Minufiya J. Agric. Res.Vol.35 No. 5:1797-1814 (2010)"http://agri.menofia.edu.eg/megla.html"

IMPACT OF WATER STRESS AND NITROGEN FERTILIZER LEVELS ON COTTON GROWN UNDER HIGH TEMPERATURE CONDATIONS IN UPPER EGYPT

S. A. F. Hamoda

Agronomy Research Section, Cotton Research Institute, Agricultural Research Center, Giza, Egypt

(Received: Aug. 14, 2010)

ABSTRACT: *Three field experiments were carried out at El-Mattana Agric. Res. St., Agric. Res. Cent., Luxor Governorate, Egypt during 2007, 2008 and 2009 seasons to study the impact of water stress and nitrogen fertilization levels on growth, earliness, yield and yield components and fiber quality of Giza 90 cotton variety under high temperature in Upper Egypt. Two irrigation intervals (15 and 21 day) and three levels of nitrogen (30, 45 and 60 kg N/fed.) were used. The experimental design was a split plot with four replications. The combined analysis between years was done. Simple correlation coefficient was computed between cotton traits and heat units. Obtained results revealed that: Years affected significantly all characters under study due to the variation in total amount of heat units, which was higher in 2008 growing season compared to 2007 and 2009 seasons, this led to significant increase in vegetative growth (plant height and no. of fruiting branches/plant) and caused decrease in seed cotton yield/fed., yield components (boll weight and no. of bolls/plant) and fiber quality. Prolonging the irrigation interval to 21 day resulted in significant reduction in plant height, no. of fruiting branches/plant, days to first flower, days to first open boll, no. of open bolls/plant, boll weight, seed index, seed cotton yield/fed. and gave low fiber quality. The increase of N level from 30 to 60 kg N /fed exhibited a significant increase in plant height, no. of fruiting branches/plant, days to first flower, days to first open boll, no. of open bolls /plant, boll weight, seed index, seed cotton yield/fed. and gave the good fiber quality. Well-watered plants every 15 day responded more favorably to N supply (60 kg N/ fed.) than water-stressed plants and exhibited significant increase in seed cotton yield/fed. The interaction between years and irrigation intervals was significant where the lowest growth and yield traits were recorded in 2008 due to prolonging the irrigation interval and increasing stress of water under high temperature. The interaction between seasons and nitrogen levels cleared that fertilizing plants with 60 kg N/fed. in 2009 season significant increase yield and fiber quality. The interaction of seasons x irrigation intervals x nitrogen levels exhibited significant effects on growth, yield and yield components where 2009 season gave the good seed cotton yield/fed. under irrigation interval every 15 day and nitrogen levels 60 kg N/fed. Positive and significant correlation was found between cotton growth and heat units but seed cotton yield/fed and its components were negatively and significantly correlated with different* *seasonally changes heat units in Upper Egypt. Under El-Mattana conditions the proper N level was 60 kg N /fed. and the irrigation interval was 15 day to assure high yield and quality and to avoid adverse effects of high air temperature in some seasons*

Key Words: *Cotton, Irrigation intervals, Nitrogen levels, Temperature, Heat units, Growth, Earliness, Yield and Fiber*

INTRODUCTION

Crop growth and yield are controlled by environmental factors (light, CO_2, temperature, water, nutrients, etc.) interacting with the genetically determined physiological and biochemical systems of the plant. Agricultural production strategy must be based on optimizing plant function in relation to environment to give high productivity with long-term stability. Crop production is directly influenced by temperature. Temperature plays a dominate role in controlling growth and developmental rates of cotton plants. Reddy *et al.* (1997) found that number of days to first flower and first open boll were decreased as temperature was increased. Roussopoulos *et al.* (1998) found that fibers were shortest in the high temperature regime where fiber strength and micronaire reading were at maximum compared with low temperature regime. Sawan *et al.* (1999) reported that humidity and air temperature governed flower and boll production during the fourth period of their production. Oosterhuis, (2002) reported that high day temperatures, night temperatures may be even more detrimental to the yield of cotton. Reddy *et al.* (1996) indicated that high night temperatures are detrimental for yield of cotton and cause yield variability due to their effects on respiration and the carbon balance of the plant where more carbohydrates are lost by the high respiratoration rates at the expense of cotton plant growth. Mohamed (1993) found that the correlation between heat units and plant height was positive and highly significant. Elayan, *et al.* (2006) found that the correlations between days to first flower or number of opened bolls/plant or boll weight or seed cotton yield/fed. or micronaire value were positive and significant with air temperature and hence heat units under Giza condition.

Water stress is considered the most agronomic variable affecting crop production worldwide. In Egypt, the forthcoming water shortage, though it is currently not well recognized by the agro-public, is a true challenge facing agricultural development and crop production in particular. Under such pressing threat of water limitations, irrigation water should be efficiently utilized so that water savings could be used in other agricultural activities. Additionally, the high input/ high output of agriculture dominated in developing countries including Egypt can not be sustainable and thus, crops should be managed to perform well and produce high yield under low input conditions. Therefore, enhancing water use efficiency has recently become a valuable goal attracting intensive research at both global and local scales.

Cotton plant, however, reacts strongly to moisture conditions in soil and the proper water supply during different stages of plant development is the most potent single factor making for a high cotton yield. Water deficiency particularly during fruiting stage markedly restricts over all plant growth, fruit retention and seed cotton yield (El-Shahawy and Abd EL-Malik, 1999; El-Sayed, 2005 and Hamed, 2007). Regardless of water availability, even irrigated cotton plants usually experience some degree of water stress, particularly at midday time, due to poor timing of irrigation or due to high evapotranspirative conditions, like those prevailing in Upper Egypt, where short-duration mild water stress could damage cotton yield (Reddy *et al*, 1998), which confirms the need for enhancing cotton tolerance to water stress. Baslious and Abdel Malak (1992) found that irrigation intervals every 14 day significantly increased seed cotton yield/fed. and its components. Ahmed and Kassem (2008) found that irrigation interval every three weeks resulted in significant reduction in plant height, no. of fruiting branches/plant, no. of open bolls/plant and seed cotton yield/fed.

The management of fertilizer nitrogen (N) is a very important component of any cotton production program. Water and N are normally the most limiting inputs to successful cotton production. It is important for farmers to use fertilizer N efficiently to maintain optimum return in yield for the amount of fertilizer N provided. Also, from an environmental standpoint, it is important to manage fertilizer N. Efficient and balanced nutrition has proved to be a means for improving plant tolerance to various environmental stresses including drought. Plants receive proper nutrients supply exhibit better performance and productivity under stressful conditions (Szezpaniak and Grzebisz, 2007). Balanced fertilization improves water use efficiency (Marchand, 2007). Thus, the development of more efficient nutrients management strategies is needed to maximize use of all available recourses in cotton production (Reiter and Krieg, 2000). Baslious and Abdel Malak (1992) found that increased nitrogen levels to 90 kg N/fed. significantly increased seed cotton yield /fed., number of fruiting branches/plant, no. of open bolls and lint %, while boll weight and seed index were increased in favour of higher application of nitrogen. The highest seed cotton yield was detected from 14 day irrigation interval x 90 or 75kg N/fed. Samy (1997) found that increasing nitrogen fertilizer up to 80 kg N/fed. increased final plant height, boll weight and seed cotton yield /fed., but decreased earliness. Ahmed and Kassem (2008) found that increasing N amount from 60 to 90 kg N/fed significantly increased plant height and no. of fruiting branches/plant but, it failed to exert any significant effects on yield or yield components. The interaction between irrigation intervals and N fertilization levels exhibited significant effects only on plant height, where growth of well-watered plants responded to increasing N amount more favorably than that of water-stressed plants. Increasing N amount to 90 kg N/fed failed to significantly increase seed cotton yield at either longer or closer irrigation intervals.

Following irrigation, nitrogen fertilization is the variable that exerts profound effects on cotton growth and productivity. Nitrogen supply may affect cotton response to drought via promoting root growth and antioxidant activities in roots (Liu *et al*, 2008). Also, Cadena and Cothren (1995) reported that N supply improved water use efficiency which was positively correlated with the N status of cotton plant. A complementary effect of N and water in cotton yield was also reported by Grimes *et al*, (1969) indicating that the addition of N may substitute for a lack of water. However, some research results indicated that cotton response to N supply is usually diminished by water stress (Reiter and Krieg, 2000 and Silvertooth *et al*, 2007) and excessive N supply had a deleterious effects on cotton plant resistance to drought (Liu *et al*, 2008).

The main objective of this investigation was to study the impact of water stress, through prolonging the irrigation interval and nitrogen fertilization levels on growth, earliness, yield and yield components and fiber quality of cotton under high temperature in Upper Egypt and the relation between cotton yield and air thermal units through the growing season

MATERIALS AND METHODS

Three field experiments were conducted at El-Mattana Agricultural Station, Luxor Governorate during three growing seasons (2007, 2008 and 2009) to investigate the response of Giza 90 cotton variety to irrigation intervals (irrigation every two or three weeks throughout the growing season starting after the first irrigation) and three levels of nitrogen (30, 45 and 60 kg N/fad.) under the different seasonally temperature in Upper Egypt. The experimental design was a split plot within a randomized complete block with four replications. Main plots included the irrigation intervals and the sub plots included nitrogen levels. The experimental unit included 7 ridges (5 m long and 65 cm apart) occupying an area of 22.75 m^2. Cotton seeds were planted on 22^{nd}, 23^{rd} and 24^{th} of March in 2007, 2008 and 2009 seasons, respectively. Hills were spaced at 25 cm within rows and seedlings were thinned at 2 plants/hill. Phosphorus fertilizer as ordinary superphosphate (15.5% P_2O_5) at the rat of 22.5 kg P_2O_5 /fed. was incorporated during seed bed preparation. Nitrogen fertilizer in the form of ammonium nitrate (33.5 % N) at the tested levels was applied in two equal doses, immediately before the first and the second irrigations. Potassium fertilizer in the form of potassium sulfate (48% K_2O) at the rate of 24 kg K_2O/fed. was side-dressed in a single dose before the second irrigation. The previous crop was Sugarcane (Saccharum spp.) in 2007 and 2009 seasons but in 2008 season was tomato. Standard agricultural practices were followed throughout the growing seasons. All samples were taken at random from each sub plot in order to study the traits. During flowering and bolling stages, number of days from planting to first flower appearance and first open boll were recorded as a mean of the five plants of each sub plot taken from the second row. At harvest, 6 guarded plants were randomly taken from the central row of each sub plot to determine plant height (cm), number of fruiting branches/plant, number of open bolls/plant, boll weight (gm), lint % and seed index (gm). Seed cotton yield (ken. /fed.) was estimated as the weight of seed cotton yield (kilogram) picked from the five middle rows in sub plot collected from two picks, then converted to yield per fedden in kentar (Kentar = 157.5 kg.). Earliness percentage (E %) was determined as percent of seed cotton yield of first pick to total seed cotton yield. The studied fiber quality traits were fiber length (upper half mean length UHM mm.), fiber strength (g/tex.) and micronaire value which were measured by using High Volume Instrument (HVI) according to A.S.T.M. D-4605 (1986). Climatic conditions and heat unit accumulations were monitored using in Department of Meteorology, Agricultural Research Center. Maximum and minimum air temperatures (°C) are shown in (Fig. 1), maximum and minimum air humidity are shown in (Fig. 2) and mean temperature and heat units are shown in (Fig. 3). These measurements were recorded in 10-day intervals through the cotton growing season (March-September) in 2007, 2008 and 2009 seasons for El-Mattana Agricultural Station. Heat units (HU) were calculated according to Young *et al.* (1980) equation as follows:

HU = Mean daily min. and max. temperatures – K (Zero growth = 12.8 °C)

Representative soil samples were taken from the experimental sites before sowing in the three seasons and were prepared for analysis, according to Chapman and Pratt (1978). The results of the soil analysis are shown in Table (1). The amounts of heat units (HU) were calculated in 30-day intervals as shown in Table (2). All collected data were subjected to statistical analysis as proposed by Gomez and Gomez (1984) and means were compared by LSD at 5% level of probability

Table (1): Soil analysis of the experimental site in the three growing seasons.

Seasons	Properties										
	Texture	pH	EC Mmhos /cm.	$CaCO_3$ %	Available element ppm						
					N	P	K	Fe	Mn	Zn	Cu
2007	Clay loam	7.4	0.26	2.9	64	11	385	12.4	16.4	2.2	4.0
2008	Clay loam	7.6	0.22	3.1	61	10	336	13.5	8.6	1.7	3.3
2009	Clay loam	7.5	0.36	2.7	69	14	400	14.2	19.2	1.9	3.9

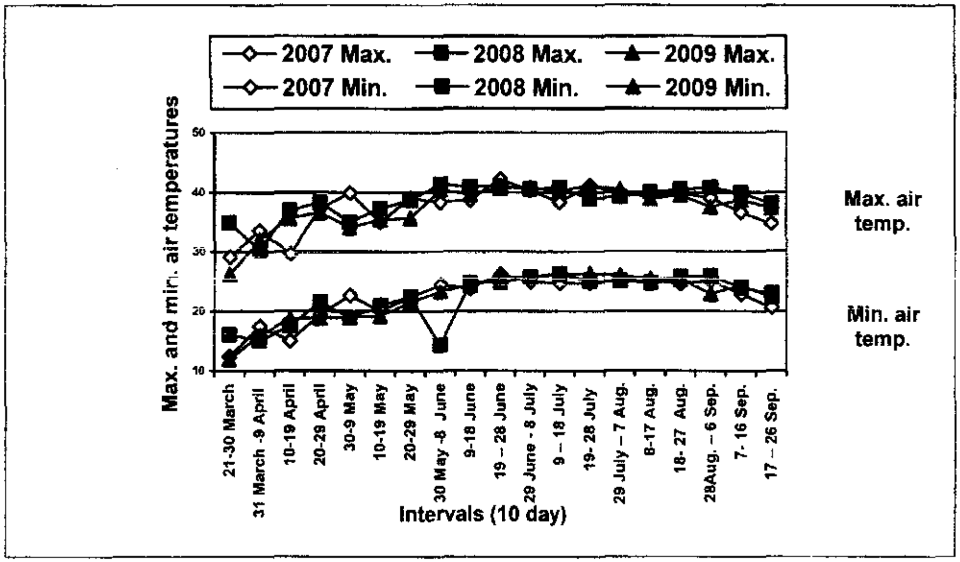

Fig. (1): Maximum and minimum air temperatures as a mean every 10 days interval in El-Mattana Agricultural Station during 2007, 2008 and 2009 seasons

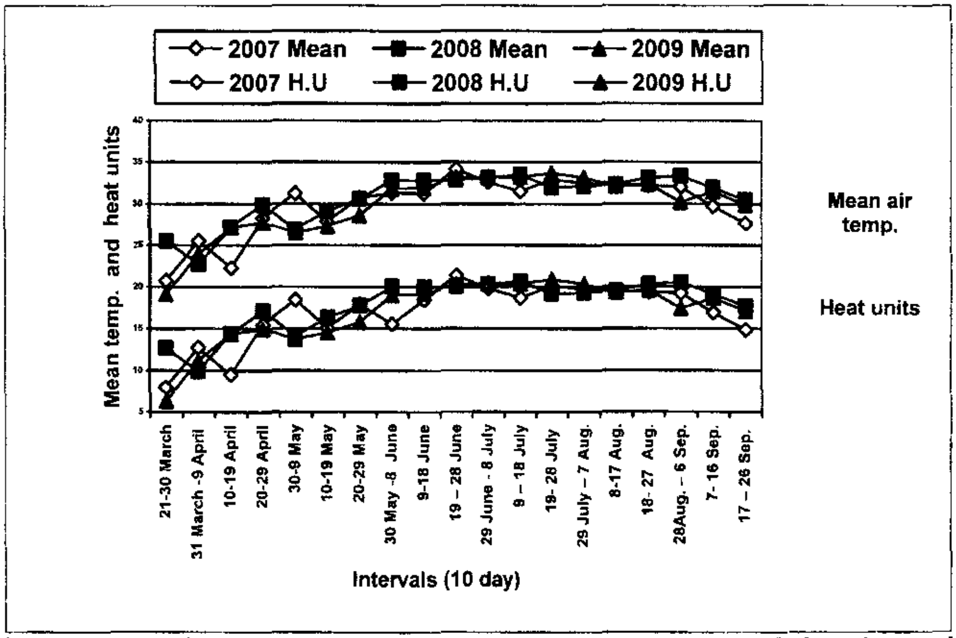

Fig. (2): Mean air temperature and heat units as a mean every 10 days interval in El-Mattana Agricultural Station during 2007, 2008 and 2009 seasons

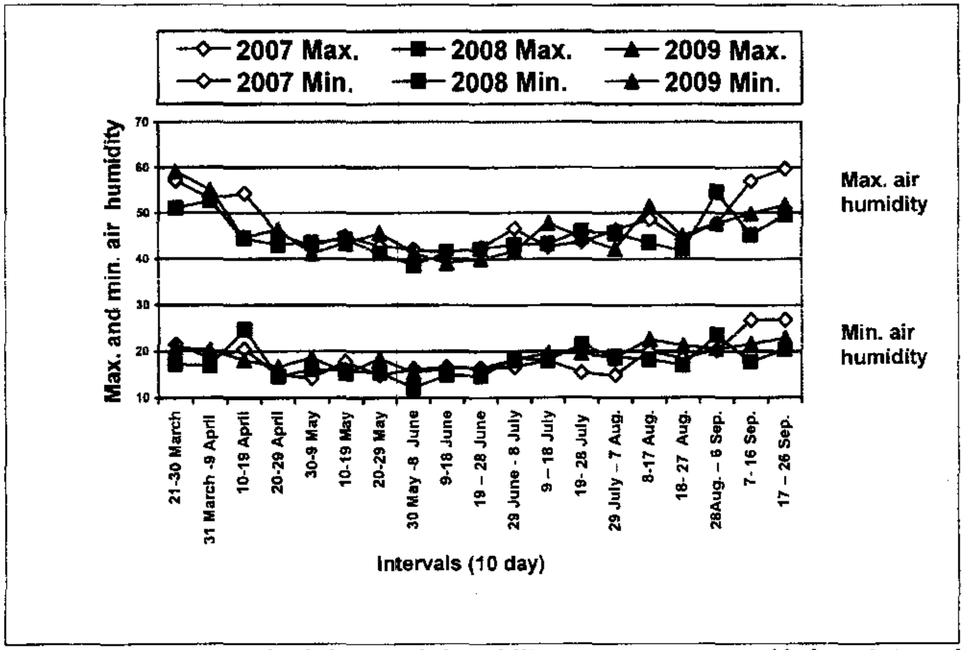

Fig. (3): Maximum and minimum air humidity as a mean every 10 days interval in El-Mattana Agricultural Station during 2007, 2008 and 2009 seasons

RESULTS AND DISCUSSION

Monthly heat units (HU) during the growing seasons:

Weather is one of the most important factors that affect crop growth and yields. Crop production is directly influenced by temperature. Through the different growing seasons, the cotton plants were exposed to different air temperatures.

Data in Table (2) cleared that the temperature in Upper Egypt is very high. The total heat units which were received by cotton plants in 2008 planting season were higher than that in 2007 or 2009 season. In 2009 season the lowest heat units were at the beginning of the season. The diurnal air temperature in Fig. (1) refers to a low night temperature which seldom surpassed 20°C during the first month. This was reflected in a low heat unit particularly in 2009 season. These heat units were progressively increased with the advance of the growing season reaching their maximum during the 91-120day period which coincides with peak of flowering and early boll development. In general, the heat units are sometimes used to predict crop growth and developmental events because cotton growth increases linearly as temperature increases Hamoda (2006)

Table (3): Seasonal changes of years, irrigation intervals and nitrogen levels effects on growth, earliness, yield and yield components and fiber properties

Treatments		Growth characters		Earliness traits			Yield and yield components					Fiber properties		
		Plant height (cm)	No. of fruiting branches /plant	Days to first flower	Days to first open boll	E %	Boll weight (g)	No. of open bolls/p	Seed index (g)	Lint %	Seed cotton yield (ken./fed.)	length U.H.M	Strength g/tex.	Mic. value
Years	2007	135.23	12.94	64.42	116.54	70.85	2.56	23.87	10.10	37.53	11.94	30.79	38.82	4.18
	2008	142.78	13.59	63.21	114.29	75.45	2.47	20.30	9.81	38.62	10.54	30.53	35.43	4.01
	2009	131.53	12.32	66.54	117.13	66.26	2.62	27.03	10.28	37.26	12.50	31.04	42.15	4.29
LSD at 0.05		0.15	0.03	0.36	0.44	0.26	0.05	0.14	0.02	0.13	0.04	0.04	0.16	0.04
irrigation intervals	15 day	137.41	13.32	65.58	117.00	69.98	2.63	25.54	10.25	38.63	12.67	30.94	39.36	4.27
	21 day	135.61	12.57	63.86	114.97	71.72	2.47	21.93	9.88	37.98	10.65	30.64	38.24	4.06
LSD at 0.05		0.12	0.03	0.30	0.36	0.21	0.04	0.12	0.02	0.12	0.03	0.03	0.13	0.03
Nitrogen levels	30 kg N	133.70	12.33	63.58	114.42	72.82	2.43	21.80	9.86	38.04	10.83	30.31	37.70	4.04
	45 kg N	137.01	12.84	64.88	116.13	71.26	2.57	23.77	10.07	37.73	11.47	30.75	38.50	4.16
	60 kg N	138.83	13.67	65.71	117.42	68.49	2.65	25.63	10.27	37.65	12.68	31.31	40.20	4.29
LSD at 0.05		0.17	0.03	0.25	0.38	0.16	0.03	0.20	0.02	0.12	0.03	0.06	0.13	0.05

Table (4): Effect of the interaction between years and irrigation intervals on growth, earliness, yield and yield components and fiber properties

Treatments		Growth characters		Earliness traits			Yield and yield components					Fiber properties		
Years	Irrigation intervals	Plant height (cm)	No. of fruiting branches /plant	Days to first flower	Days to first open boll	E %	Boll weight (g)	No. of open bolls/p	Seed index (g)	Lint %	Seed cotton yield (ken./fed.)	length U.H.M	Strength g/tex.	Mic. value
2007	15 day	135.80	13.28	65.33	117.83	69.80	2.65	25.66	10.29	37.26	12.68	30.94	39.38	4.28
	21 day	134.67	12.59	63.50	116.25	71.90	2.48	22.09	9.92	37.79	11.19	30.64	38.26	4.09
2008	15 day	144.53	13.99	64.33	115.50	74.50	2.53	22.09	10.00	38.49	11.83	30.68	36.03	4.12
	21 day	141.03	13.18	62.08	113.08	76.40	2.41	18.51	9.62	38.76	9.26	30.39	34.83	3.89
2009	15 day	131.91	12.69	67.08	117.67	65.66	2.71	28.88	10.46	37.13	13.50	31.19	42.68	4.40
	21 day	131.15	11.93	66.00	116.58	66.87	2.63	25.18	10.11	37.39	11.49	30.89	41.62	4.19
LSD at 0.05		0.21	0.05	0.51	0.62	0.37	0.06	N.S	N.S	N.S	0.06	N.S	N.S	N.S

However, it insteadly could reduce it. With increasing N level, cotton yield always reaches a plateau then it declines. These results are in harmony with those of EL-Shahawy and Abd El-Malik (1999). It is clear from Table (5) that nitrogen levels significantly affected fiber length (UHM), strength and micronair value. Higher N fertilized plant had better fiber quality than low N fertilized ones.

4- Effect of the interactions on growth, earliness, yield and fiber quality of cotton:

Data in Table (4) showed that the interaction between season 2008 and irrigation interval 21 day significantly increased earliness %, while decreased days to first flower, days to first open boll, boll weight and seed cotton yield due to increasing stress of water under high temperature. The interaction between season 2009 and irrigation interval 15 day significantly increased days to first flower, days to first open boll, boll weight and seed cotton yield/fed.. No. of boll tented to increase. Results also showed that the interaction between seasons and irrigation interval gave insignificant effect on boll number, lint %, seed index and all fiber characters studied. Data in Table (5) showed that the interaction between seasons and nitrogen levels significantly affected all studied characters except micronaire value. The interaction of seasons and N levels showed that the highest values of plant height, no. of fruiting branches/plant were obtained by fertilizing plants with 60 kg N/fed. in 2008 season. However the interaction between season 2009 and 60 kg N gave the high values of days to first flower, first open boll, boll weight, no. of bolls/plant, seed index, seed cotton yield/fed., fiber length UHM and strength. Data in Table (6) showed that the interaction of irrigation intervals × N levels had significant effect on plant growth parameters, earliness characters, yield and yield components and fiber characters except strength. Data also showed that the interaction of irrigation interval 15 day × 60 kg N/ fed. significantly increased plant height, no. of fruiting branches/plant, days to first flower, days to first open boll, boll weight, no. of open bolls/ plant, seed cotton yield/fed. and fiber length U.H.M. The effect of such interaction on plant growth revealed that growth of well-watered plants responded more favorably to N supply than of that water-stressed plants. Similar results were obtained by Cadena and Cothren (1995) who reported that N supply increased growth of well-watered cotton plants greater than that of water-stressed plants because of poor N uptake under water inadequacy since N fertilizers require water availability in soil enough for fertilizer dissolution in soil and nutrient uptake by roots. Also, Silvertooth *et al* (2007) reported that N uptake by cotton plant is usually diminished under water stress conditions and they attributed this to drought–induced stomatal closure which not only limits the transpirational stream and thus the upward flow of N solutes to the leaves. Data in Table (7) showed that the interaction of seasons x irrigation intervals x nitrogen levels had significant effects on plant height, no. of fruiting branches/plant, days to first open boll, boll weight, no. of bolls /plant, seed index and seed cotton yield/fed.. In 2009 season the irrigation interval every 15 day and nitrogen fertilizer 60 kg N/fed. gave the highest values to boll weight, no. of open bolls/plant and seed cotton yield/fed.

5- Simple correlation between heat units (H.U) and the some cotton growth, earliness, yield and quality characters (averaged over all the three seasons).

Data in Table (8) showed that the correlation between heat units and some growth, yield and quality characters of cotton averaged over the three growing seasons. Positive and significant correlation was found between cotton growth (plant height and no. of fruiting branches/plant) and heat units. These results are in harmony with those of Mohamed (1993).

Table (8): Simple correlation between heat units (H.U) and the some characters of cotton at different planting seasons (2007, 2008 and 2009).

Cotton properties		r values
Growth characters	Plant height (cm)	0.855**
	No. of fruiting branches/plant	0.595**
Earliness traits	Days to first flower	- 0.711**
	Days to first open boll	- 0.525**
	Earliness percentage	0.850**
Yield and its components	No. of open bolls /plant	- 0.740**
	Boll weight (g)	- 0.441**
	Seed index (g)	- 0.601**
	Lint percentage	0.632**
	Seed cotton yield//fed.	- 0.512**
Fiber properties	Fiber length (UHM) (mm)	- 0.412**
	Fiber strength g / tex.	- 0.911**
	Micronaire value	- 0.577**

** indicates significant at 0.01 level of probability.

On the other hand, no. of open bolls /plant, boll weight, lint % and seed cotton yield /fed. were negatively and significantly correlated with heat units in Upper Egypt. These results clearly indicate that the large heat units caused by the increase of air temperature though was in favour of plant elongation and the increase of the number of fruiting branches and lint percentage, but, on the other hand, decreased number of days to first flower, days to first open boll, seed index and the seed cotton yield/fed. had due to the decrease in the number of open bolls /plant and as well boll weight. These negative was also observed in fiber quality (fiber length UHM, fiber strength g/ tex. and micronaire value)

REFERENCES

Abou El-Nour, M.S., M.A. Saeed and M.A. Morsy (2000). Effect of fertilization under two planting dates on yield, yield components and some technological and chemical properties of Giza 80 cotton cultivar. Egypt. J. Agric. Res., 78(3): 1219-1231.

Ahmed, A.M. and M.M.A. Kassem (2008). cotton response to irrigation intervals under different levels of potassium and nitrogen. Assiut J. of Agric. Sci., 39(5): 171-185

Ali, S.A. and A.E. El-Sayed (2001). Response of cotton cultivar Giza 70 to mepequate chloride (pix) at early and late sowing dates. J. Agric. Sci., Mansoura Univ., 26(4): 1841-1851.

A.S.T.M. (1986). American Society for Testing and Materials. D-4605., Vol. 07, No 1, Easton, MD, USA.

Baslious, S.I. and K.K.I. Abdel Malak (1992). Effect of irrigation intervals, nitrogen levels and their interaction on seed cotton yield of Giza 83 and its components. Minia J. Agric. Res. & Dev. 14(3):699 - 713

Cadena, J. and J.T. Cothren (1995). Yield response of cotton to nitrogen, irrigation and PGR IV regimes. Proceed. Beltwide Cotton Conf., pp. 1142-1150.

Chapman, H.D. and P.P. Pratt (1978). Methods of analysis for soils, plants and water. Univ. of California, Div. of Agric. Sci. Priced Publ. 4034.

Elayan, Sohair, E.D., A.A. Abd El-Hafeez, H.Y. Awad and S.A.F. Hamoda (2006). Effect of light intensity and heat units on earliness, yield and fiber characters of cotton varieties. J. Agric. Sci. Mansoura Univ., 31 (7): 4107 – 4118

EL-Sayed, E.A. (2005). Effect of water stress and potassium fertilizer levels on growth and yield of cotton cultivar Giza 88. J. Agric. Sci. Mansoura Univ., 30 (1): 49-59.

EL-Shahawy, M.I.M. and R.R. Abd EL-Malik (1999). Response of Giza 87 cotton cultivar (*Gossypium barbadense* L.) to irrigation intervals and nitrogen fertilization levels. Egypt. J. Agric. Res., 77(2): 841-856.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agriculture research. 2nd Ed., John Willey and Sons, New York, USA.

Grimes, D.W., H. Yamada and W.L. Dickens (1969). Functions for cotton (*Gossypium hirsutum* L.) production from irrigation and nitrogen fertilization variables. 1. Yield and evapotranspiration. Agron. J., 61: 769-773.

Hamed, F.S. (2007). Response of cotton cultivar Giza 90 to water stress and potassium levels. Minia J. Agric. Res. & Develop. , 27(2): 377-388.

Hamoda, S.A.F. (2006). Effect of climatic conditions on bolling, earliness, yield and fiber technology in cotton. Ph.D Thesis, Fac. of Agric, Cairo Univ., Egypt, PP:47- 49.

Liu, R.; Z. Zhou, W. Guo; B. Chen and D.M. Oostrhius (2008). Effect of N fertilization on root development and activity of water-stressed cotton (*Gossypium hirsutum* L.) plants. Agric. Water Management, 95(11): 1261-1270.

Makram, E.A., H.A. Abd El-Aal, A.A. Darwish and W.M. El-Shazly (2001). Air thermal units in relation to growth and development of cotton plants through different sowing dates. Minufiya J. Agric. Res., 26(3): 659-671.

Marchand, M. (2007). Potassium fertilization and water use efficiency under saline cond-itions. International Fertilizer Correspondent, Ed. (13).

Mohamed, M.H. (1993). Present status of three long staple cotton cultivars under different environmental conditions with respect to yield, earliness and quality merits. M. Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Oosterhuis, D.M. (2002). Day or night temperatures: A major cause of yield variability. Cotton Grower 46(9):8-9.

Reddy, K.R., H.F. Hodges and J.M. McKinion (1997). A comparison of scenarios for effect global climate change on cotton growth and yield. Australian J. of plant Physiology, 24(6):707-713.

Reddy, K.R., H.F. Hodges and J.M. McKinion (1998). Photosynthesis and environmental factors. Proceed. Beltwide Cotton Conf., pp. 1443-1450.

Reddy, K.R., H.F. Hodges, W.H. McCarty and J.M. McKinion (1996). Weather and cotton growth: Present and future. 23 pp. In: Remy, K.H. (ed). Publication of the Office of Agricultural Communications, Division of Agriculture, Forestry and Veterinary Medicine. Mississippi State University. Bulletin 1061. Nov 1996.

Reiter, J. S. and D.R. Krieg (2000). Cotton fruiting patterns and lint as affected by water and fertility management Proceed. Beltwide Cotton Conf., pp. 631-633.

Roussopoulos, D., A. Liakatas and W.J. Whittington (1998). Cotton responses to different light temperature regimes. J. of Agric. Sci., Greece, 131 (3): 277-283.

Samy, A.I.A. (1997). Effect of ridging rates in combination with hill spacings and nitrogen levels on growth, earliness, yield and yield components of Giza 86 cotton cultivar J. Agric. Res., Tanta Univ., 23(1): 9-17

Sawan, Z.M., L.T. Hanna and W.L. McCuistion (1999). Effect of climatic factors during the development periods of flowering and boll formation on the production of Egyptian cotton *(Gossypium barbadense,* L.*)*. Agron. J. 19 (6): 435-443.

Silvertooth, J.C., J.T. Cothren and C.W. Bednarz (2007). The physiological basis of nitrogen demand. Proceed. Beltwide Cotton Conf., pp. 1284-1289.

Szezpaniak, W. and W. Grzebisz (2007). K as the key element to protect yield of the main crops against water shortage. Poceed. Inter. Conf.; Plant nutrition and its prospects, Brno, Czech Republic, pp. 379-382.

Xiong, L. and J.K. Zhu (2002). Molecular and genetic aspects of plant responses to osmotic stress. Plant, Cell and Environment, 25:131-139.

Young, E.F., R.M. Teyler and H.D. Petarson (1980). Day-degree units and time in relation to vegetative development and fruiting for three cultivars of cotton. Crop Sci., 20: 370-375.

تاثير الإجهاد المائي ومستويات التسميد النتروجينى على القطن المنزرع تحت ظروف الحرارة المرتفعه فى مصر العليا

سعيد عبد التواب فرج حمودة

قسم بحوث المعاملات الزراعية – معهد بحوث القطن – مركز البحوث الزراعية - الجيزة – مصر.

الملخص العربى

اجريت ثلاث تجارب حقليه بمحطة البحوث الزراعية بالمطاعنة التابعة لمركز البحوث الزراعية بمحافظة الاقصر خلال مواسم ٢٠٠٧ ، ٢٠٠٨ و٢٠٠٩ لدراسة تاثير الإجهاد المائي (فترات الرى) ومستويات التسميد النتروجينى على النمو، والتبكير، المحصول ومكوناته وصفات التيله لصنف القطن جيزة ٩٠ تحت ظروف درجات الحرارة المرتفعه فى مصر العليا حيث كانت معاملات الرى كل ١٥ و٢١ يوم وكانت مستويات التسميد النتروجينى هى ٣٠، ٤٥ و ٦٠ كجم ن/ف وقد استخدم تصميم القطع المنشقة فى أربع مكررات وتم عمل التحليل التجميعى للسنوات وتم حساب الارتباط البسيط لصفات النمو والتبكير والمحصول ومكوناته وصفات التيله مع مجموع الوحدات الحراريه خلال كل موسم ويمكن ايجاز اهم النتائج المتحصل عليها كما يلى:

١. اثرت السنوات معنويا على جميع الصفات المدروسه وذلك لتباين مجموع الوحدات الحراريه خلال المواسم حيث ادى ارتفاعها خلال موسم ٢٠٠٨ بالمقارنه بموسمى ٢٠٠٧ و٢٠٠٩ الى زيادة فى صفات النمو(طول النبات وعدد الافرع الثمريه على النبات) ونقص فى المحصول ومكوناته (وزن اللوزة، عدد اللوز على النبات) وصفات التيله.

٢. ادى الاجهاد المائى (الرى كل ٢١ يوم) الى نقص معنوى فى صفات طول النبات، عدد الافرع الثمريه على النبات، عدد الايام حتى ظهور اول زهرة وتفتح اول لوزة، عدد اللوز على النبات، متوسط وزن اللوزة، معامل البذرة، محصول القطن الزهر/الفدان وصفات التيله.

٣. ادى زيادة مستويات النتروجين من ٣٠ الى ٦٠ كجم ن/ف الى زيادة معنوية فى طول النبات،عدد الافرع الثمريه، عدد الايام حتى ظهور اول زهرة، عدد الايام حتى تفتح اول لوزة، متوسط وزن اللوزة، عدد اللوزعلى النبات، محصول القطن الزهر/الفدان وصفات التيله.

٤. تشير نتائج التفاعل بين معاملات الرى والتسميد النتروجينى الى ان النباتات المرويه كل ١٥ يوم كانت اكثر استجابه لامداد النتروجين حتى ٦٠ كجم /ف عن النباتات المعرضه للاجهاد المائى حيث اعطت هذة النباتات زيادة معنوية فى محصول القطن الزهر/الفدان.

٥. كان التفاعل بين المواسم ومعاملات الرى معنوياً حيث تم الحصول على اقل صفات للنمو والمحصول فى موسم ٢٠٠٨ عند اطالة فترة الرى الى ٢١ يوم وزيادة الاجهاد المائى تحت ظروف الحرارة العاليه خلال هذا الموسم.

٦. اوضح التفاعل بين المواسم ومستويات النتروجين ان تسميد النباتات بـ ٦٠ كجم ن / ف خلال موسم ٢٠٠٩ ادى الى زيادة معنويه فى صفات المحصول ومكوناته وصفات التيله

٧. اظهر التفاعل بين المواسم و فترات الرى ومستويات النتروجين تاثيراً معنويا على صفات النمو والمحصول ومكوناته حيث اعطى موسم ٢٠٠٩ افضل محصول للقطن الزهر/ فدان تحت الرى كل ١٥ يوم و ٦٠ كجم ن/ف.

٨. تشير النتائج الى وجود ارتباط معنوى وموجب بين مجموع الوحدات الحراريه خلال المواسم وصفات النمو كما وجد ان هناك ارتباط معنوى وسالب بين المحصول ومكوناته ومجموع الوحدات الحراريه فى مصر العليا مما يعنى ان ارتفاع الحرارة خلال موسم النمو يؤدى الى نقص واضح فى محصول القطن الزهر/ الفدان ومكوناته

٩. يمكن من خلال نتائج هذا البحث ان نوصى بانه يمكن تلافى ارتفاع درجات الحرارة تحت ظروف مصر العليا وذلك بزيادة التسميد الازوتى حتى ٦٠ كجم ن/ ف والرى كل ١٥ يوم وذلك للحصول على محصول عالى ذو جودة مرتفعه من القطن المصرى صنف جيزة ٩٠