SCREENING OF DIFFERENT WHEAT STRAINS FOR SALT TOLERANCE

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Relative salt tolerance of 50 wheat strains was compared at EC of 20 and 40 dS m^{-1}. A larger variability exited among the strains when screened at seedling stage. The strains TC-4525 and TC-4537 produced maximum per cent shoot and root fresh weight at both the salinity levels and rated as salt tolerant ones.

INTRODUCTION

Moderately salt-affected lands could be economically utilised by cultivating plant species having comparatively more salt tolerance. Plants exposed to saline environments may overcome the adverse effects of salt and associated problems through adopting physiological traits of tolerance involving compartmentation and active exclusion of Na^+ and Cl^- ions (Greenway and Munns, 1980).

Wheat yield in moderately saline areas is expected to reduce by 50% because of salinity resulting in a great economic loss (Qayyum and Malik, 1988). Selective breeding of this crop for salt tolerance seems to be promising under such conditions, as many genotypic differences have been reported in wheat with respect to salt tolerance (Qureshi *et al.*, 1990). The aim of present study was to compare 50 wheat strains obtained from CIMMYT for their response to salinity at vegetative stage.

MATERIALS AND METHODS

At 3-4 leaf stage seedlings of 50 wheat genotypes were transplanted to foam plugged holes in thermopol sheets floated over 100 litres of ½ strength Hoagland nutrient solution (Hoagland and Arnon, 1950) in plastic lined iron growth tanks. The solution was aerated for 8 hours daily. After two days of seedling establishment, salinity was developed by adding NaCl salt at the rate of 2.5 dS m^{-1} per 24 hours till the final salinity levels were achieved. EC and pH of the solutions were maintained daily. Thirty days after imposing salt stress, plants were harvested and fresh weights of shoot and root were recorded.

Cell sap from fully expanded third leaf collected before harvesting was used for the determination of Na^+ (by flame-photometer) and Cl^- (using corning Chloride Analyser 925 directly calibrated in mmol kg^{-1}).

RESULTS AND DISCUSSION

Shoot and root fresh weight (g $plant^{-1}$)

Percentage of weight of shoot and root of all the strains with respect to their controls was computed in order to compare for their relative salt tolerance (data not presented).

Classification of different wheat strains on the basis of shoot fresh weight (per cent of control) is presented in Table 1. The strain TC 4537 because of the maximum per cent shoot fresh weight at EC of 20 dS m^{-1} was placed in the highly tolerant group whereas TC 4525 in the tolerant category. Similarly, at EC of 40 dS m^{-1} TC 4525 and

TC 4537 were classified in the highly tolerant group. Same (TC 4525 and TC 4537) were rated as highly tolerant/tolerant on the basis of the root fresh weight at both the salinity levels (data not given).

Shoot and root fresh weight decreased with increasing substrate NaCl salinity. The reduction in shoot and root fresh weight may be due to absorption of excessive saline

Table 1. Classification of different wheat strains on the basis of shoot fresh weight

Groups	Ranges	Strains
at EC = 20 dS m^{-1}		
Highly tolerant	> 49.35	Tc-4537
Tolerant	39.48 - 49.35	Tc-4525
Intermediate	29.61 - 39.48	Tc-4538, Tc-4597, Tc-4550, Tc-4553
Sensitive	19.74 - 29.61	Tc-4528, Tc-4531, Tc-4532, Tc-4536, Tc-4539, Tc-4540, Tc-4543, Tc-4546, Tc-4547, Tc-4551, Tc-4552, Tc-4556, Tc-4558, Tc-4563, Tc-4564, Tc-4565
Highly sensitive	< 19.74	Tc-4521, Tc-4522, Tc-4523, Tc-4524, Tc-4526, Tc-4527, Tc-4529, Tc-4530, Tc-4533, Tc-4529, Tc-4530, Tc-4533, Tc-4534, Tc-4535, Tc-4535, Tc-4541, Tc-4534, Tc-4535, Tc-4541, Tc-4542, Tc-4544, Tc-4545, Tc-4548, Tc-4554, Tc-4555, Tc-4557, Tc-4568, Tc-4569, Tc-4570
at Ec = 40 dS m^{-1}		
Highly tolerant	> 19.60	Tc-4525, Tc-4537
Tolerant	15.11 - 19.60	-
Intermediate	11.22 - 15.11	Tc-4527, Tc-4540, Tc-4550
Sensitive	7.03 - 11.22	Tc-4521, Tc-4522, Tc-4523, Tc-4524, Tc-4530, Tc-4532, Tc-4534, Tc-4541, Tc-4543, Tc-4544, Tc-4549, Tc-4551, Tc-4548, Tc-4549, Tc-4551, Tc-4552, Tc-4553,, Tc-4555, Tc-4558, Tc-4559, Tc-4562, Tc-4563, Tc-4564, Tc-4565, Tc-4566, Tc-4567, Tc-4568, Tc-4569, Tc-4570
Highly sensitive		Tc-4526, Tc-4528, Tc-4529, Tc-4531, Tc-4533, Tc-4535, Tc-4536, Tc-4538, Tc-4539, Tc-4542, Tc-4547, Tc-4554, Tc-4556, Tc-4557, Tc-4560, Tc-4561

Table 2. Relationship between fresh shoot weight and inorganic solutes of tissue sap of 50 wheat strains

Characters	Salinity level ($dS\ m^{-1}$)	Regression constant (a)	Regression coefficient (b)	Correlation coefficient (r)	Significance
Na	20	4.8323	-0.0141	-0.6179	**
	40	1.3663	-0.0011	-0.3371	**
Cl	20	4.3447	-0.0067	-0.7849	**
	40	2.2237	-0.0022	-0.7097	**

**Highly significant at P = 0.01.

ions by the plants which ultimately affected the plant growth decreasing the photosynthates, water or other growth contributing factors (Munns, 1985).

Sodium and chloride concentration (mmol kg^{-1})

Sodium and chloride concentration increased sharply with increasing NaCl salinity of the rooting medium. Strong negative correlation between fresh shoot weight and Na^+ as well as Cl^- concentration in leaf sap (Table 2) was observed at both the salinity levels i.e. 20 $dS\ m^{-1}$ (Na -0.6179; Cl -0.7849) and 40 $dS\ m^{-1}$ (Na -0.3371, Cl -0.7097).

This indicates that the wheat plants accumulating more sodium and chloride in their leaves have poor yield. Reduced growth of wheat plants at higher salinity was thus perhaps due to ion excess in their tissues caused by enhanced sodium and chloride uptake which disrupted the osmotic balance of the cells inducing the water deficit in the expanded tissues (see Greenway and Munns, 1980; Shah and Wyn Jones, 1988).

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