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## Effect of drought stress on yield and its components in four cotton genotypes in Darab region

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(*Gossypium hirsutum* L.)

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(Yuan *et al.*, 1994)

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(McDaniel, 1997)

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(McWilliams, 2002)

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(Steger *et al.*, 1994)

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Table 1. Metreological data at agricultural research station of Darab in 2003 and 2004

Month	ماه	درجه حرارت (سانتی گراد) Temperatour (°C)						بارندگی ( میلی متر ) Precipitation (mm)		تبخیر ( میلی متر ) Evaporation (mm)	
		میانگین Mean Temp.		میانگین ماکزیمم Mean Max.		میانگین مینیمم Mean Min.		2002-2003	2003-2004	2002-2003	2003-2004
		2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004				
March-April	فروردین	19.7	18.8	27.0	26.0	12.3	11.6	68.8	4.5	5.0	5.7
April-May	اردیبهشت	24.4	24.6	32.6	33.0	16.1	16.1	7.70	0.4	8.5	8.5
May-June	خرداد	30.1	29.9	39.2	39.2	21.0	20.5	0.00	0.0	10.8	11.6
June-July	تیر	34.0	32.5	42.0	40.3	26.0	24.6	1.20	TR	12.5	12.2
July-Aug.	مرداد	34.2	33.2	42.6	41.2	26.1	25.7	2.40	TR	13.9	11.5
Aug.-Sep.	شهریور	30.2	30.2	38.8	38.2	21.5	22.1	0.00	TR	9.7	9.8
Sep.-Oct.	مهر	25.3	24.4	34.0	33.6	16.6	15.2	0.00	0.0	7.1	7.7
Oct.-Nov.	آبان	18.1	18.7	26.6	27.2	9.5	10.2	0.50	2.5	4.5	4.5
Nov.-Dec.	آذر	13.1	13.1	20.0	18.8	6.2	7.3	78.40	121.5	2.2	2.2
Dec.-Jan.	دی	12.2	9.6	17.4	15.3	7.0	3.8	200.80	142.2	1.5	2.1
Jan.-Feb.	بهمن	12.1	9.3	18.5	15.4	5.6	3.2	36.70	59.6	2.5	1.9
Feb.-March.	اسفند	17.0	14.9	25.2	20.4	8.8	9.4	15.40	37.5	4.4	2.8

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.(Ehyaee, 1997)

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I<sub>2</sub> = 100, I<sub>1</sub> = 70

I<sub>4</sub> = 160 I<sub>3</sub> = 130

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G1 = Bakhtegan( )

G4 = B557 G3 = 818-312 G2 = Siokra

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.(Farshi *et al.*, 1997)

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.(Akram Ghaderi *et al.*, 2004)

Ln (y) = 0.9091 + 1.5983 Ln (x)

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Table 2. Physico-chemical properties of soil and water for experimental site.

	( )	Amount
<u>Soil properties (0-30cm)</u>		
%Clay		22.00
% Organic Carbon		0.54
Electric Conductivity (ds/m)	( )	1.03
pH		8.40
T.N.V. (mg/Kg)	( )	44.00
P <sub>ava.</sub> (mg/Kg)	( )	9.60
K <sub>ava.</sub> (mg/Kg)	( )	244.00
Fe <sub>ava.</sub> (mg/Kg)	( )	3.60
Mn <sub>ava.</sub> (mg/Kg)	( )	10.00
Zn <sub>ava.</sub> (mg/Kg)	( )	0.40
Cu <sub>ava.</sub> (mg/Kg)	( )	0.80
<u>Irrigation water</u>		
Electric Conductivity (ds/m)	( )	0.44
pH		7.60
Hco <sub>3</sub> <sup>-</sup> (meq/litr)	( )	4.00
Cl <sup>-</sup> (meq/litr)	( )	5.00
So <sub>4</sub> <sup>=</sup> (meq/litr)	( )	0.11
Ca <sup>++</sup> + Mg <sup>++</sup> (meq/litr)	( ) +	4.00
Na <sup>+</sup> (meq/litr)	( )	0.61

(Burke and Omahony, 2001)

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Table 3. Combined analysis of variance for different traits and characteristics in cotton genotypes.

		MS									
S.O.V.		df	Earliness	Yield	Boll weight	Boll number/plant	Sympodial number/plant	Sympodial length	Monopodial number/plant	Monopodial length	Plant height
year (Y)		1	1863.8 **	9492868.1 **	8.706 **	51.188 ns	41.344 **	95.800 **	1.654 ns	1053.3 **	2773.5 **
Y/R	/	4	6.3 ns	889653.8 **	0.506 ns	24.069 ns	6.148 ns	71.964 **	1.282 ns	20.4 ns	40.4 ns
Irrigation (I)		3	108.0 ns	4505724.1 **	3.397 **	78.769 ns	4.872 ns	47.836 **	0.325 ns	113.4 ns	139.9 *
Y × I	×	3	85.1 ns	816977.3 *	0.490 ns	3.425 ns	4.075 ns	57.683 **	0.689 ns	82.9 ns	61.1 ns
Error a	a	12	42.7	190157.5	0.434	34.553	2.683	8.288	0.436	91.4	37.7
Genotype (G)		3	885.9 **	89238.0 ns	2.571 **	15.633 ns	1.966 ns	86.803 **	3.810 **	270.5 **	1243.6 **
Y × G	×	3	7.9 ns	92829.8 ns	0.512 ns	8.792 ns	3.082 *	43.530 **	2.271 **	45.7 ns	62.5 *
I × G	×	9	16.4 ns	81265.6 ns	0.385 ns	11.334 ns	0.531 ns	5.469 ns	0.430 ns	46.9 ns	38.8 ns
Y × I × G	× ×	9	14.8 ns	89560.3 ns	0.508 ns	18.149 ns	0.714 ns	18.619 ns	0.262 ns	45.9 ns	36.3 ns
Errore b	b	48	20.3	105880.5	0.530	13.953	0.876	9.317	0.291	33.8	23.476
CV (%) ( )			5.43	12.08	14.02	21.50	8.87	21.82	16.79	16.56	6.53

\* and \*\* : significant at the 5% and 1% of probability levels, respectively

ns: Non- significant

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Table 4. Mean of main effects of year and experimental treatments on different traits

Year	Earliness (%)	Yield (Kg/h)	Boll weight (g)	Boll number/plant	Sympodial number/plant	Sympodial length (cm)	Monopodial number/plant	Monopodial length (cm)	Plant height (cm)
Year									
2003	78.58b	2379 b	4.88b	16.64a	11.21a	12.99b	3.08a	31.82b	68.77b
2004	84.40a	3008a	5.49a	18.10a	9.89b	14.99a	3.34a	38.44a	79.52a
Irrigation									
I <sub>1</sub>	84.79a	3026a	5.557a	17.65ab	10.94a	15.41a	3.067a	38.10a	76.41a
I <sub>2</sub>	83.21ab	3072a	5.418ab	19.55a	10.37a	12.80b	3.346a	33.01a	72.93a
I <sub>3</sub>	79.96b	2511b	5.070bc	17.14ab	10.90a	14.99a	3.246a	35.23a	75.89a
I <sub>4</sub>	84.00ab	2168c	4.717c	15.14b	9.996a	12.74b	3.192a	34.18a	71.35b
Genotype									
G <sub>1</sub>	75.54c	2630a	5.565a	17.23a	10.88a	14.94a	3.046b	33.08b	72.58b
G <sub>2</sub>	80.75b	2678a	4.810c	16.32a	10.21b	15.10a	3.662a	32.22b	64.60c
G <sub>3</sub>	86.54a	2777a	5.327ab	17.72a	10.66ab	14.76a	3.392a	39.72a	79.65a
G <sub>4</sub>	89.13a	2683a	5.060bc	18.21a	10.45ab	11.14b	2.750b	35.50b	79.76a

%

Means, in each column for each factor, followed by similar letter(s) are not significantly different at the 5% probability level - using Duncan's Multiple Range Test

G<sub>1</sub>=Bakhtegan, G<sub>2</sub>=Siokra, G<sub>3</sub>=818-312, G<sub>4</sub>=B-557

I<sub>1</sub> = 70, I<sub>2</sub> = 100, I<sub>3</sub> = 130, I<sub>4</sub> = 160 mm evaporation from class A pan



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Table 5. Interaction of irrigation × Genotype on different traits

Treatment	Earliness (%)	Yield (Kg/h)	Boll weight (g)	Boll number/plant	Sympodial number/plant	Sympodial length (cm)	Monopodial number/plant	Monopodial length (cm)	Plant height (cm)	
I <sub>1</sub>	G <sub>1</sub>	77.67 de	3075 ab	5.887a	16.92 abcd	11.53 a	16.12 ab	2.967 bcd	34.32 bcd	76.37 bcd
	G <sub>2</sub>	84.17 abc	3009 ab	5.318abc	14.95 bcd	10.20 bcd	15.82 ab	3.417 abc	30.53 cd	64.13 fgh
	G <sub>3</sub>	87.83 ab	3062 abc	5.592ab	19.42 abc	11.00 abc	16.58 a	3.200 bcd	42.57 a	82.92 a
	G <sub>4</sub>	89.5 a	2957 abc	5.432ab	19.30 abcd	11.02 abc	13.12 abcde	2.683 cd	33.52 bcd	80.15 ab
I <sub>2</sub>	G <sub>1</sub>	76.5 e	2959 abc	5.357abc	21.47 a	10.47 abcd	13.97 abcd	3.167 bcd	30.80 cd	71.68 de
	G <sub>2</sub>	79.33 cde	2917 abc	4.965abcd	18.53 abcd	10.47 abcd	14.68 bc	4.017 a	29.25 d	61.13 h
	G <sub>3</sub>	88.00 ab	3322 a	5.877a	18.18 abcd	10.57 abcd	12.03 bcde	3.617 ab	36.25 abcd	76.52 abcd
	G <sub>4</sub>	89.00 a	3089 ab	5.472ab	20.02 ab	9.98 bcd	10.53 de	2.583 d	35.75 abcd	82.40 ab
I <sub>3</sub>	G <sub>1</sub>	70.17 f	2382 def	5.598ab	16.40 abcd	11.17 ab	15.60 ab	3.150 bcd	36.62 abcd	73.52 cde
	G <sub>2</sub>	78.00 de	2661 bcd	4.710bcd	17.53 abcd	10.53 abcd	15.90 ab	3.233 bcd	39.42 ab	69.75 ef
	G <sub>3</sub>	83.00bcd	2563 cde	5.027abcd	17.18 abcd	11.23 ab	17.30 a	3.517 ab	41.23 ab	82.90 a
	G <sub>4</sub>	88.67 ab	2337 def	4.943abcd	17.45 abcd	10.65 abcd	11.17 cde	3.083 bcd	35.12 abcd	79.48 abc
I <sub>4</sub>	G <sub>1</sub>	77.83 de	2103 f	5.420ab	14.15 d	10.35 abcd	17.08 abcd	2.900 bcd	30.58 cd	68.75 efg
	G <sub>2</sub>	81.5 cde	2161 ef	4.245d	14.25 cd	9.65 d	14.02 abcd	3.983 a	29.70 cd	63.37 gh
	G <sub>3</sub>	87.33 ab	2160 ef	4.812bcd	16.10 bcd	9.85 cd	13.12 abcde	3.223 bcd	38.82 ab	76.25 bcd
	G <sub>4</sub>	89.33 a	2237 def	4.392cd	16.07 bcd	10.13 bcd	9.75 e	2.650 d	37.63 abc	77.02 abcd

%

Means, each column, followed by similar letter(s) are not significantly different at the 5% probability level - using Duncan's Multiple Range Test

G<sub>1</sub>=Bakhtegan, G<sub>2</sub>=Siokra, G<sub>3</sub>=818-312, G<sub>4</sub>=B-557

I<sub>1</sub>=70, I<sub>2</sub>=100, I<sub>3</sub>=130, I<sub>4</sub>=160 mm evaporation from class A pan.

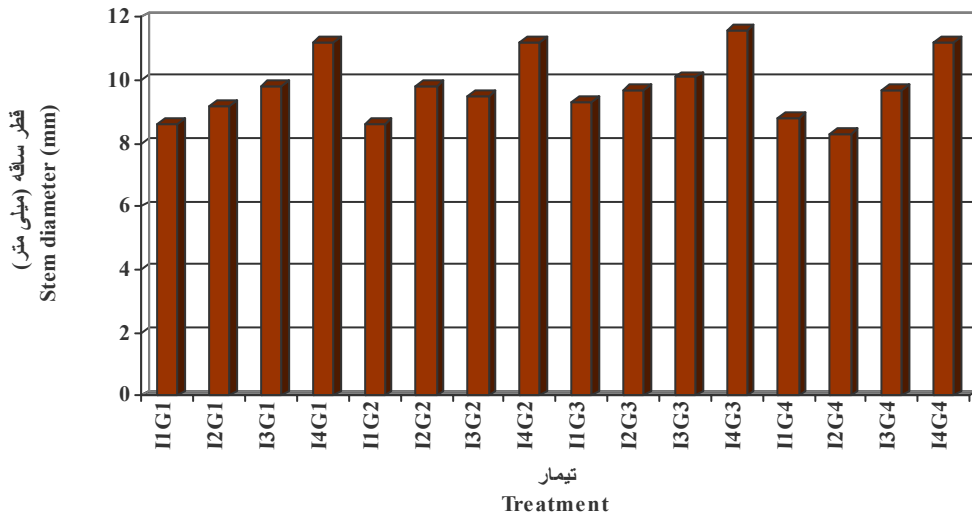


Fig. 1. Variation in stem diameter (mm) in different irrigation treatments

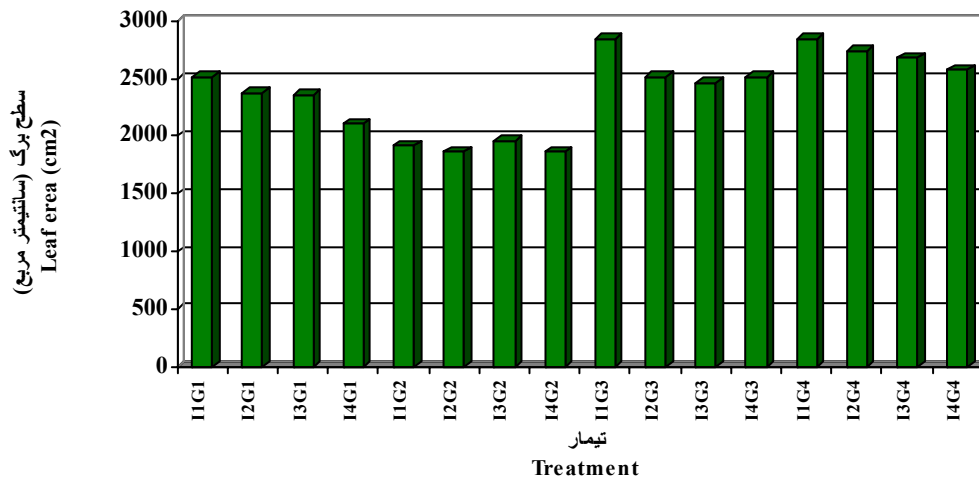


Fig. 2. Variation of leaf area (cm<sup>2</sup>) in different irrigation treatments

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(Kg/m<sup>3</sup>)

Table 6. Water use efficiency (Kg/m<sup>3</sup>) in different irrigation treatments in 2003-04

		I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>
2003					
Number of irrigation		16a	13ab	11bc	8c
Used water (m <sup>3</sup> )	(m <sup>3</sup> )	9831a	9355b	9222c	8622d
Yield (Kg/h)	(Kg/h)	2918a	2760a	1955b	1885b
W.U.E (Kg/m <sup>3</sup> )	(Kg/m <sup>3</sup> )	0.2968a	0.2950a	0.2119b	0.2151b
2004					
Number of irrigation		18a	14ab	11bc	9c
Used water (m <sup>3</sup> )	(m <sup>3</sup> )	10277a	9937b	9633c	9611c
Yield (Kg/h)	(Kg/h)	3133a	3383a	3067a	2450b
W.U.E (Kg/m <sup>3</sup> )	(Kg/m <sup>3</sup> )	0.3048a	0.3404a	0.3183a	0.2549b
Mean					
Number of irrigation		17a	13.5ab	11bc	8.5c
Used water (m <sup>3</sup> )	(m <sup>3</sup> )	9829a	9646b	9427c	9116d
Yield (Kg/h)	(Kg/h)	3025a	3071a	2511b	2167b
W.U.E (Kg/m <sup>3</sup> )	(Kg/m <sup>3</sup> )	0.3008a	0.3177a	0.2651b	0.2350b

%

Means, in each column for each year, followed by similar letter(s) are not significantly different at the 5% probability level -using Duncan's Multiple Range Test.

$$\left( \frac{\text{Yield (Kg/h)}}{\text{Used water (m}^3\text{)}} \right) \times 100 \quad (I_2)$$

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## **Effect of drought stress on yield and its components in four cotton genotypes in Darab region.**

**Fathi Saadabadi<sup>1</sup>, M. and F. Navabi<sup>2</sup>**

### **ABSTRACT**

**Fathi Saadabadi, M. and F. Navabi.** 2008. Effect of drought stress on yield and its components in four cotton genotypes in Darab region. **Iranian Journal of Crop Sciences.** 10(2): 110-124.

To evaluate the effect of drought stress on yield and its components in cotton and introduce the suitable cotton genotype for Darab region, four genotypes of cotton (*Gossypium hirsutum*) were studied in a field experiment using split plot arrangement in a randomized complete blocks design (RCBD) with three replications. Main factor, included four levels of irrigation (70, 100, 130 and 160 mm cumulative evaporation from class A pan) and four genotypes consisting of Siokra, 818-312, B-557 and Bakhtegan (control) assigned as sub-plots. Studied traits were plant height, length and numbers of monopodial (L.M.B and N.M.B) and sympodial branches (S.B), boll number, boll weight, yield and earliness. Also leaf area and water use efficiency were studied. Analysis of variance showed that the effect of irrigation interval on plant height, L.M.B, L.S.B, boll weight, and earliness were highly significant. Drought stress reduced boll weight, however, Bakhtegan cultivar had the biggest and heaviest bolls. The 70 and 100 mm irrigated treatments were in one group and 130 and 160 mm treatments grouped together. Therefore, there was high significant difference between them. The genotype 818-312 had the highest yield of 3322 Kg/ha in 100 mm (I<sub>2</sub>) irrigation treatment. Water used in this treatment was 9646 m<sup>3</sup>/ha in 13 times and irrigation intervals were approximately every 10 days.

**Key Words:** Cotton, Genotypes, Drought stress, Irrigation interval, Yield, Monopodial, Sympodial, Boll.

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