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SCREENING OF COTTON VARIETIES AGAINST SALINITY I. AT GERMINATION STAGE

Nazir Ahmad, R. H. Qureshi, R. D. Khan & A. Ghani*

ABSTRACT

Relative salt tolerance of 14 cotton varieties at germination stage was studied in sand culture under laboratory conditions. Increasing salinity levels decreased and delayed the germination of all the varieties tested. Varieties (in descending order) NIAB-78, AUH—37, AU—59, AU—14, NIAB—82, Express and MNH—93 were relatively salt tolerant while varieties Ravi, D—9, LH—61, B—557, LH—72, LH—62 and AC—134 were salt sensitive ones.

INTRODUCTION

Cotton (*Gossypium hirsutum*) is a major textile fibre crop commercially grown in Pakistan. It not only supports a massive local industry but also earns huge amount of foreign exchange. However, cotton production per unit area is low as compared to international standards. An analysis of causes responsible for the low yield of cotton reveals that soil salinity is the most serious constraint in cotton production.

Cotton is a moderately salt tolerant crop (U.S. Salinity Lab. Staff, 1954) but its tolerance varies at different stages of growth, germination generally being the most sensitive stage. Under increased salinity, germination is decreased and seedling emergence is delayed (Mehta and Desai 1958; Latif and Khan, 1976). Varietal differences in cotton at germination under sline conditions have also been reported (Abul-Nass and Omran, 1974). Cultivation of salt sensitive cotton varieties often results in failure of the crop under saline conditions. It is therefore, essential to screen the available cotton varieties for their salt tolerance. This paper presents results of the study on the comparative salt tolerance of different cotton varieties at germination stage.

MATERIALS AND METHODS

Salt tolerance of 14 cotton varieties (Table 1) at germination stage was

Department of Soil Science, University of Agriculture, Faisalabad.

tested under laboratory conditions using plastic coated metal trays (45x30x5 cm) field with sand upto 4 cm deep. Three salinity levels i. e., EC 10 20 and 30 mmhos /cm, were prepared with NaCl while distilled water served as control. Ten seeds of each variety were sown at each salinity level. Trays were covered with black polythene sheets to minimize salinity variations due to evaporation loss. Daily germination counts were recorded for two weeks. At the end of the experiment the average height and dry weight of seedlings of each variety were recorded. Relative salt tolerance of different varieties was determined by calculating EC value that was expected to cause 50 per cent reduction in dry matter yield of each variety. The following equation described by Mass and Hoffman (1977) was used for this purpose:

$$Y = 100 - B \; (EC - A)$$

where,

Y = Relative yield

B = The per cent yield decrease per unit salinity increase

A = Salinity threshold in mmhos/cm

The values of B were determined by using average regression coefficient between yield and EC values.

RESULTS AND DISCUSSION

Effect of Salinity on Germination

At low level of EC 10 mmhos/cm, the germination was not affected to a great extent (Table 1). At EC 20 mmhos/cm, Ravi and D—9 varieties were the most sensitive followed by AU—14, B—557. However, the germination was adversely affected at EC of 30 mmhos/cm. At this salinity level, varieties Ravi, D—9, B—557, LH—61, LH—62, LH—72 and AC—134 were sensitive with no germination of seeds followed by Express, MNH—93, AUH—37 and AU—14 which gave 11, 14, 14 and 22 per cent germination as compared to their respective controls. At the same EC level, NIAB—78 gave the highest germination (40%) followed by AU—59 and NIAB—82 both with 30 per cent germination compared to control. As the salinity level increased, the rate of germination was also decreased in all the varieties.

Table I. *Effect of salt levels on germination, seedling height and seedling dry weight of different cotton varieties*

Varieties	Germination (% of control)			Seedling height (% of control)			Seedling dry weight (% of control)		
	EC* 10	EC 20	EC 30	EC 10	EC 20	EC 30	EC 10	EC 20	EC 30
NIAB–78	80	80	40	102	52	30	88	64	40
NIAB–82	80	70	30	97	50	28	92	58	39
AU–59	90	60	30	103	55	32	92	61	41
LH–61	89	78	0	93	45	0	93	51	0
B—557	100	33	0	87	30	0	97	52	0
AC—134	89	67	0	98	45	0	104	56	0
Express	78	56	11	98	52	22	94	56	36
Ravi	67	11	0	94	33	0	93	41	0
D—9	89	11	0	95	30	0	97	43	0
AU—14	89	33	22	102	53	25	103	59	42
LH—72	67	67	0	97	47	0	92	56	0
LH—62	88	38	0	97	52	0	92	54	0
MNH—93	100	71	14	98	51	22	99	55	41
AUH—37	100	71	14	98	48	22	100	62	41

* = EC in mmhos/cm.

Effect of Salinity on Seedling Height

There was no decrease in seedling height of all the cotton varieties at EC 10 mmhos/cm as compared to their respective controls (Table 1). The medium salinity level (EC 20 mmhos/cm) reduced the plant height by about 50% but a remarkable decrease was recorded at maximum salinity, i. e., 30 EC mmhos/cm. Minimum decrease in plant height was recorded in variety AU—59 followed by NIAB—78 and NIAB—82 with seedling height of 32, 30 and 28 per cent, respectively. The higher salinity level greatly decreased the height as compared to that of control. The results are in agreement with those of Ayers (1952), Latif and Khan (1976) and Randhawa (1981).

Effect of Salinity on Dry Matter Yield of Seedling

At low salinity there was not much reduction in dry matter yield of all the cotton varieties as compared to their respective controls (Table 1). The decrease in dry matter yield of seedling at medium salinity level (EC 20 mmhos/cm) was relatively small (50-60%) except in Ravi and D-9 which gave 41 and 44 per cent dry matter of their respective controls. Among varieties which germinated at EC 30 mmhos/cm the minimum decrease in dry matter yield was recorded in variety AU-14 followed by AU-59, NIAB-78, AUH-37, MNH-93, NIAB-82. The probable cause of this reduction could be retarded seedling growth at higher salinity level. The vegetative growth could be retarded due to toxic effect of added salts or physiological scarcity of water with the increase in solute suction of saline media.

The calculation of relative salt tolerance of different cotton varieties at germination (Table 2) showed that NIAB—78 was the most salt tolerant as the calculated EC value for 50% reduction in yield was the highest (25.5 mmhos/cm) in this case, followed by AUH-37, AU-59, AU-14, NIAB-82, Express and MNH-93 which showed 50% reduction at EC 25.0 25.0 24.2, 23.2, 23.1 and 19.0, respectively. Against the same amount of reduction in yield, variety Ravi showed the lowest EC followed by D-9, LH-61, B-557, LH-72, LH-62 and AC-134, which were considered as salt sensitive ones.

Table 2. *Relative salt tolerance of different cotton varieties*

Varieties	Expected EC for 50% reduction in dry matter yield	Merit at 50% reduction
NIAB-78	25.5	1
NIAB-82	23.2	5
AU-59	25.0	2
LH-61	16.5	12
B-557	16.8	11
AC-134	17.5	8
Express	23.0	6
Ravi	15.9	14
D-9	16.0	13
AU-14	24.2	4
LH-72	17.0	10
LH-62	17.0	9
MNH-93	19.0	7
AUH-37	25.0	3

REFERENCES

Abul-Nass, A. A. and M.S. Omran. 1974. Salt tolerance of seventeen cotton varieties during germination and early seedling development. Zeitchrift for Acker-und Pflanzenbua, 140 (3): 229-236 (Soil & Fert., 38 (12): 6379, 1975).

Ayers, A.D. 1952. Seed germination as affected by soil moisture and salinity. Agron. J. 44 : 82-84.

Hasoon, E., I. Kahana and A. Poljakoff Mayler. 1972. Effect of Cl^- and $SO_4=$ types of salinity on growth and on osmotic adaptation of pea seedlings. Plant and Soil, 36 : 449-459

Latif, A. and M.A. Khan. 1976. Effect of soil salinity on cotton (*Gossypium* *hirsutum*) at different stages of growth. The Pak. Cottons, 20 (2) : 91-104.

Mehta, B.V. and R.S. Desai. 1958. Effect of soil salinity of germination of some seeds. Indian J. Soil & Water Conser. 6 : 168-176.

Mass, E.V. and G.J. Hoffman. 1977. Crop salt tolerance - current assecment. J. Irrigation Drainage Div. ASCE, 103 : 115-134.

Randhawa, Z. A. 1981. Effect of salinity on growth and leaf ion content of cotton. M.Sc. Thesis, Univ., of Agri., Faisalabad.

U.S. Salinity Lab. Staff. 1954. Diagnosis and Improvement of Saline and Alkali Soil. U.S.D.A. Handbook 60.