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Response of Various Wheat Cultivars to Different Salinity Levels at Early Seedling Stage

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Abstract: In order to study the response of "Various Wheat cultivate to different levels of salinity at early growth stage" a pot experiment was conducted in the green house of NWFP, Agricultural University Peshawar, Pakistan during 1990. Statistical analysis of the data revealed that various salinity levels, cultivate and their interaction had a significant ($p<0.05$) effect on germination, emergence, plant height, root length, fresh shoot weight and fresh root weight. It was clear from the moult that addition of salt progressively reduced germination, pliett height, root length, fresh shoot weight and fresh root weight and cumulative reduction for the parameters were maximum at salinity level of 30 dS m^{-1} when compared with other treatments. Wheat cultivar, mutant and LU 28s proved more salt tolerant than the other cultivate with respect to the parameters under study.

Key words: Wheat, salinity, cultivars, seedling

Introduction

Different approaches may be conducive to ameliorate the problems of salinity. Reclamation of the salt affected soils is one of the way to cope with the menace which involves higher spending and are beyond the economic means of fanners. The alternate solution of the problem Is to evolve salt tolerant genotype. This involves careful screening assay at different stages of plant growth. In comparison with reclamation, development and identification of salt tolerant genotypes is an economical and rational alternative. Agricultural crops have a wide spectrum of salt tolerance from susceptible (i.e. Bean) to moderately salt tolerant ti.e. Sugar beet). Considerable variability for tolerance has been observed among and even within the species (Norlyn and Epstein, 1984). Grain sorghum were more salt tolerant at germination than at later stages of growth (Francois *et al*., 1984). Addition of salt progressively and significantly reduced the gemination percentage and increased emergence time (Khattak, 1987). On contrary, Rashid (1986) observed that Wheat exhibited relatively high degree of salt tolerance during germination.

Materials and Methods

A pot experiment was conducted in the green house of NWFP, Agricultural University Peshawar, Pakistan during 1990 to study the response of various Wheat cultivate to different salinity levels at early seedling stage. Two factors, factorial completely randomized design was used for the experiment The experiment was carried out in plastic trays of 30 cm diameter and 5 cm deep, filled with 6 Kg soil mixture (Soil+Sand+Humus; 3:1:1) having salt concentration of 1.2 dS m^{-1} of saturation extract. The soil was salinized to 1.2 dS m^{-1} (control), 15 and 30 dS m^{-1} of salinization extract with addition of NaCl + $CaCl_2$ in the ratio of 9:1 on an equivalent basis and allowed to dry to field capacity. After soil hoeing, ten lines were drawn equidistant from center to periphery. Twenty seeds of each cultivars were placed in each line at 2.5 cm depth. The trays were kept covered to avoid evaporation. Soil in the trays were brought again to field capacity moisture level by addition of distilled water at 10th and 18th days of germination period. Daily emergence counts were recorded upto the 18th days after sowing for total germination pementage. The seedlings were allowed further upto 20th day for record of plant height, root length, fresh root and shoot biomass.

Results and Discussion

It is clear from the data presented in Table 1 that germination was reduced and progressively delayed with increasing salt level in the substrate. Germination started on the 5th day after sowing and continued up to 18th day. Higher emergence ratio was observed during 7-10 days at all salinity levels. Total germination at 15 and 30 dS m^{-1} salinity levels was lower than control. The probable reason for the decreased and delayed germination may be due to water stress caused by salinity which resulted in low water absorption by seeds required for various enzymatic activities during germination. Similarly, ions like Na^+ or Cl^- are toxic, if absorbed in higher concentration which may also reduce and delay germination in moderately salt tolerant crops like Wheat. Similar results are also reported by Khattak (1987), Ashraf and Rasul (1988), Ahmad *et al*. (1981), Francois *et al*. (1998), Kingsburg and Epstein (1984) and Bingham and Garber (1970).

Germination data is presented in Table 2. Analysis of the data revealed that germination was significantly ($p<0.05$) affected by various Wheat cultivars at different salinity levels and their interactions. It can be seen from the data presented in Table 2 that addition of setts in the substrate reduced germination progressively. Reduction were significantly over the control at 15 and 30 dS m^{-1} , Maximum germination was recorded in W-265, i.e. 100, 85 and 79% at control, 15 and 30 dS m^{-1} respectively, While minimum germination was observed in Yecora i.e. 87, 87 and 50% at control, 15 and 30 dS m^{-1} respectively. Pasine 90, Blue sliver and Pirsabak 85 had intermediate response. These findings are in conformity with those reported by Rashid (1986), Ahmad *et al*. (1981), Bernal *et al*. (1974) and Kingsburg and Epstein (1984).

Data concerning plant height is shown in Table 3. Statistical analysis of the data indicated that plant height was significantly ($p<0.05$) affected by various cultivate, different salinity levels and their interactions. It can be inferred from the data shown in Table 3 that salinity had progressively reduced plant height and the cumulative reduction were 27 and 44% respectively at 15 and 30 dS m^{-1} salinity levels when compared with control. Mutant and LU 285 had the least reduction in height under saline condition when compared to their control. Plant height decreased in all cultivate with the addition of salts. Maximum reduction occurred in WI 711 followed by Yecora and Pak 81. These results agree with the findings of Rashid (1986) and Verma and Neue (1984).

Table 1: Effect of salini on the emer ence rate of Wheat cultivars

Cultivars	(Average of three replicates) Days after sowing											
	5	6	7	8	9	10	11	12	13	14	15	16
	Erner ence rate day^{-1} at 1.2 (control) $dS\ m^{-1}$											
Pasina-90	2	2	4	4	3	2	2	0	-	-	-	-
Pavon-76	2	4	1	2	5	4	1	0	-	-	-	-
LU-26S	1	2	6	5	3	3	1	0	-	-	-	-
WI.711	1	3	4	3	3	3	1	0	-	-	-	-
Yecora	0	2	3	5	4	2	1	0	-	-	-	-
Mutant	1	2	5	4	3	3	2	0	-	-	-	-
Khyber-87	0	3	6	4	2	3	1	0	-	-	-	-
Pak-81	0	2	3	4	6	2	1	1	-	-	-	-
Blue Silver	0	2	3	4	4	2	2	1	-	-	-	-
Pirsabak-85	1	1	4	5	3	2	1	1	-	-	-	-
	Emergence rate day^{-1} at 15 $dS\ m^{-1}$											
Pasine-90	0	1	2	3	3	2	3	1	1	0	0	0
Pavon-76	0	1	2	2	3	3	2	2	0	0	0	0
LU-26S	1	1	2	3	2	3	2	2	0	0	0	0
WI-711	1	0	3	2	3	2	1	2	0	0	0	0
Yecora	0	1	2	2	2	3	2	1	0	0	0	0
Mutant	0	1	2	4	3	2	2	1	1	0	0	0
Khyber-87	0	1	2	3	3	3	1	2	0	0	0	0
Pak-81	0	1	3	2	3	2	2	1	0	0	0	0
Blue Silver	0	0	3	3	2	2	1	2	0	0	0	0
Pirsabak-85	0	0	3	2	3	2	1	2	0	0	0	0
	Emergence rate day^{-1} at 30 $dS\ m^{-1}$											
Pasina-90	0	1	1	3	3	2	1	1	1	1	0	0
Pavon-76	0	1	1	1	2	2	2	1	1	1	0	0
LU-26S	0	1	1	3	2	2	2	2	1	1	0	0
WI-711	0	1	1	0	2	3	2	1	1	0	0	0
Yecora	0	1	1	2	2	1	1	1	1	0	0	0
Mutant	0	1	1	3	2	2	2	2	1	0	0	0
Khyber-87	0	1	1	3	3	2	1	1	1	0	0	0
Pak-81	0	0	1	0	1	1	1	1	0	0	0	0
Blue Silver	0	1	1	3	2	2	2	1	1	0	0	0
Pirsabak-85	0	1	1	3	2	2	1	1	1	0	0	0

Table 2: Effect of salinity on fermination of Wheat cultivars

Cultivars	(Average of three replicates) Salinity levels ($dS\ m^{-1}$)			
	1.2 (control)	15	30	Mean
	germination %age			
Pasina-90	19.0a(95)	16a(80)	13.5b(67.5)	16.2bc
Pavon-76	19.0a(95)	15b(75)	12.0c(60)	15.3cde
LU-26S	20.0a(100)	17a(85)	15.9a(78.5)	17.6a
WI-711	17.5.0c(87.5)	14bc(70)	11.0cd(65)	14.2f
Yecora	17.0cd(87)	13c(67)	10.0d(50)	13.3g
Mutant	19.5a(97.5)	16a(80)	14.0a(70)	16.5b
Khyber-87	18.9b(90.5)	15b(75)	13.5b(67.5)	15.8bcd
Pak-81	17.0cd(87.5)	15b(75)	12.5bc(62)	14.8ef
Blue Silver	18.0bc(90)	16a(80)	12.5bc 62.5)	15.5cd
Pirsabak-85	18.0bc (90)	14bc(70)	12.0c(60)	14.6def
Mean	18.4a	15.1b (82)	12.6c (62)	

Figures in parenthesis indicate germination percentage expressed as percent of the respective control.
Moan value followed by the same letters are statistically non significant among themselves at 6% level of probability in each column.

Table 3: Effect of salinity on shoot height of Wheat cultivars at early growth stage

Cultivars	(Average of three replicates)			
	Salinity levels dS m^{-1}			
	1.2 (control)	15	30	Mean
	cm $plant^{-1}$			
Pasina-90	21.4c	13.2c(62)	12.8c(59)	15.8c
Pavon	22.1c	13.4c(61)	12.3c(56)	15.8c
LU-26S	24.4a	17.9b(73)	14.9ab(62)	19.1a
WI-711	19.2d	9.6f(50)	8.9e(46)	12.6e
Yecore	21.2c	10.8a(51)	9.8e(46)	14.0d
Mutant	23.7ab	18.9a(80)	14.8ab(62)	19.1a
Khyber-87	21.4c	13.4c(63)	12.5c(59)	15.8c
Pak-81	23.5ab	12.0d(51)	11.0d(46)	15.5c
Bilue silver	23.5ab	17.0b(73)	15.0a(61)	18.5ab
Prsabak-85	23.2b	17.0b(73)	14.0b(63)	18.3b
Meam	22.4a	14.3b(73)	12.7c(66)	

Figures In parenthesis indicate germination percentage expressed as percent of the respective control.
Mean value followed by the same letters are statistically non significant among themselves at 5% level of probability in each column.

Table 4: Effect of salinity on root length of Wheat cultivars et early growth stage

Cultivars	(Average of three replicates)			
	Salinity levels dS m^{-1}			
	1.2 (control)	15	30	Mean
	cm $plant^{-1}$			
Pssina-90	11.5c	8.7c(75)	6.1cd(75)	8.8d
Pavan-76	10.6d	8.7c(81)	8.0a(75)	9.0d
LU-268	1.6c	9.2b(80)	8.0a(89)	9.6c
WI-711	12.9b	6.3e(48)	4.4e(36)	7.9fg
Yecora	11.4c	6.5e(57)	4.7e(41)	7.5g
Mutant	13.8a	10.8a(78)	8.3a(61)	11.0a
Khyber-87	9.7e	7.7b(79)	6.5c(67)	10.0f
Pak-81	12.9b	6.6e(55)	5.6d(47)	8.1e
lue Silver	10.4b	10.0a(88)	7.3b(70)	9.2dc
Pirsebak-85	13.4e	9.4b(70)	7.3b(53)	10.0b
Mein	11.7a	8.3b(70)	6.7c(57)	

Figures in parenthesis indicate germination percentage expressed as percent of the respective
Mean value followed by the same letters are statistically non significant among themselves at 5% level of probability in each column.

Table 5: Effect of salinity on fresh weight of shoot of Wheat cultivars at early growth stage

Cultivars	(Average of three replicates)			
	Salinity levels (dS m^{-1})			
	1.2 (control)	15	30	Mean
	g $plant^{-1}$			
Patina-90	0.33c	0.25b(75)	0.22b(52)	0.27cd
Pavon-76	0.33c	0.15d(45)	0.14d(42)	0.21e
LU-285	0.45a	0.4a(88)	0.28a(82)	0.38a
WI-711	0.28d	0.12de(48)	0.11d(44)	0.16f
Yecora	0.24e	0.15b(62)	0.11d(45)	0.17f
Mutant	0.39b	0.29b(75)	0.26a(66)	0.31b
Khyber-87	0.34c	0.22c(61)	0.18c(58)	0.25d
Pak.81	0.28d	0.13de(46)	0.12d(42)	0.18f
Blue Sliver	0.33c	0.03c(69)	0.20bc(60)	0.28c
Pirsebak-B5	0.34c	0.26b(76)	0.22B(64)	0.27cd
Mean	0.33a	0.23b (69)	0.18c (54)	

Figures in parenthesis indicate germination percentage expressed as percent of the respective control.
Mean value followed by the same letters are statistically non significant among themselves at 5% level of probability in each column.

Table 4 shows data regarding length of roots. Statistical analysis of the data showed that various varieties, different salinity levels and their interaction had a significant ($p<0.05$) effect on root length. it can be seen from the data presented in Table 4 that root length was progressively reduced and the cumulative reductions were 30 and 43% at 15 and 30 dS m^{-1} salinity levels respectively when compared with control. Root length decreased in all cultivars with the addition of salt. Maximum reduction occurred in Yecora i.e. 43% at 15 dS m^{-1} and 39% at 30 dS m^{-1}. Ashraf and Rasul (1988) and Verma and Neue, 1984 reported similar results. Fresh shoot weight data presented in Table 5 revealed that various cultivars, different salinity levels and their interaction had significant ($p<0.05$) differences. Data shown in Table 5 indicated that

Table 6: Effect of salini Cultivate on germination on fresh weight of Wheat cultivars at early growth stage

Cultivars	(Average of three replicates)			
	Salinity levels dS m^{-1}			
	1.2 (control)	15	30	Mean
	mg $plant^{-1}$			
Pasina-90	170.3b	110.0d(64)	98.0(58)	126.0c
Pavon-76	118.0h	86.0f(72)	71.0e(60)	91.7e
LU-26S	136.0e	115.0c(84)	109.0b(80)	120.0c
WI-711	128.0f	67.0h(52)	56.0g(43)	83.7f
Yecora	110.0j	62.0j(56)	46.0i(41)	72.8g
Mutant	196.0e	145.0a(73)	128.0a(65)	156.3a
Khyber-87	116.0i	76.0g(65)	68.0f(68)	86.1f
Pak-81	147.0d	86.0i(44)	53.0h (36)	88.7ef
Blue Silver	125.0g	105.0e(84)	94.0d(75)	108.6d
Pirsabak-85	163.0c	134.7b(82)	108.0b(66)	130.3b
Mean	140.9a	95.1b (67)	38.1c (58)	

Figures in parenthesis indicate germination percentage expressed as percent of the respective control.
Mean value followed by the same letters are statistically non significant among themselves at 5% level of probability in each column.

fresh shoot was reduced by different salinity levels. Cumulative reductions in shoot fresh weight by different salinity levels were 31 and 46% at 15 dS m^{-1} and 30 dS m^{-1} respectively when compared with control. LU 26S had maximum fresh shoot weight at control and 15 dS m^{-1}, while Mutant proved to be high yielding at 30 dS m^{-1} salinity level. Fresh shoot weight decreased in all other cultivars with the addition of salt. Maximum reduction occurred in WI 711 followed by Yecora at 15 and 30 dS m^{-1}. These results are further supported by Ashraf and Rusul (1988) and Verma and Neue (1984). Data recording fresh root weight is presented in Table 6. Statistical analysis of the data revealed that fresh root weight was significantly ($p<0.05$) affected by various cultivars, different salinity levels and their interactions. Data shown in Table 6 indicated that fresh root yield was reduced by 33 and 42% at 15 and 30 dS m^{-1} salinity levels respectively when compared with control. LU 265 and Blue silver had minimum reduction in fresh root weight at both salinity levels. Fresh root weight was decreased in all cultivars with the addition of salt, maximum reductions occurred in Yecora followed by WI 711. Similar results are also reported by Ashraf and Rusul (1988), who observed that increasing salt concentration significantly reduced fresh root weight of Mung bean.

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