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RESPONSE OF COTTON CULTIVAR GIZA 90 TO WATER STRESS AND POTASSIUM LEVELS.

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ABSTRACT

The present investigation was carried out at Shandweel Agricultural Research station during 2003 and 2004 seasons on Egyptian cotton cultivar Giza 90 (Gossypium barbadense L.). to study the effect of water stress and potassium fertilization levels on growth, earliness and seed cotton yield as well as its components. A split plot design with four replication was used. The main plots were assigned to water stress treatments (irrigation intervals) i.e. irrigation every two weeks, every three weeks and every four weeks. Three potassium levels i.e.o, 24 and 48Kg K_2O/feddan were assigned in the sub plots. The results of this experiments indicated that irrigation interval every two weeks increased plant height at harvest, number of fruiting branches/plant, location of first fruiting node, first flower appearance, boll maturity period, and seed cotton yield/ feddan in both seasons. While, number of open bolls/plant (in both seasons), boll weight and seed cotton yield / plant (in 2004 season only.) increased significantly by irrigation intervals (irrigation interval every three weeks.). Mean while, number of plants at harvest/feddan was not affected by irrigation intervals in both seasons.

With respect to potassium levels the results indicated that plant height at harvest, location of first fruiting and boll maturity period decreased significantly by increasing potassium levels up to 48kg K_2O / fed in 2003 season only. On the other hand, number of fruiting branches and open bolls/plant, boll weight and seed cotton yield/plant and seed cotton yield/fed increased significantly by increasing potassium levels up to 48kg K_2O / fed in 2004 season only. While, number of plants at harvest/fed and first flower

appearance were not affected by potassium. application in both seasons.

The interaction between irrigation intervals and potassium levels had significant effect on plant height at harvest in both seasons, while on the, number of fruiting branches / plant and boll weight was in 2004 season only. On the other hand, location of first fruiting node, first flower appearance, boll maturity period, number of open bolls / plant, seed cotton yield / plant, number of plants at harvest / fed and seed cotton yield / fed were not affected by the interaction between irrigation intervals and potassium levels in both seasons. The greatest values of these traits were obtained from the irrigation every two weeks and potassium application up to 48kg K_2O / fed.

INTRODUCTION

Irrigation and potassium fertilization are two of the most important aspects of cotton (Gossypium barbadense,L.) production. In Egypt, the reduction of cotton yield is the first problem facing the cotton producers. This reduction in yield may be due to many factors such as water supply, potassium fertilization and pest control management. Many studies were carried out in this respect but the problem was more difficult because this problem associated with the political, social and economic behavior of Egyptian farmers and in the same time the growing conditions over all the seasons changed from year to year. Chaudhry (1969) found that irrigation intervals (8,15,22 and 29 days) influenced plant height, numbers of branches/plant and number of node at the first sympodium. He indicated that closely spaced irrigation delayed the appearance of the first flower. Gomaa et al (1981) indicated that decreasing irrigation intervals significantly increased both boll number and weight, number of sympodia and seed cotton yield. Guinn et al (1981) indicated that water deficit decreased plant height and number of branches per plant. Ali (1990) found that irrigation every 15 days produced the highest seed cotton yield per feddan, number of open bolls per plant and boll weight more than irrigation every l0 or 20 days. Radin et al (1992) indicated that plant height, boll weight and seed cotton yield increased significantly by reducing irrigation intervals. Ibrahim and Moftah (1997) indicated that plant height, number of branches and bolls per plant decreased

significantly by extending the irrigation frequency intervals to 28 days while the position or number of fruiting branches / plant were not significantly affected. El-Shahaway and Abd El- Malik (1999) found that close irrigation interval (every two weeks) resulted in higher number of sympodia, number of open bolls, boll weight and seed cotton yield (Kent. / fed.). Final plant height reached the maximum with the intermediate interval (irrigation every three weeks) . Close irrigation delayed maturation in terms of raising nodal position of the first sympodium, increasing number of days to first open flower and boll. El-Shahawy et al(2000) found that irrigation intervals every two weeks increased plant height, number sympodial branches, number of open bolls per plant, boll weight and seed cotton yield (Kentar per feddan), while it delayed the maturation as the increase number of days to both first open flower and boll. He added that node location of the first sympodium did not affected by irrigation intervals. Ziadah et al (2000) found that irrigation intervals 15 / 15 - d increased significantly plant height at harvest, no. of fruiting branches plant, boll weight, no. of open bolls plant, seed cotton yield plant and seed cotton yield / fed in both seasons compared to the other tested irrigation treatments (30 / 15, / 15 / 30 and 30 / 30 days during vegetative and fruiting stages, respectively). Ali (2002) found that plant height, number of sympodia per plant increased significantly as irrigation intervals decreased up to two weeks, while number open bolls / plant, boll weight and seed cotton yield per plant and feddan were significantly influenced by irrigation intervals close irrigation (every two weeks). The days from sowing date to the first flower appearance and cracking the first boll were significantly decreased as the irrigation intervals increased. El- Sayed (2005) found that irrigation interval every two weeks increased final plant height, both sympodial branches, number of open bolls, boll weight and seed cotton yield per both plant and feddan, while number of days from sowing date to the first flower appearance and the first boll craking decreased significantly as the irrigation intervals increased. While position of the first sympodium was not affected by irrigation intervals.

On the other hand, potassium is one of the most important elements in plant nutrition. Mean while, many workers studied the

effect of potassium levels. Makram and El- Shahawy (1995), Abou - Zeid et al(1997) and hamed (2006) found that plant height at harvest and the number of fruiting branches / plant increased significantly by potassium application, While. Darwish (1991), El-Sayed and El- Meanshawi (2001), El - Sayed (2005) and Hamed (2006) reported that, number of open bolls plant, boll weight, seed cotton yield / plant and seed cotton yield / feddan increased significantly by potassium application. The aim of this investigation was to evalute the optimum potassium level which minimize water deficiency of cotton plants.

MATERIALS AND METHODS

Two field experiments were carried out at Shandweel Agricultural Research station during 2003 and 2004 seasons to study the effect of water stress (irrigation intervals), potassium fertilizer levels and their interaction on growth, earliness, seed cotton yield and yield components of cotton. Seeds were sown at the last week of March in both seasons. Thinning was done 30 days after sowing leaving two plants per hill. Mechanical and chemicals analysis of the soil are presented in Table 1.

Table 1 : Mechanical and chemical analysis of soil samples at 0-30cm depth from the surface in 2003 and 2004 seasons.

Soil characteristics	2003 season	2004 season
Texture	Clay loam	Loam
Calcium carbonate%	1.49	1.24
Organic matter%	0.938	1.02
PH(1:2:5suspension NPK)	7.40	7.20
Total N (ppm)	681	702
AVailable P (ppm)	8.1	9.4
AVailable k (ppm)	410	448

The experimental design was split- plot with four replications. The main plots were assigned for the three irrigation intervals, i.e., every two, three or four weeks (Table 2) .

Table 2 : Number of irrigation over all the growing seasons.

Seasons	2003/2004		
Irrigation intervals	2weeks	3weeks	4weeks
Number of irrigation	11	8	6

While potassium fertilizer levels 0,24 and 48 k20/ faddan occupied the sub - plots. The area of experimental plot was 19.5 m^2 (5 m.length and 3.9m. width) included 6 rows at 65 cm apart. Plots were isolated by deep channals of 2m width to avoid the effect of lateral movement of irrigated water. Calcium super phosphate (15.5% P_2O_5) was applied befor sowing at the rate of 150 kg / faddan besides 60KgN/faddan was added in bands and divided in two equal protions, the first one was applied after thinning just before the second irrigation and the second portion was added befor the third irrigation besides 50 Kg potassium sulphate (48%K_2O/ feddan) before the fourth irrigation occupied the sub – plots. Five guarded hills were randomly chosen from the three inner rows in order to study the following characters:

A- Growth and Earliness:

1- plant height at harvest (cm)

2- Number of fruiting braches / plant.

3- Location of first fruiting node.

4- Days to first flower appearance: the number of days from sowing to the appearance of first flower was determined.

5- Boll maturity period : was calculated from flower appearance to boll opening.

B- Yield and Yiled component :

1- Number of open bolls / plant.

2- Average boll weight in grams.

3- Average seed cotton yield in grams / plant.

4- Number of plants at harvest in thousand / feddan : Number of plants at harvest were recorded and transformed to thousands / faddan.

5- Seed cotton yield in kentars / feddan : seed cotton yield / plot in kilograms was recorded and transformed to kentars / feddan (one kentar : 157.5kg).

The obtained data were subjected to analysis of variance out lined by Snedecor and Cochran (1967) and the mean values were compared using L.S.D. at 5%.

RESULTS AND DISCUSSIONS

Growth and Earliness traits:

The results in Table 3 show that, plant height at harvest, number of fruiting branches / plant, location of first fruiting node, first flower appearance and boll maturity period increased significantly as irrigation intervals decreased in both seasons. The irrigation every two weeks interval gave the tallest plants due to shorter internodes with higher node number in addition to more number of monopodia and sympodia which in turn maximized total dry matter of plants. The reverse trend was detected with prolonging irrigation intervals up to four weeks intervals. These results may be due to the sufficient water irrigation supply which was necessary to provide the cotton plants with its requirements of water to activate vital processes such as metabolism which reflected on growth and earliness. Simlar results were obtained by Ibrahim and Moftah (1997), El – Shahawy and Abd El - Malik (1999) . El- Shahawy et al (2000), Ziadah et al (2000), Ali (2002) and El - Sayed (2005). With respect to potassium fertilizer levels the results illustrated in Table (3) show that plant height at harvest (2003), number of fruiting branches) / plant (2004), location first fruiting node (2003) and boll maturity period (2004) were significantly affected by potassium levels up to 48kg K_2O / fed. These results indicated that potassium fertilization prolonged the vegetative growth period and consequently delayed flowering and boll maturity period. Similar results were obtained by Makram and El - Shahawy (1995), Abou Zeid et al (1997) and Hamed (2006). But first flower appearance was not affected by potassium level in both seasons.

The interaction affected significantly plant height at harvest in both, where the highest values of this trait were obtained from the irrigation every two weeks and potassium levels 48kg K_2O/ fed or 0 Kg K_2O/fed in 2003 and 2004 seasons respectively. While the interaction affected significantly number of fruiting branches/ plant in 2004 season only, the highest values of this trait were obtained from

the irrigation every two weeks and potassium levels up to 48kg K_2O/ fed. But this interaction had not significant effects on the location of frist fruiting node, first flower appearance and boll maturity period in both seasons.

Yield and Yield components :

The results in Table 4 show that number of open bolls / plant (both seasons), boll weight and seed cotton yield / plant (2004) increased significantly by irrigation intervals(irrigation every three weeks). These results may be due to the water irrigation supply in case of the intermediate interval (irrigation every three weeks.) gave cotton plants of Giza 90 cultivar which had the sufficient water led to an increase in total dry weight per plant and fruiting set as, a result of increase leaf area and metabolism process. While, seed cotton yield/fed increased significantly by irrigation intervals (irrigation every two weeks) in both seasons. These results could be ascribed on the bases that plants grown with low water supply produced higher nodes, higher fruiting branches and higher fruiting froms. Similar results were obtained by Goma et al. (1981), Guinn et al. (1981), Ali (1990), El – Shahawy and Abd El - Malik (1999),El–Shahawy et al(2000), Ziadah et al. (2000) Ali (2002) and El – Saiyed (2005). However number of plants at harvest/fed was not affected by irrigation intervals in both seasons. On the other hand, number of open bolls / plant, boll weight, seed cotton yield/plant and seed cotton yield/fed increased significantly by potassium application up to 48kg K_2O/ fed in 2004 season only. These results may be due to the role of potassium fertilizer encouraging early growth and increasing its elongation as well as early appearance of bolls of cotton plants (El - Sayed and El - Menshawi 2001, El- Sayed 2005 and Hamed 2006 . While, number of plants at harvest / fed was not affected by potassium levels.

The interaction affected significantly boll weight in 2004 season only, the highest values of this trait were obtained from the irrigation every three weeks and potassium level up to 24 kg K_2O/fed. While this interaction had no significant effects on number of open bolls/plant, seed cotton yield/plant, number of plants at harvest/feddan and seed cotton yield/feddan in both seasons.

The results concluded that using regular irrigation interval every two weeks through the whole plant life and potassium application of 48kg K_2O/ fed is the best treatment for good and high productivity of Giza 90 cultivar.

Table 3: Effect of irrigation intervals and potassium levels on growth and earliness in 2003 – 2004 seasons

Treatments	Plant height at harvest		No. of fruiting branches/ plant		Location of first node		First flower appearance		Boll Maturity period	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
A: Irrigation intervals										
2weeks	129.86	164.00	16.60	19.73	6.53	6.73	81.85	81.09	52.15	52.05
3weeks	126.30	134.94	15.17	17.91	6.47	6.57	81.50	81.02	52.05	51.58
4weeks	103.89	113.10	13.06	17.49	5.83	5.86	80.05	79.55	50.14	50.38
F. test	*	*	*	*	*	*	*	*	*	*
L.S.D. at 0.05	5.65	2.95	1.42	1.42	0.54	0.64	1.19	0.79	1.64	0.56
B: Potassium levels										
0 Kg k_2o	122.28	138.84	14.47	16.73	6.59	6.48	81.02	80.28	50.72	52.18
24 Kg k_2o	118.33	136.83	15.06	16.85	6.19	6.40	81.22	80.47	52.58	51.04
48 Kg k_2o	119.44	136.36	15.30	18.85	6.06	6.27	81.16	80.91	51.04	50.72
F. test	*	NS	NS	*	*	NS	NS	NS	NS	NS
L.S.D. at 0.05	3.59	NS	NS	0.89	0.42	NS	NS	NS	NS	NS
Interaction (A)x(B)	128.60	173.25	NS	19.05	NS	NS	NS	NS	NS	NS
	125.75	160.50	NS	18.90	NS	NS	NS	NS	NS	NS
	135.22	158.25	NS	21.25	NS	NS	NS	NS	NS	NS
	127.32	131.10	NS	16.55	NS	NS	NS	NS	NS	NS
	127.37	136.00	NS	16.82	NS	NS	NS	NS	NS	NS
	124.22	137.72	NS	20.35	NS	NS	NS	NS	NS	NS
	110.92	112.17	NS	13.70	NS	NS	NS	NS	NS	NS
	101.87	114.00	NS	14.82	NS	NS	NS	NS	NS	NS
	98.87	113.12	NS	14.95	NS	NS	NS	NS	NS	NS
L.S.D. at 0.05	*	*	NS	*	NS	NS	NS	NS	NS	NS
F. test	6.22	5.33	NS	1.55	NS	NS	NS	NS	NS	NS

Table 4: Effect of irrigation intervals and potassium levels on yield and yield components in 2003 – 2004 seasons

Treatments	No. of open bolls/ plan		Boll weight		Seed cotton yield / plant		No. plants at harvest / fed		Seed cotton yield/ fed	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
A: Irrigation intervals										
2weeks	15.39	17.05	2.08	1.77	32.06	30.38	44666	44783	10.81	7.79
3weeks	17.85	18.10	1.89	1.84	33.17	23.47	44000	42916	10.53	7.40
4weeks	13.17	13.92	2.35	1.69	30.33	23.73	42333	43916	9.25	5.95
F. test	*	*	*	*	NS	*	NS	NS	*	*
L.S.D. at 0.05	1.92	1.56	0.19	0.11	NS	3.59	NS	NS	0.92	0.56
B: Potassium levels										
0 Kg k_2o	15.06	14.93	2.22	1.60	32.77	23.97	44083	44550	9.84	5.71
24 Kg k_2o	15.73	16.83	2.07	1.81	32.01	30.47	44416	42950	10.34	5.53
48 Kg k_2o	15.62	17.30	2.03	1.80	30.78	33.13	42500	44116	10.42	7.91
F. test	NS	*	NS	*	NS	*	NS	NS	NS	*
L.S.D. at 0.05	NS	1.55	NS	0.1	NS	3.85	NS	NS	NS	0.41
Interaction (A)x(B)	NS	NS	NS	1.77	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.62	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.92	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.53	NS	NS	NS	NS	NS	NS
	NS	NS	NS	2.03	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.97	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.51	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.77	NS	NS	NS	NS	NS	NS
	NS	NS	NS	1.80	NS	NS	NS	NS	NS	NS
L.S.D. at 0.05	NS	NS	NS	*	NS	NS	NS	NS	NS	NS
F. test	NS	NS	NS	0.18	NS	NS	NS	NS	NS	NS

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استجابة صنف القطن جيزة ٩٠ للإجهاد المائي والتسميد البوتاسي.

فكرى سيد حامد

معهد بحوث القطن – مركز البحوث الزراعية – الجيزة – مصر

أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بشندويل فى موسمي ٢٠٠٣ ، ٢٠٠٤ م لدراسة تأثير الإجهاد المائي (فترات الري) ومستويات التسميد البوتاسى على النمو والتبكير والمحصول ومكوناته على صنف القطن المصري جيزة ٩٠ تم تنفيذ التجارب فى تصميم قطع منشقة مرة واحدة فى أربع مكررات حيث خصصت القطع الرئيسية لفترات الري (كل أسبوعين ، كل ثلاثة أسابيع ، وكل أربعة أسابيع) حين خصصت القطع المنشقة للثلاث مستويات من التسمين البوتاسى صفر ، ٢٤ ، ٤٨ كجم بو ٢أ / فدان وكانت النتائج كالآتي:.

١- الري كل أسبوعين أدى إلى زيادة معنوية لكل من طول النبات وعدد الأفرع الثمرية /نبات وارتفاع أول فرع ثمري ، وظهور أول زهرة ، وفترة نضج اللوزة بالإضافة إلي محصول القطن الزهري (قنطار / فدان) فى كلا الموسمين ، بينما تأثر عدد اللوز المتفتح / نبات (فى كلا الموسمين) ووزن اللوزة ومحصول النبات فى الفردي ، (فى موسم ٢٠٠٤) تأثير معنوي بفترات الري (الري كل ثلاث أسابيع) . بينما لم يكن هناك تأثير لفترات الري على صفة عدد النباتات / فدان فى كلا الموسمين .

٢- أدت زيادة المستوى التسميد البوتاسى حتى ٤٨ كجم بو٢أ / فدان إلى نقص فى الطول النبات ، وارتفاع أول ثمري ، وفترة نضج اللوزة فى موسم ٢٠٠٣ م بينما زاد كل من عدد الأفرع الثمرية وعدد اللوز المتفتح / نبات ، ووزن اللوزة ومحصول النبات الفردي زيادة معنوية لزيادة المستوى التسميد البوتاسى حتى ٤٨ كجم بو٢ أ / فدان فى موسم ٢٠٠٤ ، بينما لم يتأثر كل من عدد النباتات / فدان وظهور أول زهرة بالمستوى التسميد البوتاس حتى ٤٨ كجم بو٢ أ / فدان فى موسم ٢٠٠٤ ، بينما لم يتأثر كل من عدد النباتات / فدان وظهور أول زهرة بالمستوى التسميد البوتاسى فى كلا الموسمين .

٣- كان التفاعل بين فترات الري (الإجهاد المائي) ومعاملات التسميد البوتاسى تأثير معنوي على طول النبات فى كلا الموسمين ، بينما عدد الأفرع الثمرية / نبات ووزن اللوزة فى موسم ٢٠٠٤ م ، بينما لم يكن هناك تأثير معنوي للتفاعل على ارتفاع أول ثمري ، وظهور أول زهرة ، وفترة نضج اللوزة وعدد اللوز المتفتح / نبات ، ومحصول النبات الفردي فى كلا الموسمين ، وكانت افضل النتائج فى معظم الصفات من التفاعل بين فترات الري كل أسبوعين والتسميد البوتاسى ٤٨ كجم بو ٢ أ / فدان.