

EFFECT OF IRRIGATION INTERVALS AND DEFOLIANT APPLICATION ON YIELD AND FIBER QUALITY OF GIZA 92 COTTON VARIETY

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By

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ABSTRACT

Two field experiments were conducted at Sakha Station, Cotton Research Institute, Agricultural Research Center, during 2010 and 2011 seasons, to investigate the impact of irrigation interval, defoliant type and defoliation time on the yield, yield components and fiber properties of the Egyptian cotton (*G. barbadense*, L.) variety Giza 92 . Split Split plot design with four replicates was used. The irrigation intervals (I) occupied the main plots as follows:(I₁) normal irrigation (at two- week interval) , normal irrigation (at two week interval) until flowering then increasing time to 4 week interval (I₂) , and four week interval (I₃). The second factor defoliant type (D) occupied the sub-plots with three levels: "Dropp" defoliant- (D₁) , "Prep" defoliant - (D₂), and control spraying with water- (D₃).The third factor, time of defoliant application (T) was distributed randomly in the sub-sub plots as follows: defoliant spray after 60% of bolls open (T₁) , spraying after 70% of bolls open (T₂),spraying after 80% of bolls are open (T₃). The effects of all main factors were significant in both seasons except for the effect of spraying date on the no. of fruiting branches. The significance of the interaction varied according to the cotton trait. The results revealed that the best irrigation treatment is the 15- days interval throughout the growing season. The "Dropp" defoliant generally surpassed the "Prep" defoliant in affecting all characters under study. The application of defoliant after 60% of bolls are open resulted in the highest value of all traits under study except the number of fruiting branches in both seasons. It was concluded that normal irrigation coupled with the application of the defoliant "Dropp" after 60 % of bolls are open had a positive effect on the cotton agronomic traits, cotton yield and cotton fiber characteristics .

Key words: cotton , defoliation, irrigation interval.

1. INTRODUCTION

Defoliation is defined as the application of chemicals to encourage or force cotton leaves to drop from the plant in order to facilitate harvesting. Defoliation function is a balancing act between killing the leaves and not affecting the leaves (Baker *et al.*, 1987). Deciding when to defoliate is a complicated matter because crop maturity, crop condition, current and expected weather conditions and harvest scheduling must be considered (Edmisten ,2006). Phipps *et al.*, (2002) found that delayed defoliation may increase boll rotting or decrease lint and fiber quality due to weathering. Yield may also be reduced, therefore defoliation decisions are a compromise between late season yield gains, timely harvest and defoliant rate (Snipes and Baskin, (1999) and Faircloth *et al.* (2004) noted that maturity was reached 10 to 15 days earlier due to chemical defoliation. Proper timing and

rate of defoliation can significantly increase yield as well as micronaire and other fiber quality traits (Robertson *et al.*, 2003). In contrast, Kelley *et al.* (2000) and Gwathmey and Wyatt (2001) indicated that premature defoliation before 60 % of bolls open may decrease yields and fiber quality. However, Fromme *et al.* (2005) concluded that chemical defoliants such as "Dropp" at 0.45 kg/ha insignificantly affect lint percentage, fiber length, fiber strength and length uniformity ratio. Defoliation is useful when cotton plants face some stresses like drought and high temperature. Also, water stress especially during fruiting stage adversely affected yield and fiber quality (Silvertooth and Galadima 2003 and Zaxos *et al.*, 2012) while,(Jill *et al.*, 2006 and Cetin *et al.*,2011) indicated that variable rate irrigation affected fiber lint yield and quality. Fiber quality parameters of interest are micronaire value, fiber strength, and fiber length properties. In 2001 and

2003, micronaire value was not affected by the rate of irrigation. Fiber strength improved with a decrease in water application in 2001, but was not affected in 2003.

2. MATERIALS AND METHODS

Two field experiments were carried out at Sakha Experimental Station, Cotton Research Institute. Cotton seeds were sown on April 10 and April 7 in 2010 and 2011 seasons, respectively. The experimental unit included 6 ridges (3 meters long and 60 cm wide) representing an area of 10.8 m². Hills were 20 cm apart within the row and seedlings were thinned to 2 plants/hill. Standard agricultural practices were followed throughout the growing season. The objective of the present study was to investigate the effect of irrigation intervals, defoliant types and defoliation time on lint yield, yield components and fiber properties of the Egyptian cotton (*G. barbadense*, L.) variety Giza 92 which represents the extra long staple cotton category. The split split plot design with four replicates was used. The time of irrigation (I) occupied the main plots as follows:

- 1- I₁: normal irrigation every 15 days (two - week interval) .
- 2- I₂: normal irrigation (two - week interval) until flowering , followed by irrigation every 4 weeks.
- 3- I₃: irrigation every four – week interval .

The second factor, defoliant type (D) occupied the sub - plots as follows:

- 1- D₁: "Dropp" defoliant (N-phenyl-N1,2,3-thiadiawol -5-yl-Urea) 50% w.p
- 2- D₂: "Prep" defoliant (Sodium cis-2-chloroacrylate).
- 3- D₃: Control spraying with water .

The third factor, spraying date of defoliant (T) was distributed randomly in the sub-sub plots, as follows:

- 1- T₁: spraying after 60% of bolls are open .
- 2- T₂: spraying after 70% of bolls are open .
- 3- T₃: spraying after 80% of bolls are open.

Dropp was used at the rate of 30 g /fed, and Prep solution was used at 600 cm³ /fed.

The LSD test at the .05 level was used to test the significance of differences among treatment means. Data were subjected to the analysis of variance according to the methods described by Snedecor and Cochran (1982).

The characters were

1-Yield and yield components: at harvest, ten plants were randomly selected from the inner ridges of each sub-plot to measure the following attributes: no. of sympodial branches per plant, no.

of open bolls /plant, average boll weight (g.), cotton yield /plant (g), lint percentage ratio of lint weight to seed cotton weight in the sample expressed as percentage, (lint weight × 100)/seed cotton weight), and seed cotton yield /fed. (Kentar.).

2- Fiber properties

Micronaire value was measured using Micromate instrument according to (ASTM, D3818,1986). While, The HVI instrument system was used to determine fiber upper half mean (mm), fiber strength(g/tex) according to (ASTM: D- 4605 -1986.

3.RESULTS AND DISCUSSION

3.1. Agronomic attributes

3.1.1. Number of sympodial branches

Data pertaining to the number of sympodial branches of Giza 92 variety under the applied treatments in the two Experimental seasons are given in Tables (1, 2 and 3). Results show that the effects of irrigation interval and defoliant type were significant in both seasons. In contrast, the defoliant application time, as well as the first and second order interactions were not significant in both seasons. As to the effect of irrigation interval, normal irrigation every 15 days resulted in the highest number of sympodial branches (14.37 and 13.99) in both seasons. This may be due to that plants exposed to water stress seem to end the growth cycle which negatively affect the no. of sympodial branches. Similar results were reported by Silvertooth and Galadima (2003). As to the sub-main factor (defoliant type), the "Prep" defoliant caused the highest number of sympodial branches (12.66 and 12.51 in 2010 and 2011 seasons, respectively).

3.1.2. Number of open bolls /plant

Data in Tables (1, 2 and 3,) show the effect of irrigation interval, defoliant type and spraying time on the no. of open bolls /plant. It is clear that the effects of these main factors were significant in both seasons, while the significance of the first and the second order interactions varied between seasons. As for the effect of irrigation treatments, normal irrigation exhibited the largest means of open bolls /plant (11.87 and 11.47) due to sufficient water available to the plants at the physiological stage. This decreased shedding and enhanced normal plant growth and increased plant productivity. Results pertaining to defoliant types revealed that the highest numbers of open bolls (13.87 and 12.65) was obtained from Dropp. As to the effect of spraying date, the greatest numbers (13.01 and 11.97) were obtained from

Table(1): The effect of irrigation intervals, defoliant type, and spraying date on no. of sympodia branches, no. of open boll and boll weight for Giza 92 variety in 2010 and 2011 seasons.

Main effects		No. sympodia branches		No. of open bolls		Boll weight (g.)	
		2010	2011	2010	2011	2010	2011
Irrigation intervals	I ¹	14.37	13.99	11.87	11.47	3.49	3.46
	I ²	11.83	11.70	12.78	11.50	3.05	3.04
	I ³	10.97	10.85	13.16	11.86	2.68	2.65
L.S.D 0.05		0.28	0.46	0.13	0.15	0.02	0.04
Defoliant	D ¹	12.66	12.51	13.87	12.65	3.11	3.08
	D ²	12.59	12.23	12.95	12.01	3.08	3.07
	D ³	11.91	11.81	10.99	10.17	3.02	3.00
L.S.D 0.05		0.54	0.58	0.28	0.22	0.02	0.02
Spraying date	T ¹	12.87	12.59	13.01	11.97	3.11	3.10
	T ²	12.34	12.17	12.60	11.62	3.07	3.04
	T ³	11.94	11.78	12.18	11.23	3.03	3.00
L.S.D 0.05		ns	ns	0.32	0.33	0.03	0.02

Table (2):Effect of the first order interaction between irrigation intervals, defoliant type, and spraying date on, no. of sympodia, no.of open boll and boll weight for Giza 92 variety in 2010& 2011.

Character			No. sympodia branches		No. of open bolls		Boll weight (g.)	
Treatment			2010	2011	2010	2011	2010	2011
Irrigation	I ¹	D ¹	14.91	14.32	14.03	12.93	3.53	3.49
		D ²	14.79	14.23	11.92	11.82	3.48	3.47
		D ³	13.42	13.43	9.65	9.64	3.43	3.42
	I ²	D ¹	11.88	11.96	13.58	12.21	3.07	3.06
		D ²	11.82	11.62	13.30	12.08	3.07	3.06
		D ³	11.78	11.53	11.47	10.21	3.01	3.00
I ³	D ¹	11.20	11.24	13.99	12.79	2.74	2.70	
	D ²	11.16	10.84	13.63	12.14	2.70	2.70	
	D ³	10.54	10.47	11.84	10.66	2.61	2.60	
Irrigation	I ¹	T ¹	14.73	14.28	12.38	11.89	3.53	3.52
		T ²	14.43	14.02	11.72	11.45	3.47	3.44
		T ³	13.93	13.69	11.51	11.06	3.45	3.42
	I ²	T ¹	12.47	12.37	13.15	11.79	3.07	3.08
		T ²	11.70	11.60	12.84	11.54	3.05	3.04
		T ³	11.30	11.14	12.34	11.17	3.03	3.01
	I ³	T ¹	11.42	11.13	13.50	12.25	2.73	2.72
		T ²	10.89	10.91	13.26	11.87	2.71	2.66
		T ³	10.59	10.51	12.71	11.48	2.61	2.58
Defoliant	D ¹	T ¹	13.26	12.74	14.40	13.08	3.16	3.16
		T ²	12.59	12.54	13.84	12.69	3.11	3.07
		T ³	12.13	12.23	13.35	12.17	3.07	3.01
	D ²	T ¹	12.95	12.64	13.30	12.36	3.14	3.13
		T ²	12.47	12.14	13.02	12.07	3.08	3.05
		T ³	12.34	11.91	12.53	11.62	3.03	3.02
	D ³	T ¹	12.41	12.39	11.33	10.49	3.04	3.03
		T ²	11.97	11.84	10.96	10.10	3.03	3.01
		T ³	11.37	11.20	10.68	9.92	2.98	2.97
L.S.D 0.05	ID	ns	ns	0.49	0.38	ns	ns	
	IT	ns	ns	0.56	ns	ns	0.04	
	DT	ns	ns	ns	ns	ns	0.04	

early spraying at 60% of open bolls in both seasons. In contrast, the lowest values (12.18 and 11.23) were obtained from spraying at 80% open bolls in both seasons. This may be due to the increase in boll rot and insect attack from late defoliation. This affected the normal growth of the boll and caused large number to remain closed. These results agree with the results obtained by Phipps *et al.*, (2002). The interaction between irrigation interval and the defoliant type, show that the normal irrigation and application of the defoliant "Dropp" resulted in the highest number of open bolls per plant (14.03 and 12.93) in the first and second seasons, respectively.

As to the effect of the interaction between irrigation interval and defoliant application date, the highest value (12.38) of open bolls per plant was obtained from "Dropp" defoliant applied after 60% of bolls open only in 2010 season.

3.1.3. Boll weight

Data in Tables (1, 2 and 3) show that the effects of the studied main factors were significant in both seasons. However, the first and the second order interaction were not significant in both seasons, except for the interaction between irrigation interval and application date and the interaction between defoliation type and application date in 2011 season only. Concerning the effect of the irrigation treatments, normal irrigation resulted in the heaviest means of boll weight in two seasons (3.49 and 3.46 g) respectively. In contrast, the four-week interval (I_3) treatment gave the lowest boll weight (2.68 and 2.65 gm) in both seasons. Results related to the defoliant type revealed that the highest values of boll weight (3.11 and 3.08 g) were obtained from "Dropp". On the other hand, the lowest boll weights (3.08 and 3.06 g) were obtained from the defoliant "Prep" in both seasons, respectively compared to the control. As to the effect of spraying date, the highest boll weight (3.11 and 3.10 gm) were obtained from early spraying at 60% open bolls in both seasons. In contrast, the lowest values (3.03 and 3.00 g) were obtained from spraying at 80% open bolls in both seasons. This may be due to the fact that late defoliation increased boll rot and insect damage. reduce the boll weight, These results agree with the results obtained by Phipps *et al.* (2002). As to the effect of the interaction between irrigation interval and application date, the highest boll weight (3.52 g) was obtained when "Dropp" defoliant was applied after the opening of 60% of bolls in 2011 season. The interaction between the defoliation type and

the application date resulted in the highest boll weight (3.16 g) when "Dropp" defoliant was applied after the opening of 60% of bolls in 2011 season only. In contrast, the lowest value (3.02 g.) was obtained from the application of "Prep" after 80% of bolls were open.

3.1.4. Seed cotton yield/plant

Results pertaining to the seed cotton yield/plant are presented in Tables (4), and (6). It is obvious that the effects of irrigation interval, defoliant type and spraying time on the seed cotton yield /plant were significant in both seasons, but the significance of the first order interactions varied from season to another. The second-order interaction was not significant in both seasons. Concerning the effect of irrigation treatments, normal irrigation (I_1) resulted in the highest values of seed cotton yield /plant (32.36 and 31.99 g.) in both seasons, respectively. In contrast, the lowest values (28.98 and 28.70g.) were obtained from the third irrigation treatment (I_3). In conclusion, cotton seed yield /plant decreased as the irrigation interval increased, which agrees with the results obtained by Silvertooth and Galadima (2003); Zaxos *et al.* (2012) while, Jill *et al.* (2006); Cetin *et al.* (2011). This may be due to the fact that cotton plants irrigated normally are characterized by strong vegetative growth, which results in a great accumulation of the plant dry matter, and enhanced productivity. Regarding the effect of the defoliant type on seed cotton yield /plant, the defoliant "Dropp" surpassed the defoliant "Prep" (32.08 and 31.62g) vs. (31.99 and 30.97g) in both seasons, respectively. Spraying the defoliant after 60 % of open bolls enhanced seed cotton yield /plant (32.41 and 31.73g in 2010 and 2011 seasons, respectively), due to the expected decrease in boll rot and boll damage by weather and insects. The interaction between irrigation and defoliant types, data in Table (5) show that the maximum seed cotton yield /plant (33.84g.) in 2010 season was obtained under normal irrigation using the defoliant "Dropp". The interaction between irrigation treatments and defoliant application date shows that normal irrigation of cotton and spraying the defoliant when 60% of bolls are open had a good influence on seed cotton yield/plant in 2011 season.

3.1.5. Seed cotton yield /feddan

Tables (4, 5 and 6) show that the effects of the irrigation interval, defoliant type and spraying time on seed cotton yield were significant in both seasons. In contrast, the effects of the interactions were not significant in both seasons, except for the

Table (3): Effects of the second order interactions between irrigation intervals, defoliant type, and spraying date on no. of sympodia, no. of open boll and boll weight for Giza 92 cotton variety in 2010 and 2011 seasons.

Character			No. sympodia branches		No. of open bolls		Boll weight (g.)	
Treatment			2010	2011	2010	2011	2010	2011
Irrigation 2	D¹	T¹	15.10	14.80	14.80	13.50	3.63	3.62
		T²	15.00	14.33	13.73	12.87	3.50	3.43
		T³	14.63	13.83	13.57	12.43	3.47	3.42
	D²	T¹	15.40	14.33	12.40	12.23	3.52	3.52
		T²	14.63	14.20	11.77	11.90	3.47	3.46
		T³	14.33	14.17	11.60	11.33	3.46	3.42
	D³	T¹	13.70	13.70	9.93	9.93	3.45	3.43
		T²	13.67	13.53	9.67	9.57	3.44	3.42
		T³	12.90	13.07	9.37	9.43	3.41	3.41
	D¹	T¹	13.03	12.10	14.03	12.53	3.10	3.11
		T²	11.73	12.03	13.63	12.23	3.06	3.05
		T³	10.87	11.73	13.06	11.87	3.05	3.01
	D²	T¹	11.93	12.43	13.60	12.37	3.10	3.10
		T²	11.77	11.53	13.43	12.17	3.06	3.06
		T³	11.77	10.90	12.87	11.70	3.05	3.03
	D³	T¹	12.47	12.57	11.83	10.47	3.03	3.02
		T²	11.60	11.23	11.47	10.23	3.02	3.00
		T³	11.27	10.79	11.10	9.93	2.99	2.99
	D¹	T¹	11.67	11.33	14.37	13.20	2.76	2.76
		T²	11.03	11.27	14.17	12.97	2.76	2.73
		T³	10.90	11.13	13.43	12.20	2.70	2.61
	D²	T¹	11.53	11.17	13.90	12.47	2.79	2.76
		T²	11.00	11.70	13.87	12.13	2.72	2.63
		T³	10.93	10.67	13.13	11.83	2.59	2.60
	D³	T¹	11.07	10.90	12.23	11.07	2.65	2.65
		T²	10.63	10.77	11.73	10.50	2.64	2.62
		T³	9.93	9.73	11.57	10.40	2.55	2.52
L.S.D 0.05	IDT	ns	ns	ns	ns	ns	ns	

Table(4): The effect of irrigation intervals, defoliant type, and spraying date on lint percentage, plant yield and seed cotton yield, for Giza 92 variety in 2010 and 2011 seasons.

Main effects		Lint Percentage%		Plant Yield(g.)		Seed cotton yield(k/f)	
		2010	2011	2010	2011	2010	2011
Irrigation intervals	I¹	35.46	35.30	32.36	31.99	10.93	10.99
	I²	31.58	31.00	29.75	28.61	10.03	9.80
	I³	29.75	28.45	28.98	28.70	8.09	8.45
L.S.D 0.05		0.14	0.09	0.36	0.31	0.12	0.13
Defoliant	D¹	32.98	32.25	32.08	31.62	10.33	10.37
	D²	32.10	31.45	31.99	30.97	10.30	10.33
	D³	31.71	31.12	27.03	26.70	8.41	8.51
L.S.D 0.05		0.15	0.05	0.51	0.53	0.20	0.19
Spraying date	T¹	32.41	31.73	31.16	30.51	9.98	9.98
	T²	32.28	31.63	30.08	29.83	9.58	9.67
	T³	32.10	31.47	29.85	28.95	9.49	9.57
L.S.D 0.05		0.11	0.05	0.53	0.53	0.20	0.20

Table (5): Effects of the first order interactions between irrigation intervals, defoliant type, and spraying date on lint percentage, plant yield and seed cotton yield, for Giza 92 cotton variety in 2010 and 2011 seasons.

Character			Lint Percentage%		Plant Yield(g)		Seed Cotton Yield(k/f)	
Treatment			2010	2011	2010	2011	2010	2011
Irrigation	I ¹	D ¹	35.71	35.62	33.84	33.41	11.49	11.53
		D ²	35.38	35.21	33.60	33.16	11.40	11.44
		D ³	35.28	35.06	29.65	29.41	9.89	10.02
	I ²	D ¹	32.52	31.48	31.57	30.89	10.73	10.48
		D ²	31.52	31.29	31.56	29.33	10.72	10.47
		D ³	30.70	30.48	26.13	25.61	8.66	8.43
	I ³	D ¹	30.72	29.67	30.83	30.58	8.80	9.16
		D ²	29.38	27.85	30.80	30.43	8.78	9.10
		D ³	29.16	27.83	25.31	25.09	6.69	7.07
Irrigation	I ¹	T ¹	35.53	35.40	33.60	32.95	11.40	11.37
		T ²	35.48	35.31	31.92	31.69	10.76	10.87
		T ³	35.36	35.19	31.57	31.34	10.62	10.74
	I ²	T ¹	31.71	31.23	30.34	29.40	10.26	9.97
		T ²	31.61	31.09	29.53	29.22	9.95	9.75
		T ³	31.42	30.92	29.38	27.21	9.89	9.65
	I ³	T ¹	30.00	28.55	29.53	29.19	8.30	8.63
		T ²	29.74	28.48	28.79	28.59	8.02	8.40
		T ³	29.52	28.31	28.62	28.32	7.95	8.30
Defoliant	D ¹	T ¹	33.13	32.43	32.80	32.09	10.61	10.54
		T ²	33.08	32.30	31.81	31.49	10.24	10.33
		T ³	32.74	32.03	31.63	31.29	10.17	10.29
	D ²	T ¹	32.28	31.55	32.76	32.07	10.59	10.62
		T ²	32.07	31.49	31.63	31.40	10.17	10.22
		T ³	31.94	31.31	31.57	29.46	10.14	10.16
	D ³	T ¹	31.83	31.20	27.92	27.38	8.75	8.80
		T ²	31.59	31.09	26.80	26.61	8.33	8.46
		T ³	31.62	31.06	26.37	26.12	8.16	8.25
L.S.D 0.05	ID	0.27	0.09	0.88	ns	ns	0.33	
	IT	ns	ns	ns	0.91	0.35	ns	
	DT	0.20	0.08	ns	ns	ns	ns	

effect of the interaction between irrigation interval and defoliant type in 2011 season, and the interaction between irrigation interval and defoliant application date in 2010 season. As for the effect of irrigation interval, the first irrigation treatment (I₁) resulted in the highest seed cotton yield (10.93 k/f and 10.99k/f in 2010 and 2011 seasons, respectively). Similar results were obtained by Silvertooth and Galadima (2003) and Zaxos *et al.* (2012), Jill *et al.* (2006) and Cetin *et al.* (2011). Similar trend was shown by defoliant type, where "Dropp" gave the highest seed yield in both seasons. Application of the recommended dose of "Dropp" after 60% of bolls are open provided the highest yield of (9.98 k/f and 9.98 k/f) in 2010 and 2011 seasons, respectively. This yield increase may be due to the increased boll

weight from early defoliation as mentioned above which is in harmony with Phipps *et al.* (2003) who found that delayed defoliation may increase boll rot or possible damage or loss of lint and fiber quality due to weathering. Yield can also be reduced, therefore defoliation decisions are a compromise between late season yield gains. The interaction between irrigation interval and defoliant type shows that applying the normal irrigation interval with the defoliant "Dropp" surpassed the other treatment in seed cotton yield in the first season (11.53k/f). The interaction between irrigation interval and application date showed that the first irrigation and the application of 60% boll open gave the highest seed cotton yield (11.40kf) in 2010 season only.

Table (6): Effects of the second order interaction between irrigation intervals, defoliant type and spraying date on lint percentage, plant yield l(g.)and seed cotton yield, for Giza 92 variety in 2010 and 2011 seasons

Character			Lint Percentage%		Plant Yield(g)		Seed cotton Yield (k/f)	
Treatments			2010	2011	2010	2011	2010	2011
Irrigation 1	D¹	T¹	35.80	35.77	35.00	34.03	11.93	11.76
		T²	35.77	35.63	33.40	33.17	11.32	11.43
		T³	35.57	35.47	33.13	33.03	11.22	11.38
	D²	T¹	35.47	35.30	35.00	34.33	11.93	11.88
		T²	35.40	35.27	32.90	32.63	11.13	11.23
		T³	35.27	35.07	32.90	32.53	11.13	11.19
	D³	T¹	35.33	35.13	30.80	30.50	10.33	10.46
		T²	35.27	35.03	29.47	29.26	9.82	9.95
		T³	35.23	35.00	28.67	28.47	9.52	9.65
	D¹	T¹	32.63	31.63	31.90	31.13	10.85	10.49
		T²	32.60	31.53	31.50	30.93	10.70	10.48
		T³	32.33	31.27	31.30	30.60	10.63	10.46
	D²	T¹	31.60	31.43	32.37	31.27	11.03	10.81
		T²	31.60	31.33	31.17	31.20	10.57	10.36
		T³	31.37	31.10	31.13	25.53	10.56	10.23
	D³	T¹	30.90	30.63	26.76	25.80	8.90	8.60
		T²	30.63	30.40	25.93	25.53	8.58	8.40
		T³	30.57	30.40	25.70	25.50	8.49	8.28
	D¹	T¹	30.97	29.90	31.50	31.13	9.05	9.37
		T²	30.87	29.73	30.53	30.37	8.68	9.08
		T³	30.33	29.37	30.47	30.23	8.66	9.03
	D²	T¹	29.77	27.91	30.90	30.60	8.82	9.17
		T²	29.20	27.88	30.83	30.37	8.80	9.08
		T³	29.17	27.75	30.67	30.33	8.73	9.07
	D³	T¹	29.25	27.85	26.20	25.83	7.03	7.35
		T²	29.17	27.83	25.00	25.03	6.58	7.05
		T³	29.07	27.80	24.73	24.40	6.47	6.81
L.S.D 0.05	IDT	0.34	ns	ns	ns	ns	ns	

Table(7): The effect of irrigation intervals ,defoliant type, and spraying date on upper half mean length, fiber strength and micronaire value for Giza 92 cotton variety in 2010 and 2011 seasons.

Main effects		UHM(mm)		Fiber strength (g.tex)		Micronaire value	
		2010	2011	2010	2011	2010	2011
Irrigation intervals	I¹	34.71	34.56	48.73	48.80	3.87	3.81
	I²	32.90	31.97	46.02	45.04	3.25	3.08
	I³	32.18	30.79	44.94	44.60	3.12	3.07
L.S.D 0.05		0.10	0.11	0.41	0.24	0.06	0.07
Defoliant	D¹	33.55	32.66	47.01	46.51	3.55	3.48
	D²	33.40	32.53	46.56	46.26	3.44	3.33
	D³	32.85	32.13	46.12	45.66	3.24	3.15
L.S.D 0.05		0.07	0.12	0.19	0.19	0.06	0.08
Spraying date	T¹	33.42	32.68	47.15	46.84	3.57	3.49
	T²	33.28	32.43	46.75	46.22	3.42	3.31
	T³	33.09	32.21	45.79	45.37	3.25	3.15
L.S.D 0.05		0.08	0.09	0.28	0.18	0.05	0.05

3.1.6. Lint percentage

Data in Tables (4,5 & 6), show that the effects of the main factors and the first order interactions on lint percentage were generally significant in both seasons except for the effects of the interaction between irrigation interval and time of application. The effect of the other interactions was significant in the first season only. Normal irrigation at 15 day intervals gave the highest lint percentage in both seasons (35.46% and 35.30%), respectively. The defoliant "Dropp" increased lint percentage compared with "Prep" defoliant in both seasons (32.98% and 32.25% respectively), as indicated by Faircloth *et al.*, 2004. With reference to defoliant spraying time, spraying after 60% of open bolls exceeded other application treatments in lint percentage (32.41% and 31.73%), respectively in both seasons,. According to the effect of the interaction between irrigation interval and defoliant type the highest lint percentages were 35.71% and 35.62% in both seasons. The interaction between defoliant type and spraying time increased the lint percentage ., (33.13% and 32.43%) respectively in 2010 and 2011 seasons. Also, the effect of the interaction between irrigation interval, defoliant type and time of application increased lint percentage (35.80%) in 2010 season.

3.1.7. Fiber properties

3.1.7. 1. Fiber length

Data pertaining to fiber length (mm) of Giza 92 variety under the applied treatments in the two experimental seasons are given in Tables(7,8 &9). The results show that the effect of irrigation interval, defoliant type, defoliant application time and their interactions were significant in both seasons except for the interaction between defoliant type and application time in 2011 season only. Concerning the effect of irrigation treatments, normal irrigation (I_1) resulted in the highest fiber length (34.71 and 34.56 mm respectively) in both seasons,. In contrast, the lowest values (32.18 and 30.79 mm) were obtained by the third irrigation treatment (I_3). In conclusion, fiber length decreased as the irrigation interval increased. These results are in line with those obtained by Silvertooth & Galadima (2002), and Zaxos *et al.* (2012) while (Jill *et al.* (2006). , and Cetin *et al.*,2011) This may be due to the fact that cotton plants irrigated normally are characterized with strong vegetative growth, resulting in greater accumulation of dry matter, which enhances cotton fiber length. Regarding the effect of the defoliant type on fiber length, the defoliant "Dropp" surpassed the defoliant "Prep"

(33.55 and 32.66 mm.) vs. (33.40and 32.53 mm) in both seasons, respectively. These results are in agreement with Fromme *et al.* (2005) who concluded that the chemical defoliant such as "Dropp" had no significant effect on fiber length. The effect of the application date shows that spraying the defoliant after 60 % of bolls are open enhances fiber length (33.42 and 32.68mm in 2010 and 2011 seasons, respectively) as compared to the other treatments due to the decreased occurrence of boll rot and damage by weather and insects. As for the effect of the interaction between irrigation treatments and defoliant type treatments, the data in Table (8) indicate that the maximum fiber length (34.83 and 34.76 mm) was obtained from normal irrigation and using the defoliant "Dropp". Concerning the effect of the interaction between irrigation treatments and the defoliant application date, normal irrigation coupled with spraying defoliant when 60% bolls are open had a favorable influence on fiber length in both seasons (34.84 and 34.71 mm). The interaction between defoliant type and defoliant application date showed that spraying "Dropp" defoliant at 60 % open bolls gave the greatest value of fiber length (32.85mm.) in 2011 season. The interaction between irrigation interval, defoliant type and defoliant application date showed that the greatest fiber length (34.90 and 34.83 mm) was obtained under normal irrigation and spraying "Dropp" defoliant after 60 % of bolls are open in both 2010 and 2011 seasons. On the contrary, irrigation at four-week interval and spraying "Prep" defoliant after 80 % of bolls are open decreased fiber length to 31.27 and 29.73 mm in 2010 and 2011 seasons, respectively.

3.1.8.Fiber strength

Results in Tables (7, 8 and 9) show that fiber strength (g/tex) was significantly affected by all the factors under the study and their interactions were significant in both seasons. Concerning the main factor (irrigation interval) the first irrigation treatment (two- week interval) gave the strongest fibers (48.73and 48.80g/tex) for both seasons. These results are in harmony with (Zaxos *et al.*, 2012). With reference to the second factor (defoliant type), "Dropp" defoliant surpassed "Prep" defoliant in fiber strength (47.01and 46.51g/tex. in 2010 and 2011 seasons, respectively. These results are in agreement with Fromme *et al.* (2005) who concluded that chemical defoliant had no significant effect on fiber strength due to using "Dropp" as a

Table (8):Effect of the first order interaction between irrigation intervals , defoliant type, and spraying date on upper half mean, strength and micronaire value for Giza 92 cotton variety in 2010 and 2011.

Character			UHM(mm)		Fiber strength (g.tex)		Micronaire value	
Treatment			2010	2011	2010	2011	2010	2011
Irrigation	I ¹	D ¹	34.83	34.76	49.19	49.12	3.96	3.93
		D ²	34.74	34.47	48.67	49.11	3.93	3.83
		D ³	34.57	34.46	48.33	48.16	3.72	3.66
	I ²	D ¹	33.29	32.07	46.70	45.63	3.40	3.23
		D ²	32.92	31.99	46.16	45.13	3.26	3.08
		D ³	32.49	31.86	45.22	44.38	3.10	2.94
	I ³	D ¹	32.53	31.17	45.16	44.81	3.30	3.02
		D ²	32.51	31.15	44.87	44.54	3.14	3.08
		D ³	31.49	30.06	44.81	44.44	2.91	2.86
Irrigation	I ¹	T ¹	34.84	34.71	49.33	49.63	3.97	3.95
		T ²	34.70	34.53	48.93	48.81	3.83	3.75
		T ³	34.60	34.43	47.92	47.94	3.81	3.72
	I ²	T ¹	33.14	32.38	46.78	45.80	3.42	3.24
		T ²	32.91	31.93	46.32	45.29	3.28	3.11
		T ³	32.65	31.61	44.97	44.06	3.06	2.90
	I ³	T ¹	32.28	30.97	45.36	45.11	3.32	3.29
		T ²	32.24	30.83	45.00	44.57	3.14	3.08
		T ³	31.01	30.57	44.48	44.12	2.89	2.83
Defoliant	D ¹	T ¹	33.65	32.85	47.37	46.91	3.59	3.57
		T ²	33.57	32.72	47.03	46.49	3.58	3.45
		T ³	33.42	32.41	46.64	46.16	3.49	3.41
	D ²	T ¹	33.53	32.72	47.07	46.94	3.55	3.46
		T ²	33.48	32.53	46.88	46.35	3.44	3.34
		T ³	33.19	32.36	45.73	45.49	3.34	3.19
	D ³	T ¹	33.08	32.48	47.02	46.69	3.58	3.46
		T ²	32.81	32.04	46.35	45.82	3.23	3.15
		T ³	32.66	31.86	45.00	44.47	2.92	2.86
L.S.D 0.05	ID	0.13	0.20	0.33	0.34	0.14	0.13	
	IT	0.13	0.15	0.48	0.31	ns	ns	
	DT	ns	0.15	0.48	0.31	0.09	0.09	

defoliant. The defoliant spraying time showed that spraying after 60% of bolls open usually resulted in the maximum values of fiber strength (47.15 and 46.84g/tex in both seasons) .These results are in line with Snipes and Baskin, (1999) and Phipps *et al.*, (2002). The effect of the interaction between irrigation intervals and defoliant type, showed that the interaction between the first irrigation treatment and "Dropp" defoliant gave the highest fiber strength (49.19 and 49.12 g/tex.in both seasons, respectively). As for the interaction between irrigation interval and the application time, the interaction between the first irrigation and the application of defoliant after 60% open bolls gave the highest fiber strength values (49.33 and 49.63(g/tex.) in both seasons) . The second order interaction among the three factors (Table 9) showed that spraying Giza 92 variety with "Dropp" defoliant after 60 % of bolls are open

with normal irrigation (15 day intervals) increased fiber strength to 49.67and 49.90 g/tex in both seasons, respectively .

3.1.9. Micronaire value

Data presented in Tables (7, 8 and 9) clearly show that micronaire values for all the factors under study and their interactions were significant in both seasons, except for the interaction between irrigation interval and spraying time. Concerning irrigation interval, the first irrigation treatment (two- week interval) gave the highest micronaire values (3.87 and 3.81) in both seasons. These results are in harmony with (Zaxos *et al.*, 2012). With reference to the secondary factor (defoliant type) "Dropp" defoliant surpassed "Prep" defoliant in micronaire values (3.55 and 3.48) in 2010 and 2011 seasons, respectively. With respect to defoliant spraying time, spraying after 60% of bolls open usually exhibited the highest micronaire values (3.57 and 3.49) in both seasons,

Table (9): Effect of the second order interactions between irrigation intervals, defoliant type, and spraying date on upper half mean, fiber strength and micronaire value for Giza 92 cotton variety in 2010 and 2011 seasons.

Character			UHM(mm)		Fiber strength (g.tex)		Micronaire value	
Treatment			2010	2011	2010	2011	2010	2011
Irrigation 2	D ¹	T ¹	34.90	34.83	49.67	49.90	3.97	3.97
		T ²	34.90	34.83	49.13	48.77	3.97	3.93
		T ³	34.70	34.60	48.77	48.70	3.93	3.90
	D ²	T ¹	34.80	34.53	49.00	49.67	3.97	3.90
		T ²	34.73	34.43	49.00	49.00	3.93	3.83
		T ³	34.70	34.43	48.00	48.67	3.90	3.77
	D ³	T ¹	34.83	34.77	49.33	49.33	3.97	3.97
		T ²	34.47	34.33	48.67	48.67	3.60	3.50
		T ³	34.40	34.27	47.00	46.47	3.60	3.50
	D ¹	T ¹	33.47	32.43	47.03	45.70	3.47	3.33
		T ²	33.27	32.07	46.57	45.63	3.43	3.23
		T ³	33.13	31.70	46.50	45.57	3.30	3.13
	D ²	T ¹	33.17	32.37	46.90	46.03	3.37	3.20
		T ²	33.07	32.06	46.83	45.66	3.30	3.13
		T ³	32.53	31.57	44.73	43.70	3.10	2.90
	D ³	T ¹	32.77	32.33	46.40	45.67	3.43	3.20
		T ²	32.40	31.67	45.57	44.57	3.10	2.97
		T ³	32.30	31.57	43.70	42.90	2.77	2.67
	D ¹	T ¹	32.63	31.30	45.40	45.13	3.33	3.40
		T ²	32.63	31.27	45.40	45.07	3.33	3.20
		T ³	32.33	30.43	44.67	44.23	3.23	3.20
	D ²	T ¹	32.57	31.27	45.33	45.07	3.30	3.27
		T ²	32.53	31.10	44.80	44.40	3.10	3.07
		T ³	32.43	31.07	44.47	44.10	3.03	2.90
D ³	T ¹	31.63	30.33	45.33	45.07	3.33	3.20	
	T ²	31.57	30.13	44.80	44.23	3.00	2.97	
	T ³	31.27	29.73	44.30	44.03	2.40	2.40	
L.S.D 0.05		IDT	0.24	0.26	0.84	0.61	0.15	0.15

which agrees with Snipes and Baskin (1999). The effect of the interaction between irrigation intervals and defoliant types, data in Table (8) indicate that the interaction between the first irrigation treatment and "Dropp" defoliant gave the highest micronaire values (3.96 and 3.93) in both seasons. The interaction between irrigation interval and application time, as well as the interaction between the first irrigation and the application of defoliant after 60% open bolls gave the highest micronaire values (3.97 and 3.95) in 2010 and 2011 seasons, respectively. The second order interaction among the three factors showed that spraying Giza 92 variety with the "Dropp" defoliant after 60 % of bolls open with normal irrigation (15 day intervals) surpassed the other interactions in micronaire values (3.97 and 3.97). It is worth mentioning that micronaire values incorporate both fineness and maturity. Fiber fineness is a genetic trait influenced by genotype, while maturity is affected by environment.

Accordingly the variation between the treatments expresses maturity.

It could be concluded applying "Dropp" defoliant after 60 % of bolls are open, coupled with normal irrigation gave the highest values of cotton agronomic and yield characters, in addition to the best fiber quality.

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تأثير فترات الري ومسقطات الأوراق على محصول القطن الزهرو جودة الألياف لصنف القطن جيزة 92

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ملخص

أقيمت تجربتان بمحطة بحوث سخا تابعة لمعهد بحوث القطن موسمي 2010 و 2011 بهدف دراسة تأثير فترات الري ومسقطات الأوراق وميعاد إضافتها على المحصول ومكوناته وبعض صفات التبله للصنف جيزة 92 . استخدم تصميم القطع المنشقه مرتين في أربع مكررات حيث تم وضع فترة الري في القطع الرئيسي بثلاث مستويات، الأول هو الري كل 15 يوم والثاني الري كل 15 يوم حتى التزهير ثم كل أربع أسابيع حتى نهاية الموسم والثالث هو الري كل أربع أسابيع حتى نهاية الموسم . كما تم وضع نوع المسقط في القطع المنشقه الأولى في ثلاث معاملات الأولى هي مسقط الأوراق "دروب" والثانية مسقط الأوراق "برب" والثالثة معاملة مقارنة الرش بالماء بينما تم توزيع ميعاد الرش عشوائيا في القطع المنشقه الثانيه في ثلاث مستويات هي الرش عند 60% من تفتح اللوز والثانيه الرش عند 70% من تفتح اللوز والثالثة الرش عند 80% من تفتح اللوز . وكانت أهم النتائج ما يلي:

أن تأثير كل العوامل الرئيسييه تحت الدراسه كان معنويا في الموسمين على جميع الصفات فيما عدا صفة عدد الأفرع الثمريه في موسم 2011 . بينما إختلفت معنوية التفاعل بين العوامل حسب الصفة ، وظهر أن أفضل معاملة ري القطن هي الري كل 15 يوم طوال موسم الزراعة ، كما تفوق مسقط الأوراق "دروب" على المسقط "برب" في كل الصفات تحت الدراسه فيما عدا صفة عدد الأفرع الثمريه في موسم 2011 حيث لم يكن هناك تأثير معنوي . ووجد أن رش المسقط عند تفتح 60% من اللوز اعطى اعلى قيم لميعاد الرش في كل الصفات تحت الدراسه . ولذلك نوصي بالاتي :

1- ري القطن كل (15) يوما طوال الموسم . 2- استخدام مسقط الأوراق "دروب". 3- رش المسقط عند تفتح 60% من اللوز .
وبذلك يمكن الحصول على أفضل صفات خضرية وثمرية ، وصفات جودة الألياف.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (64) العدد الرابع (أكتوبر 2013): 358-368.