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Effects of Salinity on Germination and Seedling Growth in Wheat

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Germination and early growth are importaint to ensure proper stand establishment in wheat. Increasing salinity decrease germination (Singh et al. 1985) as well as coleoptile length in wheat (Shah et al. 1973). The present investigation was planned to determine the relation between various growth parameters and salinity levels.

Twenty two genotypes of wheat comprising both tolerant and suceptible ones were selected and 25 seeds of each were sown per petridish (lined with blotting paper), 4 such petridishes represent 4 replications and were irrigated with four test solutions. The test solutions were prepared by supplementing 0,5,10, and 15 g $NaCL^{-1}$ to Hoagland's solution corresponding to 0 (control), 0.5, 1.0 and 1.5% of NaCl. The corresponding EC values were 1.9, 8.0, 15.0 and 21.5 dS m^{-1} , respectively. Each petridish was irrigated with 5 mL of test solution on 1st and 5th day after sowing. The petridishes were kept under darkness for 4 days at 20°C and then under artificial light for 6 days in a culture room to complete the seedling growth. The germination percentage was recorded on 5th day. The coleoptile length (cm), seedling height (cm), fresh weight 100^{-1} seedlings and dry weight 100^{-1} seedlings were recorded on 10th day.

The analysis of variance indicated significant differrences between genotypes and between concentrations for all the parameters studied. However, significant interaction, sum of squares between genotypes and concentrations signify differential response of genotypes to the NaCl concentrations.

The mean germination percentage was 97.41 in the control while at 211.5 dS m^{-1} it was 94.90, indicating that this trail was least affected by the salinity (Table 1). Among the genotypes the lowest germination was observed for Raj 1114 (89.75) while the highest was for Raj 1972 (99.50%) which also indicated that the genotypes did not differ much for their germinability. Raj 1972, a variety developed for saline conditions, registered high germination at all levels of NaCl; much better than the other saline resistant line Kharchia 65. However genotypes such as WL 711, Kalyansona also showed high germination (98-100%) at different levels of salinity. This indicated that salinity did not affect the germination of the 22 selected wheat genotypes.

The mean coleoptile length decreased from 4.34 cm in the control to 3.52 cm in 21.5 dS m^{-1} salinity which is significant ($X^2 = 0.46$). Among the genotypes Kharchia mutant had only 2.96 cm of coleoptle length while KRL-3-4 had the maximum coleoptile length (5.99 cm). Linear decline in the coleoptile length was observed in many genotypes while it was negligible in Kharchia 65 (6.00 cm in control to 5.29 cm in 21.5 dS m^{-1} and WH 157 (3.57 cm in control to 3.26 cm in 21.5 dS m^{-1}). In comparision to coleoptile length, the mean seedling height showed maximum decline with incresing salinity. The mean seedling height in control was 14.03 cm while it was only 6.21 cm in the highest salinity level. All the genotypes exhibited significant decline in the seedling height along the salinity gradient. This observation is in line with Shah *et al* (1973).

The coleoptile length and seedling height are related. The tall genotypes normally have longer coleoptile length and more seedling height. The reverse is also true for dwarf genotypes (Sastry 1983). Looking into this effect, regression between the coleoptile length and seedling height at different salinities has been worked out. This indicated that high regression (b=2.20 in control)

Table 1 *General mean of various characters at different salinity levels.*

Character	EC ($dS\ m^{-1}$)			
	1.9	8.0	15.0	21.5
Germination (%)	97.41	96.77	93.96	94.90
Coleoptile length (cm)	4.34	04.43	03.91	03.52
Seedling height (cm)	14.03	12.40	09.04	06.21.
Fresh weight (g) 100^{-1} seedlings	11.54	09.28	07.01	05.12
Dry weight (g) 100^{-1} seedlings	0.97	00.95	00.81	00.66

between seedling height (dependent) and coleoptile length (independent) decreased with the increase salinity (b = 1.47 in 8.0 $dS\ m^{-1}$, b = 0.93 in 15.0 $dS\ m^{-1}$ b = 0.63 in 21.5 $dS\ m^{-1}$). Such reduction may be either due to toxic effect induced by salinity, reduced root growth which is generally observed under salinity or simply because of imbalance of nutrients.

The fresh weight, similar to seedling height showed linear reductions along the salinity gradient. The reduction in fresh weight at higher salt concentration was significant. The fresh weight of Sonalika (10.12g 100^{-1} seeldings) was the highest among the genotypes while Kharchia mutant had the lowest fresh weight (5.37 g 100^{-1} seedlings). The normal observation that taller seedlings have more fresh weight could not be found among the genotypes. The mean dry weight showed significant reduction only at high salinity. The kharchia mutant which had lowest fresh weight also exhibited lowest dry weight (0.41 100^{-1} seedlings) among the genotypes. KRL-3-4 has highest dry weight (1.10 g 100^{-1} seedlings) similar to the fresh weight. Higher dry weight may implicate a higher growth rate. The regression between the dry weight (dependent) and fresh weight (independent) at different salinities was worked out to know the effects of salinity. It showed that the increase in fresh weight did not have concurrent increase in dry weight at higher salinity level. This again supports the possible reasons envisaged elsehwere that salinity affects root growth and estabilshment or the nutrient uptake is hindered (Levitt 1972).

Based upon the five characters studied, Raj 1114, Sonalika, Raj 1482, KRL-3-4 and Kharchia 65 can be classified as salinity tolerant.

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