2	0.2	0.3	0.4	1.4	2.9	10.4	14.8	14.9	1.1
Pond water (EC_w)	2.5	2.4	2.4	2.4	2.5	2.5	2.7	3.1	3.4	4.5	6.8	5.1
Tube well water (EC_w)	1.1	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.4	3.0	-	-

Source: SRDI, 1999.

The river, pond and tube well water were collected to determine EC_w for irrigation feasibility. Rainfall data was collected from Meteorological Department of Khulna for comparing the salinity variation with rainfall. Data presented in Table 2 reveals that river water salinity decreased from June to October with the increase of rainfall, and increased during November to May when rainfall was low. Table 2 also reveals that with the inception of drought period, the salinity of soil and pond water increased and attained the peak values during April-May and became hazardous for most of the crops. Deep tube

well (± 300 m deep) water exhibited low salinity. But pond water was preferred for irrigation rather than deep tube well water due to local availability of pond water.

Table 3. Rate of germination of *Mungbean* seeds in the field.

Variety	Soil EC _e (dS/m)	Irrigated water EC _w (dS/m)	Germination(%)	
			With Irrigation	Without Irrigation
<i>BINA Mung-2</i>	6.5	3.0-4.8	87	65

From Table 3 it may be observed that the rate of germination of exotic *BINA Mung-2* increased more than 20% after irrigation with pond water having EC_w 3.0-4.8 dS/m.

Table 4. Growth performance of *BINA Mung-2* with different fertilizer doses (F₁, F₂, F₃).

Treatment		Growth stages (Weeks)					
		0	2	4	6 (Flowering stage)	8	Harvesting period
F ₁	Plant height (cm)	-	21.11	38.88	42.88	44.33	45.88
	Topsoil EC _e (dS/m)	6.5	9.8	8.6	7.9	9.6	9.1
	Pond water EC _w (dS/m)	3.0	3.5	4.2	4.8	5.0*	5.0*
F ₂	Plant height (cm)	-	20.77	40.77	45.11	46.22	47.66
	Topsoil EC _e (dS/m)	6.5	9.8	8.6	7.9	9.6	9.1
	Pond water EC _w (dS/m)	3.0	3.5	4.2	4.8	5.0*	5.0*
F ₃	Plant height (cm)	-	20.88	40.77	42.11	45.88	48.3
	Topsoil EC _e (dS/m)	6.5	9.8	8.6	7.9	9.6	9.1
	Pond water EC _w (dS/m)	3.0	3.5	4.2	4.8	5.0*	5.0*

* Irrigation was not applied.

Table 4 reveals that flowering was initiated at 42 days after sowing of the crop. *BINA Mung-2* existed in soil salinity of 6.5-9.8 dS/m with irrigated water (EC_w 3.0-4.8 dS/m) during drought period. In soil test based fertilizer dose, plant height slightly decreased compared to BINA recommended dose and control. Ayres and Westcot (1976) indicated that irrigation water with electro-conductivity of >3 mmhos/cm (3 dS/m) begins to affect the growth of soybeans under field condition. Ayub and Ishag (1974) reported that the salinity in addition to osmotic potential exerts a strong influence on the uptake of ions by plants.

Table 5. Yield contributing data of *Mungbean*.

Treatment	No. of pod/plant	Pod length(cm)	1000 seed wt. (g)
F ₁	8 ^a	7.05 ^b	28.70 ^a
F ₂	6 ^b	7.27 ^a	28.03 ^{ab}
F ₃	8 ^a	7.02 ^a	27.50 ^b

^a and ^b signify the significant differences (p=0.05) as measured by DMR test

Soil test based fertilizer dose (F₁) responded better yield (Table 5) compared to BINA recommended fertilizer dose (F₂) and control (F₃). Bhuiyan *et al.* (1998) stated that application of irrigation water with moderate salinity, will affect soybean growth and

yield adversely when drainage is insufficient in the fields. They also reported that severe salinity reduced both growth and nitrogen fixations.

Conclusion

BINA Mung-2 responded better yield with soil test based fertilizer dose and can exist in slightly to moderately saline soils in *Kharif-1* at soil salinity of 6.5-9.8 dS/m with any surface or subsurface water irrigation even 3.0-4.8 dS/m of salinity during drought period. More research is required for database information and further recommendation.

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