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AIR THERMAL UNITS IN RELATION TO GROWTH AND DEVELOPMENT OF COTTON PLANTS THROUGH DIFFERENT SOWING DATES

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ABSTRACT

This study was carried out at Shandaweel Agric. Res. Station (Sohag Governorate), Egypt during 2009 and 2010 seasons. At each season three planting date treatments (March 25, April 10 and April 25) were studied on the Egyption cotton Giza 90 cultivar. The experimental design was Randomized Complete Blocks (R.C.B.) with four replications. Obtained results revealed that plant ages 75, 105 and 135 days late sowing obtained the highest number of heat units and resulted in increasing plant height, number of nodes per plant, dry weight per plant, number of leaves per plant, leaf area and leaf area index while, it had no effect on internode length, leaf area index in age 135 days. Number of sympodia per plant increased in favour early sowing due to lower night temperature which lowered the position of early sympodium and inducing early balance between vegetative and fruiting development. Number of leaves, leaf area and leaf area index of early sowing increased slowly through, early season. Late sowing produced the first flower and open first boll in shorter period as compared to early sowing, but it consumed more number of heat units. The highest yield components and yield per unit area was produced from early sowing, where the cotton plants received the highest number of heat units through the growing season as compared to late sowing. Most of these units were utilized in produced the fruiting organs, while late sowing used most of these units in increasing the vegetative growth. The efficiency use of heat units by cotton plants increased in favour of early sowing rather than in late sowings. Best results were obtained when cotton plants were sown early (25 March).

Generally, it is recommended to grow cotton early (25 March) for Giza 90 cotton cultivar gave the highest seed cotton yield per feddan rather than the late sowing (25 April) under the condition of this study.

INTRODUCTION

Air temperature is one of the important factors which affect the rate of growth and development of cotton plants. The lower and upper developmental threshold ranging between 15- 37 C° (Gipson and Ray, 1970). Below 15 c° the development ceases sharply and above 37 C° the co development tended to decrease. One the other hand, the measure of accumulation heat expresses the physiological time of cotton development. Mc-Mahon and Low (1972) suggested the growing day-degree (GDD) to measure the physiological time. Young *et al.* (1980) computed day-degrees (DD) and heat units (HU). However, there are several techniques available for calculating the day-degree. In the central lab, Agric. Climatalog (CLAC). Eissa *et al.* (1989) showed that early planting in March increased plant height. They added that early sown plants made the vegetative growth period to be longer as compared to late planting this is turn may increase the metabolites synthesized by plants which reflected on height of main stem, consequently more fruiting branches. Also, early sowing cotton plants in full seasons help to obtain complete heat unit requirement. El-Shahawy *et al.*

(1994) showed that sowing dates did not affect node position of the first sympodium. The relatively lower temperature prevailed during seedling and vegetative stages or prior to floral initiation in case of early sowing which may help the plants to have at their disposal a longer period to flowering. But, late sowing decreased number of fruiting branches per plant significantly. Makram *et al.* (1994) showed that early planting in March increased plant height and number of fruiting branches per plant. However, earliness parameters i.e. days to first flower appearance and days to first open boll were not affected by sowing dates. Abd El-Malak *et al.* (1996) found that late sowing increased plant height significantly. However, late sowing affected significantly decreasing number of both stem node and sympodia per plant. Also, delaying sowing on (20^{th} April) improved earliness characters as shown increasing days to first of flower appearance. However, increasing number of open bolls per plant, boll weight, seed cotton yield per plant and per fed. occurred with early sowing on (the last week of March). El-Beily *et al.* (1996) found that number of true leaves and leaf area per plant increased in favour of late sowing. while, number of days to first flower decreased by delaying the date of sowing. Abdel-Aal (1997) stated that sowing date had an insignificant effect on plant height. However, early sowing in March produced has a significant longer period to flowering. Abou El-Nour *et al.* (2000) found early sowing increased the yield components and yield of seed cotton, while, it decreased plant height, position of first sympodium and internode length but it delayed the first flower appearance. Sowing dates had no effect on boll weight. Ali and El-Sayed (2001) revealed that early sowing (25 March) had significantly increased number of internodes and sympodia on the main-stem, number of open bolls per plant, boll weight, number of days to the first flower appearance, days to crack the first boll, seed cotton yield per plant and feddan. While, plant height, internode length, number of true leaves at 80 days age and first sympodium position were decreased. Makram *et al.* (2001) showed that late sowing obtained the highest number of heat units and resulted in increasing plant height, number of nodes length. Number of sympodia per plant increased in favour of early sowing due to lower night which lowered the position of first sympodium, and inducing early balance between vegetative and fruiting development. Number of leaves, leaf area index early sowing increased slowly through early season, but it increased rapidly to approach the late sowing at 90 days and exceed it at 120 days old, while, it decline sharply at 150 days old. However, late sowings continued to increase the previous characters late in the season. Late sowings produced the first flower in shorter period as compared to early sowing, but it consumed more number of heat units. Early sowing exceeded late sowing in number of open bolls, besides it inter flowering stage early. The highest yield components and yield per unit area was produced from early sowing, where the cotton plants received the highest number of heat units through the growing season as compared to late sowing. Most of these units were utilized in producing the fruiting oranges, while, late sowing used most of these units in increasing the vegetative growth. The efficiency use of heat units by cotton plants increased in favour of early sowing rater than in late sowing. Saleh *et al.* (2004) found that late sowing increased plant height. However, early sowing may help the plants to have at their disposal a longer period to flowering. While, delaying sowing date from March to April decreased days to both first open flower and boll. However, increasing number of open bolls per plant, boll weight, seed cotton yield per plant and per feddan occurred with early sowing (on the last week of March). El Hindi *et al.* (2006) found that number of days to both first flower appearance and boll opening were decreased with delaying sowing to 10th April. While, early sowing in March increased yield and its component, number of open bolls per plant, boll weight, seed cotton yield per plant and per feddan in varieties related to (*Gossypium barbadense* L.). El Sayed & El Menshawi (2006) found that sowing cotton in 25 th March had significantly decreased final plant height, while number of main stem internodes, number of sympodia per plant, nodal position of the first sympodia, days to first flowers and first open boll, number of open bolls per plant, boll weight, seed cotton yield per plant and per feddan were increased. Abd-El-All (2011) found that plant height, number of fruiting branches per plant and boll weight were decreased significantly as planting date was delayed. However, location of the first sympodium on plant main stem tended to be higher as planting date was delayed. While, the average number of days from planting to first flower appearance and first boll opening tended to be decreased significantly as planting date was delayed. Also, the maximum number of bolls per plant and yield of seed cotton per plant and per feddan were produced from planting on the first of March.

Therefore, this investigation was carried out to study the effect of air thermal units through different planting dates on growth and yield of seeds cotton.

MATERIALS AND METHODS

Field experiment was carried out through 2009 and repeated through 2010 season at Shandweel Agric. Res. Sta. Sohag Governorate, to study the effect of three planting dates (March 25, April 10 and April 25), on the growth and yield of as an indicator to different climatic conditions of air temperature and heat units on Egyptian cotton cultivar Giza 90 (*G. barbadense*, L.). The experiment design was randomized complete blocks with four replications. The size of each plot was 17.55 m^2 (4.5 m length and 3.9 width) and included 6. ridge of 65 cm apart and hill spacing was 20 cm. The plants were thinned to two plants per hill. Five plants were taken from each plot at 75,105 and 135 days from sowing, in order to study the following characters: plant height(cm), number of sympodia per plant, number of leaves per plant, leaf area index, dry weight per plant (g). At picking, ten plants (five hills) from each plot were taken at random to determine the following characters, final plant height (cm), position of first sympodium per plant, number of sympodia per plant, number of open bolls per plant, boll weight (g) seed cotton yield per plant (g), seed cotton yield in kantars per feddan and number of plants at harvest per feddan.

The maximum and minimum air temperature and relative humidity in the two growing seasons are presented in Table 1 and maximum and minimum soil temperature in the two growing seasons are presented in Table 2.

Table 1: Minimum and maximum values of air temperature and relative humidity (R.H) as means of ten-day intervals through 2009 and 2010 seasons.

Intervals	2009				2010			
	Air temp. C°		R.H %		Air temp. C°		R.H %	
	min	max	min	max	min	max	min	max
21/3 – 31/3	9.00	26.10	31.80	96.00	11.80	27.60	17.50	42.00
1/4 – 10/4	10.60	30.80	28.70	74.50	14.30	34.00	22.40	50.20
11/4 -20/4	12.20	36.22	29.60	79.20	21.50	34.90	28.50	51.90
21/4 – 30/4	14.20	34.40	33.00	79.00	22.70	35.30	23.50	41.90
1/5 – 10 /5	15.35	32.20	33.40	85.80	20.10	37.40	25.00	48.20
11/5 – 20/5	20.10	39.60	26.60	83.00	29.60	42.70	48.10	69.90
21/5 – 31/5	22.40	38.80	37.60	97.20	21.50	37.10	28.40	58.50
1/6 – 10/6	22.00	41.00	25.60	73.80	18.70	34.40	29.30	59.70
11/6 -20/6	22.90	38.20	28.80	88.70	20.10	36.10	28.00	62.90
21/6 – 30/6	26.70	42.80	22.30	90.30	24.30	41.20	29.00	61.80
1/7 – 10/7	27.10	36.90	27.00	88.00	24.00	36.40	22.10	47.30
11/7- 20/7	29.80	41.70	38.30	88.90	27.00	40.50	32.40	64.40
21/7 -31/7	31.60	45.50	34.20	91.63	30.30	44.20	37.30	68.40
1/8 – 10/8	25.00	40.00	29.90	89.60	30.00	42.00	36.40	71.50
11/8 – 20/8	21.50	37.20	21.00	83.20	32.00	41.20	35.50	72.70
21/ 8 – 31/8	24.60	41.00	27.60	89.80	31.40	45.70	36.60	73.20
1/9 – 10/9	21.65	36.80	25.50	81.50	26.40	39.70	33.60	61.00
11/9 – 20/9	22.30	37.80	24.90	81.50	25.40	37.35	38.60	70.80
21/9 – 30/9	21.90	37.00	25.20	82.60	27.20	39.80	35.80	62.90
1/10 – 10/10	20.20	36.40	22.80	77.40	22.50	36.60	29.70	61.30
11/10 – 20/10	18.70	35.70	27.70	75.70	20.60	39.50	23.70	68.40
21/10 – 31/10	18.90	35.30	26.70	69.60	19.70	36.90	19.20	66.20

The heat units were computed according to the following equation by Young *et al.* (1980).
Heat unit = average daily temperature Constant (k = 12.8 C°) This constant was used as the temperature below which cotton plants do not develop, (zero growth).

Table 2: Minimum and maximum values of soil temperature as means of ten-day intervals through 2009 and 2010 season.

Intervals	2009		2010	
	soil		soil	
	Min	Max	Min	Max
21/3 – 31/3	29.31	32.35	16.80	19.80
1/4 – 10/4	28.35	34.27	22.20	26.40
11/4 -20/4	33.30	36.12	17.20	22.50
21/4 – 30/4	34.62	40.44	16.80	25.10
1/5 – 10 /5	33.75	36.59	13.80	21.80
11/5 – 20/5	38.22	38.50	18.60	25.60
21/5 – 31/5	41.30	43.80	14.40	18.80
1/6 – 10/6	39.80	43.60	14.40	18.90
11/6 -20/6	38.10	39.10	17.90	23.80
21/6 – 30/6	42.50	45.40	20.50	27.10
1/7 – 10/7	44.70	47.00	17.70	21.70
11/7- 20/7	46.25	48.25	18.70	22.60
21/7 -31/7	46.00	48.40	17.40	23.50
1/8 – 10/8	44.70	46.90	18.20	23.10
11/8 – 20/8	36.10	38.45	16.30	21.70
21/ 8 – 31/8	41.22	47.60	18.50	23.40
1/9 – 10/9	33.70	42.60	15.00	21.00
11/9 – 20/9	30.70	40.50	13.30	18.90
21/9 – 30/9	27.65	39.45	17.60	20.80
1/10 – 10/10	23.60	34.80	13.40	20.60
11/10 – 20/10	17.90	28.30	11.50	22.30
21/10 – 31/10	13.80	29.10	9.40	19.60

Total heat units were summed over the growth period. Efficiency use of heat units = Total heat units through the whole season /Number of open bolls per plant= (hu /boll). The obtained data were subjected to statical analysis according to the procedure out line by Snedecor and Cochran (1967) using LSD at 5% Level for comparison between the means of treatments.

	Total Heat Units	
Sowing dates	**2009**	**2010**
March 25	3508.10	3891.95
April 10	3405.90	3740.75
April 25	3240.80	3530.75

RESULTS AND DISCUSSION

Growth characters in relation to the heat units:

The data presented in Tables 3 and 4 revealed that the late sowing (April 25) of cotton plants received the highest number of heat units through plant ages 75,105 and 135 days as compared to early sowing (March 25). The increases in the heat units and air temperature in the late sowing caused an increase in plant height and number of nodes per plant, without affecting in internode length. Similar results were obtained by Blibro (1975) and Makram *et al.*, (2001). At plant ages 75.105 and 135 days, number of leaves per plant increased in favour of late sowing due to the increase of air temperature and consequently the increase of heat unit (Tables 1, 2, 3 and 4). This trend was obtained with leaf area and leaf area index, however, previous results could be explained on the basis of air temperature and heat units. Early sowing at early stages of growth exposed to relatively lower air temperature and low number of heat units which allowed the cotton plants to produce lower number of leaves per plant as compared to late sowing. As the season advanced, number of leaves and sympodia per plant increased by increasing the heat units, in regular biological rhythm for appearance of leaves and branches in suitable balance (Gipson and Ray, 1970 and Makram *et al.*, 2001). Therefore, the increase of leaves in number and expansion in favour of early sowing may be due to the increase of carbone dioxide exchange rate (CER) in order to provide the developing bolls by photosynthate (Mauney *et al.*, 1978). This source of photosynthate was shifted from subtending leaves (Morris, 1964). Therefore, most of lower leaves intered senescence and dropped. For this reason, early sowing start to lost leaves early as compared to late sowing which continued to increase leaves number, area and weight (Muramoto *et. al.*,1967). These results are in line with those obtained by El-Beily *et al.* (1996) and Makram *et al.*, (2001).

Regarding number of fruiting branches per plant in ages (75, 105 and 135 days) it tended to increase in favour of early sowing (Tables 3 and 4). This may be due to the lower amounts of heat units in early season encourages the formation of more sympodia per plant which are the barriers of fruiting oranges, that increased the fruiting capacity of the cotton plant.

These results are in agreement with those obtaind by Mc-Mahon and low (1972) and Makram *et al.*, (2001).

For the above mentioned results it could suggested that, early sowing maximized the efficiency use of heat units early in the season by inducing early balance between vegetative growth and fruiting development. Consequently, early sowing produced the highest number of open bolls/plant in the season as compared to late sowing. These results are in agreement with those obtained by Makram *et al.*, (2001)

Table 3 : Effect of sowing dates and total heat units on some growth characters of cotton during 2009 season.

Plant age (days)	Sowing dates	Total heat units	Plant height (cm)	No.of node . length	Internode. length cm)(	No .of sympodiay/ plant	No .of leaves/ plant	LA dm^2 / plant	LAI	Dw /plant (gm)
75	25/3	879.15	75.17	19.94	6.08	12.83	16.80	4.30	0.66	9.50
	10/4	1073.65	103.67	17.66	5.87	12.14	18.30	5.10	0.78	14.20
	25/4	1145.35	121.25	14.26	5.26	9.08	23.70	7.20	1.10	15.70
LSD at 5 %			1.40	1.87	NS	0.95	0.71	0.62	0.17	2.13
105	25/3	1506.85	156.42	29.33	6.12	23.17	29.70	9.90	1.52	31.70
	10/4	1770.85	170.00	26.31	6.46	21.42	32.50	11.40	1.75	39.60
	25/4	1916.75	179.50	26.06	6.00	17.92	35.80	13.70	2.10	42.40
LSD at 5 %			1.04	1.09	NS	1.26	0.86	1.54	0.22	1.63
135	25/3	2141.15	176.92	29.91	6.33	23.58	39.50	16.70	2.57	45.30
	10/4	2320.15	179.00	26.40	6.78	22.75	47.90	19.70	3.03	50.40
	25/4	2404.30	189.33	26.17	6.76	21.92	50.60	21.50	2.57	54.50
LSD at 5 %			2.14	1.02	NS	0.57	1.75	0.39	NS	0.35

L.A=leaf area L.A.I= leaf area index

Table 4 : Effect of sowing dates and total heat units on some growth characters of cotton during 2010 season.

Plant age (days)	Sowing dates	Total heat units	Plant height (cm)	No.of node . length	Internode. Length (m)	No. of sympodiay/ plant	No. of leaves/ plant	LA dm^2 / plant	LAI	Dw plant (gm)
75	25/3	1115.5	47.37	18.51	3.87	10.33	14.70	3.30	0.66	8.60
	10/4	1243.5	61.62	18.28	3.37	10.31	19.90	5.40	0.83	12.70
	25/4	1293.7	71.62	15.03	3.15	7.12	21.50	6.80	1.05	13.70
LSD at 5 %			1.19	1.47	NS	0.54	0.19	1.25	0.17	1.67
105	25/3	1623.00	118.81	29.99	4.71	20.87	28.9	9.20	1.41	34.50
	10/4	1802.70	120.33	25.93	4.64	17.42	34.50	13. 40	2.06	40.30
	25/4	1903.00	141.25	25.77	4.61	15.25	36.60	14.50	2.23	43.60
LSD at 5 %			1.05	0.89	NS	0.62	0.46	2.00	NS	0.11
135	25/3	2238.5	137.69	31.55	5.13	26.19	40.77	17.30	2.66	48.80
	10/4	2481.2	144.56	29.68	4.87	22.56	50.90	21.00	3.23	55.40
	25/4	2576.0	161.87	29.05	4.74	26.19	53.40	23.70	3.65	59.70
LSD at 5 %			0.55	0.45	NS	1.54	2.18	1.47	NS	1.96

LA= leaf area LAI= leaf area index DW = Dry weight

Flowering characters in relation to heat units :

The results presented in Table 5 cleared that early sowing delayed the appearance of first flower as compared to late sowing, while it utilized lower number of heat units from sowing to first flower. There fore, most of the remained heat units were consumed through fruiting stage. This is situation was not achieved in case of late sowing, because most of the heat units were consumed in vegetative growth. Similar results were obtained by El-Beily *et al.* (1996) and Makram *et al.* (2001).

Table 5: The effect of sowing dates and total heat units on flowering and fruiting characters for cotton in 2009and 2010 seasons.

Season	2009			2010		
Sowing dates	Days to 1st flower	Total heat units to 1st flower	Total heat units 1st flower to picking	Days to 1st flower	Total heat units To 1st flower	Total heat units 1st flower to picking
25/3	79	951.95	2556.15	76	1127.7	2764.25
10/4	71	995.35	2410.55	71	1128.7	2612.05
25/4	68	1094.15	2146.65	65	1047.0	2433.75

Yield and yield components in relation to heat units :

The data presented in Table 6 revealed that early sowing exposed to low air temperature and heat units at the beginning of the season which decreased plant height and consequently initiated early balance between vegetative growth, there fore, planting cotton as early as local climatic conditions are favourable is one of the important factors which control the rank growth through the growing season (Table 6). Similar results were obtained by Abdel-Malak *et al.* (1996), Abou El-Nour (2000), Makram *et al.* (2001), Saleh *et al.* (2004), El-Hindi *et al.* (2006) and Abd-El-All (2011). On the other hand, number of open bolls yield per plant and/or per feddan increased infavour of early sowing.

Table 6: The effect of sowing dates and total heat units on growth, yield and yield components of cotton in 2009 and 2010 seasons.

Season	sowing dates	total heat units	node number of 1st sympodium	final plant height (cm)	no. of sympodia/ plant	no. of open bolls/ plant	boll weight (gm)	seed cotton yield/ Plant (gm)	no. of plants at picking/ Fed (1000)	seed cotton yield/fed (kentars)	days of first flower/ plant	days of first open boll / plant
2009	March25	3508	6.20	181.00	25.20	18.75	1.65	30.72	45.94	6.93	79.97	134.60
	April 10	3405	6.20	124.50	25.10	15.30	1.71	26.31	46.20	5.06	71.20	129.95
	April 25	3240	7.37	191.25	24.65	8.65	1.61	13.89	45.98	2.35	68.25	123.45
LSD at 5 %			N.S	N.S	N.S	5.30	N.S	7.69	N.S	1.57	2.99	3.21
2010	March25	3891	6.90	150.25	28.30	21.05	1.96	40.63	44.33	5.93	76.95	126.17
	April 10	3740	6.95	168.50	25.70	17.40	1.77	30.39	44.30	4.75	71.15	129.57
	April 25	3530	7.15	17750	23.20	13.60	1.67	22.78	45.11	3.52	65.80	121.60
LSD at 5 %			NS	11.03	NS	3.68	NS	5.40	NS	1.89	3.06	NS

Similar results were obtained by Abdel- Malak *et al.*, (1996), Abou El Nour (2000), Makram *et al.*, (2001), Saleh *et al.*, (2004), El-Hindi *et al.*, (2006), El- Sayed and Menshawi (2006) and Abd-El All (2011). However, previous results obviously cleared that early sowing fit the cotton plants to full season in suitable climatic window to obtain complete thermal units requirements (Young *et al.*, 1980). These climatic conditions promote flowering early and bring the crop to be picked in suitable time (Makram *et al.*, (2001).

The efficiency use of heat units by cotton plants:

The data in Table 7 cleared that early sowing caused a decrease in the values of heat unit efficiency for producing one open boll, that means the increase in efficiency use of thermal air units. This could be achieved by sowing cotton in the suitable time when the soil temperature at the depth of 20 cm reaches 15 C° at 8 a.m and continued for ten successive days Makram *et al.* (1995). These results are in line with those obtained by Makram *et al.*, (2001).

Finally, it is important to measure the efficiency use of heat units in cotton production, in order to maximize the use of the inputs in cotton fields by using the equation.

Table 7: Effect of sowing dates on the efficiency use of heat units by cotton plant during 2009 and 2010 seasons.

Seasons	Early sowing (hu / boll)	medium sowing (hu/boll)	late sowing (hu/boll)
2009	187.09	222.61	324.66
2010	184.89	214.98	259.61

CONCLUSION

This study cleared the importance of taken in consideration heat units effects on the growth and developing timing of cotton plants for improving the yield quantity and quality. Therefore, in order to increase the efficiency use of the heat units through the growing season, it must bear in the mind the following recommendations:

1. Fitting the cotton plant in suitable climatic window which meet different developmental stages in order to produce higher yields.
2. The previous point maxi mazes the efficiency use of cotton plants to other management practices through the growing season.
3. Thermal unit accumulation also used to predict the crop development.
4. Modifying cotton management practices against undesirable climatic condition such as late sowing, new locations...etc .
5. The selection of new varieties characterized by high rate of carbon dioxide fixation in order to optimize the efficiency use of heat units.
6. Avoiding the problems which face the growth of cotton plants through the season
7. as a result of undesirable climatic condition such as rank growth, thermal inactivation, water stress ... etc

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علاقة الوحدات الحرارية الجوية بنمو نباتات القطن من خلال مواعيد زراعة مختلفة

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أجريت تجربتان حقليتان بمحطة البحوث الزراعية جزيرة شندويل بمحافظة سوهاج في موسمي ٢٠٠٩م و٢٠١٠م لدراسة علاقة الوحدات الحرارية الجوية بنمو وإثمار نباتات القطن صنف جيزة ٩٠ وذلك من خلال ثلاث مواعيد للزراعة وهي ٢٥ مارس ، ١٠ أبريل و ٢٥ أبريل. وكان التصميم المستخدم هو القطاعات الكاملة العشوائية في أربعة مكررات.

وكانت أهم النتائج المتحصل عليها :

١) حصلت نباتات القطن المزروعة متأخرة على وحدات حرارية أكثر من المنزرعة مبكراً عن أعمار ٧٥ ، ١٠٥ و ١٣٥ يوماً من الزراعة وهذا أدى بدوره إلى زيادة طول النبات ، وعدد العقد على النبات والوزن الجاف للنبات ، عدد الأوراق للنبات ومساحة الورقة ، ومعامل مساحة الورقة نتيجة لاستهلاك غالبية هذه الوحدات الحرارية في النمو الخضري ، بينما لم يكن للزراعة تأثير على طول السلامية ومعامل مساحة الورقة عن عمر ١٣٥ يوم وارتفاع عقدة أول فرع ثمرى وعدد الأفرع الثمرية للنبات عند الحصاد .

٢) ازداد عدد الأفرع الثمرية للنبات في حالة الزراعة المبكرة في الأعمار المختلفة لانخفاض في موضع أول فرع ثمري نتيجة لانخفاض درجة حرارة الليل علاوة على إحداث توازن خضري – ثمري مبكراً بعكس الزراعات المتأخرة .

٣) نتيجة لانخفاض درجة الحرارة في بداية الموسم ونقص عدد الوحدات الجوية انخفض عدد الأوراق على النبات في حالة الزراعة المبكرة بالمقارنة بالزراعات المتأخرة ، كما لوحظ نفس الاتجاه بالنسبة لمساحة الأوراق ودليل مساحة الورقة

٤) أدت الزراعة المبكرة إلى زيادة طول الفترة من الزراعة وحتى ظهور أول زهرة مع استهلاك عدد أقل من الوحدات الحرارية ، بينما كان العكس صحيحاً في حالة الزراعة المتأخرة ونفس الاتجاه بالنسبة لتفتح أول لوزة .

٥) ازداد محصول القطن للفدان ومكوناته (عدد اللوز على النبات ، محصول القطن الزهر للنبات) وذلك عند الزراعة المبكرة نتيجة لاستغلال النباتات ، عدد أكبر من الوحدات الحرارية خلال الموسم وتناسقها مع مراحل النمو الخضري والثمري لنباتات القطن بعكس الزراعة المتأخرة التي استغلت الوحدات الحرارية في زيادة النمو الخضري .

٦) ازدادت كفاءة الزراعة المبكرة في استغلال الوحدات الحرارية الجوية في إنتاج محصول عالي حيث احتاجت نباتات القطن المنزرعة مبكراً إلى عدد وحدات حرارية قليلة لتكوين لوزة واحدة متفتحة على النبات بعكس النباتات المنزرعة متأخرا فقد احتاجت إلى عدد وحدات حرارية أكثر لتكوين اللوزة الواحدة .

وتوصى الدراسة أن زراعة صنف القطن جيزة ٩٠ مبكراً فى (٢٥ مراس) تؤدى إلى تحقيق أعلى محصول للفدان بالمقارنة بالزراعة المتأخرة (٢٥ أبريل) تحت ظروف الدراسة.

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