GAU Res. J. 1997, 23 (1) : 91-97

Screening of Some Wheat Varieties for Salinity Tolerance

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In the coastal areas of South Gujarat, paddy-wheat seems to be a economically viable cropping sequence. However, wheat as such is not much popular crop in this area owing to its low productivity under salt affected soil conditions. The differential behaviour of wheat varieties under varying salinity levels has been reported by some workers (Kumar *et al.,* 1981 and Sen Gupta, 1981). For making wheat cultivation more popular and profitable in costal areas, appropriate tolerant variety is to be idnetified and the present experiment was a step towards this direction.

A pot experiment was conducted with six wheat varieties (V_1 = J24, V_2 = J18, V_3 = Lok1, V_4 = NP 824, V_5 = Sonalika and V_6 = 206) and for EC_e levels (S_1 = non saline soil 2.1, S_2 = 4, S_3 = 8 and S_4 = 12 dSm^{-1}) in CRD. The treatments were repeated thrice. The experimental soil was clayey in texture, alkaline in reaction (pH = 7.40), non saline (Ec_e = 2.1 dSm^{-1}), low in organic carbon (0.5%), medium in available P (19 kg P_2O_5/ha) and high in available K (400 kg K_2O/ha). The desired salinity levels were achieved by adding $CaCl_2$, and NaCl in such a proportion to maintain constant SAR value. For attaining equilibrium, treated soil was subjected to wetting and drying cycles and this equiliberated soil was filled in alkathene lined earthen pots @ 2.5 kg/pot. In each pot, 30 healthy wheat seeds were sown and thinned to 15 plant/pot, 8 days after sowing. The pots were maintained at field capacity till the harvest of crop i.e. 60 days after sowing. In addition to per cent reduction in germination and dry matter yield, mean salinity index (Kumar, 1983) and salinity elasticity coefficient (Dravid *et al.,* 1976) were also worked out.

Germination : The individual and interactive effects of variety and salinity levels were significant on the germination of wheat (Table 1). Among the varieties tested, Sonalika recorded significantly higher germination per cent (87.5%) which was closely followed by J 24 (86.6%) and J 18 (85.8%) varieties. The lower value of germination with A 206 (77.5%) and NP 824 (80.3%) varieties indicate their suceptability to the salinity. A gradual reduction in the germination count was observed with increase in salinity level (EC_e). The differential behaviour of wheat varieties at varying levels of salinity was evident from the minimum of 19.5 per cent reduction in

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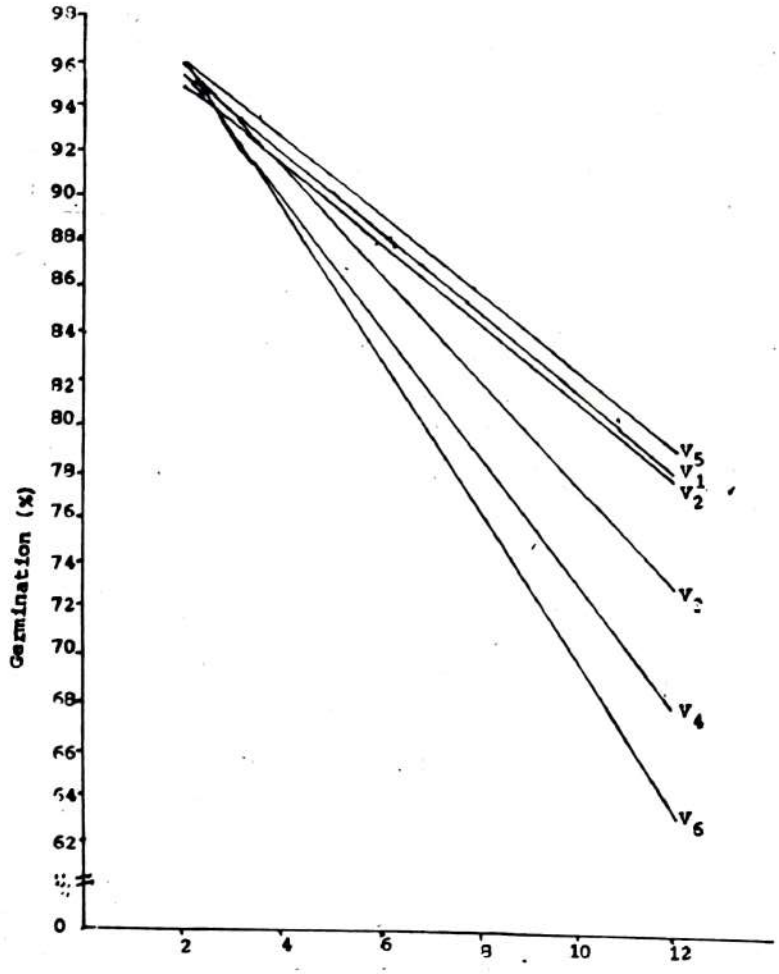
TABLE 1

Effect of salinity levels on the germination (%) of different varieties.

Salinity level	*Variety*						*Mean*
	V_1	V_2	V_3	V_4	V_5	V_6	
S_1	95.8 (–)	95.6 (–)	90.0 (–)	95.6 (–)	96.7 (–)	94.4 (–)	94.6
S_2	92.2 (3.6)	90.0 (5.9)	90.0 (1.11)	85.6 (10.5)	91.1 (5.8)	85.6 (9.3)	89.1
S_3	83.3 (12.9)	83.3 (12.9)	80.0 (11.11)	75.6 (20.9)	84.4 (12.7)	68.9 (27.0)	79.2
S_4	75.6 (20.9)	74.4 (22.2)	71.1 (21.0)	64.5 (32.5)	77.8 (19.5)	61.1 (35.3)	70.0
Mean	86.6	85.8	82.8	80.3	87.5	77.5	
		V	S	V x S			
S. Em. ±		1.0	0.8	2.0			
C. D. at 5%		2.0	2.3	5.7			

( ) : Data in parentheses are per cent decrease in germination over normal soil (S_1).

Variety	*Regression*	*'r'*
V_1	Y = 99.19 –1.75 X	-0.966
V_2	Y = 98.99 –1.75 X	-0.945
V_3	Y = 101.00 –2.34 X	-0.906
V_4	Y = 100.86 –2.25 X	-0.946
V_5	Y = 99.78 –1.80 X	-0.983
V_6	Y = 102.92 –5.29 X	-0.957



Salinity levels dSm^{-1}

Fig. 1 : Relationship between salinity levels and germination percentage of different wheat varieties.

TABLE 2

Effect of salinity levels on dry matter production by different wheat varieties (g/pot).

Salinity level	Variety						Mean
	V_1	V_2	V_3	V_4	V_5	V_6	
S_1	4.19 (–)	5.82 (–)	4.97 (–)	5.51 (–)	5.54 (–)	3.80 (–)	4.97
S_2	4.37 (+4.3)	4.80 (17.5)	4.17 (16.1)	3.79 (31.2)	4.90 (11.5)	3.00 (21.1)	4.18
S_3	3.86 (7.9)	2.73 (53.1)	3.23 (35.0)	3.34 (39.4)	4.27 (22.9)	1.77 (53.4)	3.20
S_4	2.72 (35.1)	1.97 (66.2)	2.37 (52.3)	2.14 (61.2)	2.75 (50.4)	1.40 (63.2)	2.23
Mean	3.79	3.83	3.69	3.69	4.37	2.49	—
	V	S	V x S				
S. Em. ±	0.28	0.22	0.55				
C. D. at 5%	0.80	0.63	NS				

( ) : Data in parentheses indicate per cent decline in yield over S_1.

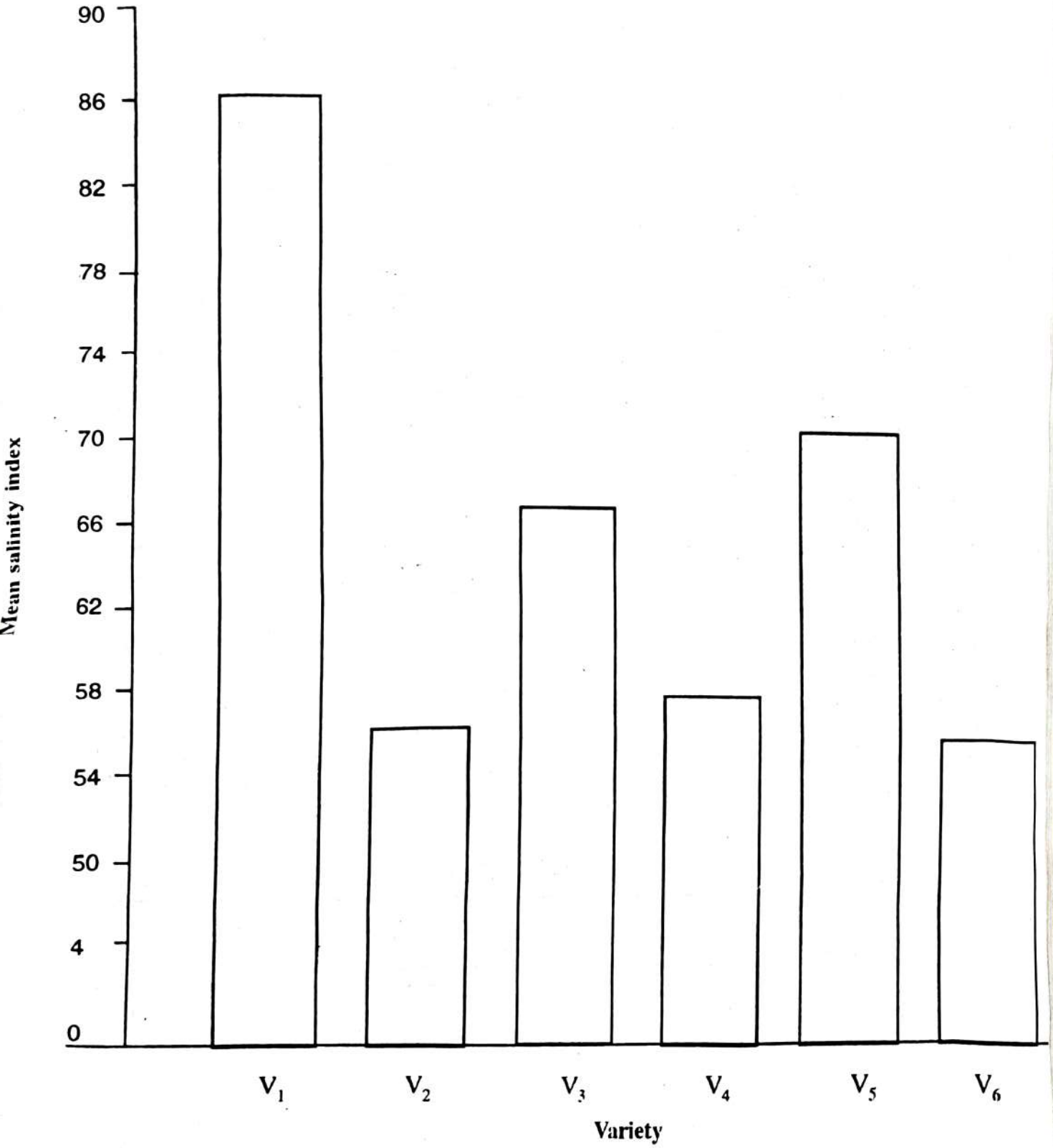


Fig. 2 : Mean salinity index of different wheat varieties

germination recorded with Sonalika and that of maximum with variety A 206 (35.3%). This was further substantiated from the regression equation (Fig. 1) in which Sonalika had lower 'b' value (-1.697) than A 206 (-3.291). The correlation between salinity and germination count was invariably negative and it was varying between -0.906 with Lok 1 to -0.966 with J 24. Earlier workers have also reported silimar effect of salinity on germination of wheat varieties (Singh and Dastane, 1970 and Sharma *et al.* 1971).

Dry matter production : The dry matter yield significantly differred due to different varieties of weat (Table 2). Sonalika recorded significantly higher dry matter yield of 4.37 g/pot than A 206 (2.49 g/pot) but it was at par with rest of the varieties. With increase in each level of salinity, considerable decline in dry matter yield was observed. However, the interaction effect (V X S) was found to be absent. In order to mask the yield potential effect on salinity tolerance of wheat varieties, per cent yield reductuin over contol, (S_1) was computed. The yield reduction was of the order of 50 per cent in the case of J 18 and A 206 varieties even at ECe 8 dSm^{-1}, while similar magnitude of reduction was noticed only at EC_e 12 dSm^{-1} (S_4) in Sonalika. The behaviour of variety Lok-1 was rather ambiguous i.e. instead of decrease in dry matter yield at S_2 over S_1, it was found to increase by 4.3 per cent and further increase in salinity also could not depress the yield to an extent that was observed with other varieties at equal salinity level, Panda *et al.* (1979) and Kumar (1983) have also observed silimar behaviour of different wheat varieties under varying salinity levels.

In present study 'Mean Salinity Index' (MSI) was also computed as described by Kumar (1983). The higher MSI value of 86.75 for J 24 amply substantiate its better performance under saline condition in comparison to other varieties (Fig. 2). Apart from this, for further testing of performance of wheat varieties in saline conditions, yardstick 'Salinity Elasticity Coefficient' (SEC) as suggested by Dravid *et al.* (1976) was also employed. Here too, variety J 24 maintained its superiority over other varieties which is evident from the lowest SEC values of -0.563 which was recorded with this variety at 12 dSm^{-1} salinity level (Table 3). The next in

TABLE 3

Salinity elastically co-efficient (SEC) of different wheat varieties at varying salinity levels.

Variety	*'r' value*	*Salinity elasticity co-efficient*		
		X=4	*X=8*	*X=12*
J 24	-0.709	-0.136	-0.316	-0.563
J 18	-0.915	-0.282	-0.788	-1.954
Lok 1	-0.966	-0.223	-0.576	-1.215
NP 824	-00.873	-0.264	-0.718	-1.681
Sonalika	-0.726	-0.216	-0.552	-1.144
Arnej 206	-0.863	-0.305	-0.881	-2.362

order at the same salinity level was variety Sonalika (-1,144). The SEC values of more than –1 recorded with other varieties suggest that the reduction in yield of these varities will be at much faster rate at corresponding increase in salinity level.

The results of present study clearly brought out the fact that wheat varieties *viz.*, J 24 and Sonalika are better performers under saline soil conditions.

(Received on 21st June, 1994)

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