EVALUATION OF WHEAT CULTIVARS FOR DROUGHT RESISTANCE DURINC GERMINATIN

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ABSTRACT

Cultivars seeds of T. durum and T. aestivum were tested for their potential germination under drought stress conditions. Seeds of aestivum c.v.'s were more drought stress resistant than durum c.v.'s seeds. In addition, aestivum seeds germinate faster than durum under high stress conditions. Cultivars were differ in their respond to different moisture stress conditions.

INTRODUCTION

Plant can resist drought environment through several mechanisms. During dry condition, when enough rain falls to wet the soil to considerable depth, cultivated seeds become germinated. It has been found that there is a great variation among the grain accessions tested in their drought tolerance (1, 2, 3). Several variables of embryonic roots and coleoptiles of durum wheat have been studied (4).

The results indicated that shoot length is correlated with root number, length of the longest root, and total root length. Stress of any mean usually analogous to an induced force (5).

Stress such as drought, which is similar to stress of excessive salt. Work have been carried out to test wheat germplasms concerning salt and drought tolerance (2, 6, 7, 8). Durum wheat cultivars were tested for their seed germination potential under different soil moisture content extending from saturation down to extremely dry soil (2).The results indicated that cultivars differed in their mean germination time, and seed germination potential.

However, it is clear that germination depends vary strongly on moisture availability, and water potential of imbibition of seed is usually vary great (9).

The purpose of this investigation was to evaluate the drought resistance of several common and durum wheat c.v.'s grown in Sulaimani area, Kurdistan.

MATERIALS AND METHODS

Seeds of durum wheat, Triticum durum c.v., Senator Capelli, Bakrajow, Gerardo, Cocorit, and Stork-S, and seed of aestivum wheat, T. aestivum c.v., Aras, Mexipak, Sabir – Beg, Abu – Ghriab, and Inia 66 were evaluated. Percentage germination potential, shoot length, and mean germination time were evaluated under different moisture stress conditions created using graduated water potentials which equal to 0.000, -0.374, -0.749, -1.124, -1.498, and –1.873 Mega Pascals. Solutions of NaCl were used to generate moisture stress gradients (using 58.44 g/ 1 NaCl, which provide -42.62 bars, or –4.32 MPa of potential) (10,11). Fifty seeds of each c.v.'s were used in four replicate for germination potential. In addition, length of shoot was measured after 12 days of growth from germination to evaluate the growth of seedling under stress (2,10,11). Mean germination time (MGT) was calculated according to the following formula:

$$MGT = \frac{I \sum n_i d_i}{N}$$

or

$$MGT = \frac{\sum n_i d_i \quad (i=1 \text{ to } m)}{\sum n_i \quad (i=1 \text{ to } m)}$$

Where n_i is the No. of germinated seeds on day i, d_i is the rank order of day i, and n is the total No. of germinated seeds. Germination were conducted under ambiant temperature of 8-18 C^o . Data were analyzed according to CRD design.

RESULTS AND DISCUSSION

Figure 1 represent the effects of stress on the germination potential. It is clear that aestivum c.v.'s seeds are more stress resistant than durum c.v.'s seeds. In which germination potential of aestivum at –1.5 MPa stress was equal to that of durum at –1.1 Mpa stress. Which in fact –1.5 MPa is the range of permanent wilting point for a wide range of economical plants. However, significant correlations were found to exist between percentage seed germination and grain yield under salt- stress (6). For specific c.v., Table 1 show the distinct pattern of stress resistance concerning the germination potential of both, durum and aestivum c.v.'s. Among durum c.v.'s, all have shown severe germination potential drop by shifting the stress to higher than –1.124 MPa. The average drop is in the range of 44.2%. At high stress condition, Gerardo, Cocorit, and Stork- S seem to be more drought resistant. For aestivum c.v.'s, stress of –1.498 Mpa have resulted in germination potential reduction of 27% except that of Aras (Table 1).A differences in germination potential were found among wheat c.v.'s tested (2). Germination of durum c.v.'s seeds were started on the fourth day after incubation, and ended on the sixteenth. Maximum of germination occured on fourth for 0, and –0.374 MPa conditions, fifth day for –0.749 MPa , sixth to ninth days for –1.124 MPa, eleventh to twelfth days for –1.498 MPa , and fourteenth to sixteenth days for –1.873 MPa conditions. While the germination of aestivum c.v.'s were started on the fourth day after incubation, and ended on the twelfth. Maximum of germination occurred on the fourth day for 0, -0.374, and –0.749 MPa conditions. Fifth to sixth for –1.124 MPa,

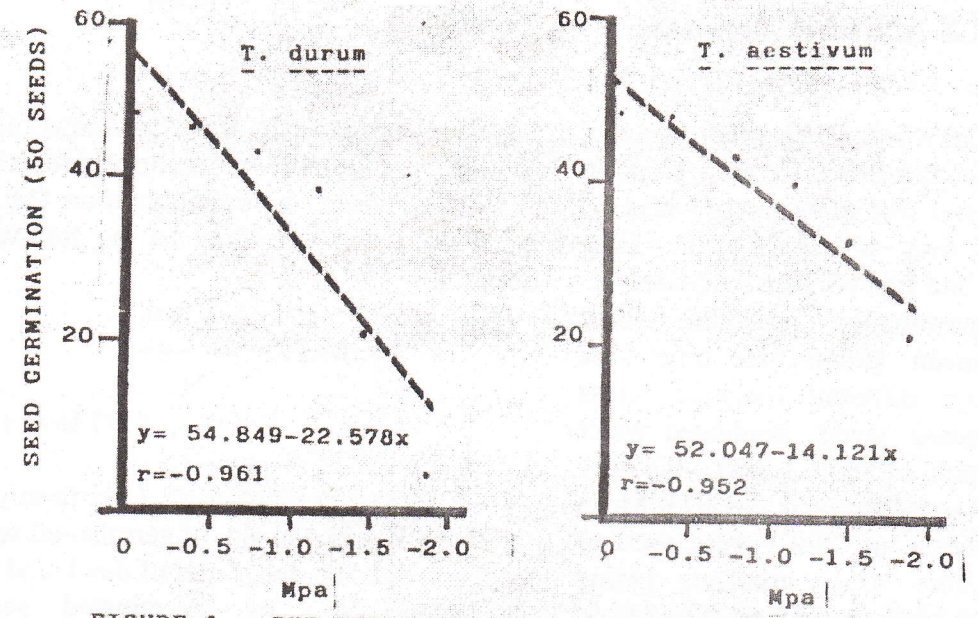

FIGURE 1 : THE EFFECT OF MOISTURE STRESS IN MPa ON SEED GERMINATION OF WHEAT(50 SEEDS).

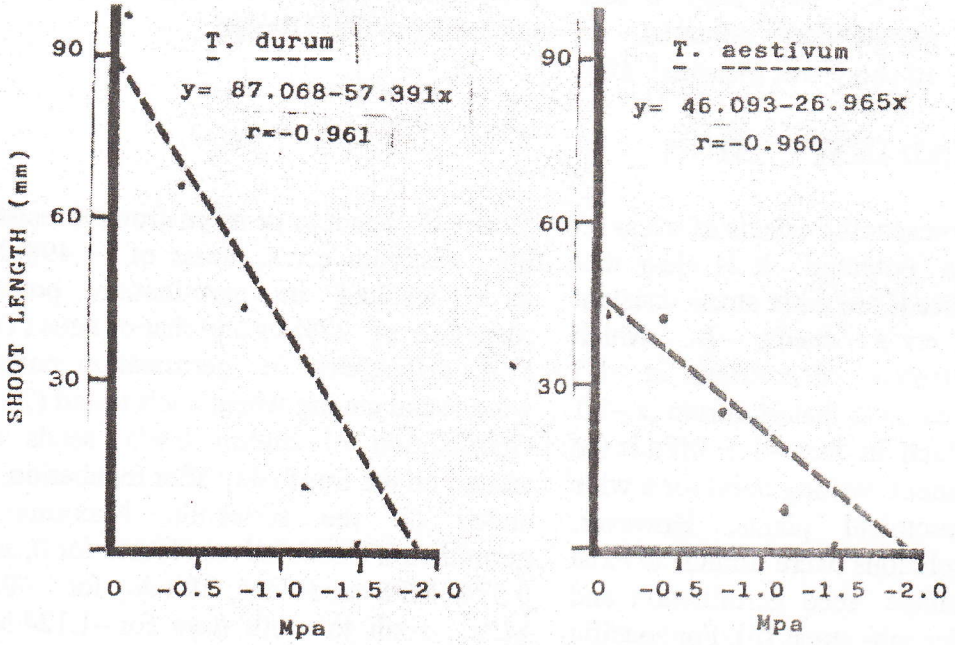

FIGURE 2 : THE EFFECT OF MOISTURE STRESS IN MPa ON THE SHOOT LENGTH OF WHEAT(mm) DURING 12 DAYS.

Table 1: The Influence of moisture stress on percentage seed germination of wheat cultivars

Moisture stress MPa	Seed Germination %				
			T.durum		
	Senator Capelli	Bakrajow	Gerardo	Cocorit	Stork-S
0.000	96.00 ab	96.50 a	95.00 abc	96.00 ab	94.00 abc
-0.374	95.00 abc	95.50 ab	92.50 abcd	91.50 bcd	89.50 de
-0.749	88.50 de	90.50 cd	83.00 fg	83.00 fg	85.00 ef
-1.124	80.50 fg	75.00 hi	79.50 gh	78.50 ghi	74.50 I
-1.498	37.50 l	31.00 m	48.00 k	50.00 jk	54.50 j
-1.873	4.50 o	4.50 o	10.00 n	11.50 n	10.00 n
	LSD=4.640 (p=0.01)				
			T.aestivum		
	Aras	Maxipak	Sabir-Beg	Abu-Ghriab	Inia 66
0.000	96.50 abcd	99.50 a	97.50 abc	99.00 ab	95.00 abcde
-0.374	92.50 cde	97.50 abc	97.50 abc	94.00 bcde	94.00 bcde
-0.749	84.50 fg	90.50 e	92.00 de	81.00 ghi	82.50 ghi
-1.124	74.50 jkl	84.00 gh	78.00 ijk	79.00 hij	78.00 ijk
-1.498	50.50 n	74.00 jkl	64.00 m	73.00 kl	71.00 l
-1.873	53.50 n	40.50 o	18.00 p	50.00 n	48.50 n
	LSD =5.204(p=0.01)				

Table 2: The Influence of moisture stress on mean germination time of wheat cultivars

Moisture stress MPa	Mean Germination time (Days)				
			T.durum		
	Senator Capelli	Bakrajow	Gerardo	Cocorit	Stork-S
0.000	4.02	3.94	4.03	4.03	4.00
-0.374	4.07	4.08	4.19	4.02	4.09
-0.749	5.26	5.07	5.18	5.23	5.08
-1.124	7.70	7.71	6.21	6.35	6.30
-1.498	12.92	12.24	12.13	12.43	12.44
-1.873	12.44	12.44	16.00	16.00	16.00
r	0.936	0.948	0.915	0.919	0.917
			T.aestivum		
	Aras	Maxipak	Sabir-Beg	Abu-Ghriab	Inia 66
0.000	4.45	4.02	4.22	4.11	4.38
-0.374	4.39	4.22	4.27	4.65	4.41
-0.749	4.84	4.76	4.87	5.05	5.34
-1.124	6.20	5.77	6.70	5.45	6.33
-1.498	8.13	8.61	9.55	8.02	8.17
-1.873	11.00	12.09	11.33	11.22	11.57
r	0.924	0.916	0.949	0.906	0.929

Table 3: The Influence of moisture stress on the rate of shoot growth mm / day.

Moisture stress MPa	Shoot Growth mm / day	
	T.durum	T.aestivum
0.000	8.09	3.74
-0.374	5.52	3.52
-0.749	3.59	2.16
-1.124	0.94	0.64
-1.498	0.28	0.22
-1.873	0.10	0.13
r	-0.961	-0.809

able 4: The Influence of moisture stress on shoot length of wheat cultivars (mm).

loisture stress MPa	Shoot length (mm)				
			T.durum LSD =9.65 (p=0.01)		
	Senator Capelli	Bakrajow	Gerardo	Cocorit	Stork-S
0.000	99.25 a	97.05 a	94.60 a	97.25 a	97.20 a
-0.374	64.05 bc	58.85 cd	69.60 b	69.80 b	69.30 b
-0.749	38.67 f	43.85 cf	49.80 de	38.65 f	44.92 cf
-1.124	10.32 ghij	9.72 ghij	15.52 g	10.45 ghi	10.85 gh
-1.498	2.12 hij	2.10 hij	3.90 hij	4.20 hij	4.45 hij
-1.873	0.82 j	0.80 j	1.35 hij	1.75 hij	1.25 ij
			T.aestivum LSD=4.19 (p=0.01)		
	Aras	Maxipak	Sabir-Beg	Abu-Ghriab	Inia 66
0.000	45.00 ab	43.10 bc	46.40 ab	47.40 a	42.55 bc
-0.374	43.40 abc	45.00 ab	39.55 bc	41.10 bc	42.35 bc
-0.749	28.30 d	28.15 d	21.50 e	24.95 de	26.85 d
-1.124	9.25 f	7.95 f	4.73 fg	7.85 f	8.65 f
-1.498	2.38 g	3.25 g	1.50 g	3.30 g	2.95 g
-1.873	2.07 g	1.82 g	1.00 g	1.62 g	1.50 g

sixth to eighth days for –1.498 MPa, and eleventh to twelfth days for –1.873 MPa conditions.

Mean germination time for both, durum and aestivum c.v.'s was similar under 0 -0.374, and –0.749 MPa potentials (Table 2). Difference in time of germination started under the conditions of higher moisture stress. Table 2 shows that c.v.'s seeds of aestivum germinate faster than durum under high stress conditions.

Figure 2 represent the effect of moisture stress in MPa on the shoot length (mm) during 12 days of growth. Shoot growth of durum c.v.'s seeds where faster due to the elevated ambiant temperature of 14-18 °C, in compairision to the slower growth of aestivum c.v.'s seeds under lower range of temperature of 8-13 °C .However, the slope of decline of shoot growth under stress in durum was twice that of aestivum (Figure 2).

Table 3 show the rate of shoot growth, mm/day under stress. The regression equation of the decline of speed of growth under stress is y= 7.251- 4.448x, r = - 0.961 for durum c.v.'s, and y= 3.839-2.248x, r = -0.960 (all r values at p = 0.01 level) for aestivum c.v.'s. Thus the slope of decline in shoot growth in durum is twice that of aestivum under moisture stress.

The influence of moisture stress on shoot length of durum and aestivum c .v.'s are shown in Table 4. The difference in shoot growth between the two species c.v.'s is due to the difference in the ambiant temperature during the growth test. However, for both species, the dramatic drop in shoot growth did occur under this type of moisture stress which equal to –0.749 MPa It has been shown that percentage seed germination, seedling emergence rate, seedling height, and seedling growth rate are correlated with grain yield under salt stress conditions (6,8).

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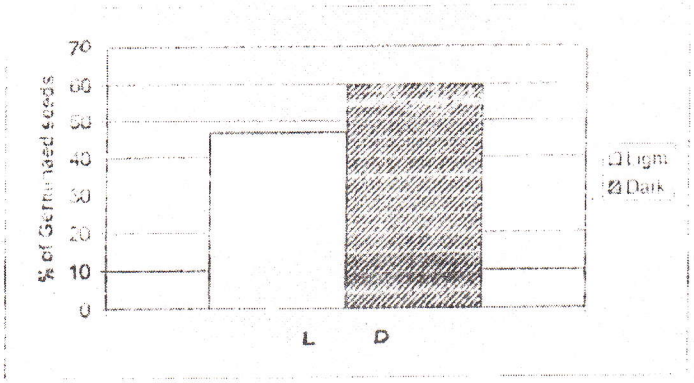
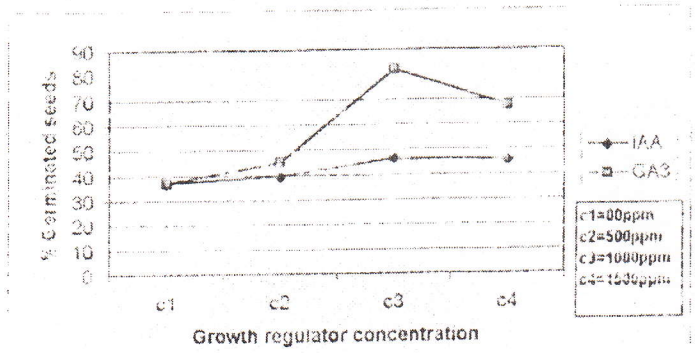


شكل(١) : تاثير عاملي الضوء و الظلام على النسبة المئوية للانبات



شكل (٢): تاثير منظمات النمو (GA3 , IAA) على النسبة المئوية للانبات