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RESPONSE OF COTTON CULTIVAR GIZA 83 TO FOLIAR APPLICATION OF ETHREL (ETHEPHON) IN LOW CONCENTRATIONS UNDER LATE PLANTING CONDITIONS

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ABSTRACT

The present study was carried out at Mallawi Agric. Res. Station, Minia, in 2001 and 2002 seasons to study the effect of foliar application of ethrel (ethephon) in low concentrations (0, 10, 20 and 40 ppm) at squaring stage or at early flowering stage on late sown cotton plants of Giza 83 cultivar.

The obtained results showed that, in comparison with the control, ethrel tended to decrease plant height, leaves content of chlorophyll and number of days to first open boll with increasing the reduction in these traits as ethrel concentration increased. On the other hand, all ethrel concentrations, in general, increased leaves content of sugars, number of sympodia, flowers, and open bolls per plant, boll retention%, earliness%, and seed cotton yield per faddan, however, all of these traits were significantly increased over the control only by 10 or 20 ppm which gave the highest yield and the best results in general. Fiber properties were not affected by ethrel treatments.

Both time of application and the interaction between time of application and ethrel concentration had almost no marked effects on plant growth and yield.

It could be concluded that treatment of late sown cotton plants with 10 or 20 ppm of ethrel at either squaring stage or early flowering stage improved the plant fruiting performance and yield under late planting conditions.

INTRODUCTION

It is general knowledge that cotton plant grows vegtatively and develops fruit simultaneously which gives rise the competition between vegetative and reproductive growth on photoassimelates and nutrients. This may make it difficult to maintain the balance between vegetative growth and fruit development, which is essential for getting maximum cotton yield, particularly when climatic conditions encourage the plant vegetative growth like under late planting conditions. High cotton yield is associated with directing plant resources toward fruiting sinks at the formation of sufficient level of vegetative growth that can serve as effective assimilates supplier. Climatic factors, especially temperature, have profound effects on plant growth and crop development. Planting date influences cotton growth and productively by changing the in-season sequence of the environmental conditions. With delaying cotton sowing, temperature associated with plant growth becomes higher which induces plant growth through putting plant metabolic energy into the formation of new vegetative structures, which may create a developmental imbalance trouble. Both fruiting capacity and efficiency of late cotton plantings are often depressed due to the higher competition of vegetative growth, limited time for full fruiting expression, and unsuitable late season environmental conditions for crop maturity. Therefore, it has long been recommended that cotton sowing should be as early as climatic conditions permit. Yet, late cotton planting is still increasing common which emphasizes the need for physiological treatments that could modify the metabolic pathway of cotton plant and improve its fruiting performance under late planting conditions.

Ethrel (2-chloroethyl-phosphoric acid) is an ethylene-releasing substance and is probably the most widely used plant growth regulator in agriculture. Ethrel (ethephon) is regarded as "liquid ethylene" (Abeles *et al.*, 1992b) and when it is applied to plants, it breaks down, acts as a direct source of ethylene, and elicits responses identical to those induced by ethylene gas itself (Grodzinski and Woodrow, 1989). Ethylene is a simple hydrocarbon compound that affects many, if not all, aspects of plant metabolism at the molecular, cellular, and whole-plant levels. Such gaseous hormone plays important roles in biological signaling in plant physiology (Chang and Stadler, 2001). Ethylene-mediated signal transudation leads to induction and expression of a set of genes related to senescence and ripining promotion, several stresses tolerance and plant defense mechanisms (He *et al.*, 2001; Pieterse *et al.*, 2001; and Klee & Clark, 2002).

It has been demonstrated that ethylene has direct or indirect effects on several biochemical and physiological processes, it inhibits photosynthesis and transpiration, via inducing stomata closure, but it increases respiration (Abeles *et al.*, 1992a), it alters assimilates translocation by reducing the upward translocation toward the apical meristem and increasing the downward translocation toward roots (Grodzinski and Woodrow, 1989; and Abeles *et al.*, 1992a). Ethylene (ethephon) mediates changes in levels and actions of other phytohormones as it reduces auxins, gibberellins and cytokinins levels but increases absisic acid level (Abeles *et al.*, 1992a and Bondok *et al.*, 1994), inhibits auxin transport, induces auxin conjugation and degradation (Abeles *et al.*, 1992a). Also, ethrel (ethephon) was found to decrease chlorophyll content but to increase reducing sugars and total soluble sugars in cotton leaves (Bondok, 1986; Bondok *et al.*, 1994 and Wahdan & Wassel, 2000).

Also, ethylene (ethephon) affects plant growth and development as it inhibits shoot apex growth and reduces plant height (Grodzinski & Woodrow, 1989 and Abeles *et al.*, 1992b), stimulates lateral growth and bud break by inhibiting apical dominance (Abeles *et al.*, 1992a), increases number of fruiting branches (Bondok *et al.*, 1994), induces root hair and lateral roots growth (Abeles *et al.*, 1992a).

It has been shown that ethrel increased seed cotton yield by increasing numbers of flowers and open bolls per plant, boll setting% and earliness% (Abdel-Al *et al.*, 1987; Bondok *et al.*, 1994; Wahdan and Ghourab, 1995; and Wahdan and Wassel, 2000). However, the application of ethrel (ethephon) did not affect fiber quality; fiber strength and finenss (Bondok *et al.*, 1994; Wahdan and Wassel, 2000).

In the light of the above findings, the present work was designed and conducted to study the effect of ethrel in low concentrations on late sown cotton.

MATERIALS AND METHODS

The field experiments were carried out at Mallawi Agric. Res. Station, Minia Governorate, in 2001 and 2002 seasons, to study the response of late sown cotton plants of Giza 83 cotton cultivar to foliar application of ethrel (ethephon) in low concentrations; 0, 10, 20 and 40 ppm, under two times of application, at squaring stage or at early flowering stage.

A split-plot design with four replicates was used in which main-plots were assigned to time of application while sub-plots were occupied by ethrel concentrations. The sub-plot area was 13 m^2 including 5 ridges, 4 m long and 65 cm width. Cotton seeds were sown on 22nd of April in both seasons. Distance between hills was 20 cm and seedlings were thinned leaving two plants per hill. All other cultural practices were performed as recommended for cotton crop.

For estimating effects of ethrel treatments, the following data were recorded :

A- Leaves chemical composition : leaf samples were taken 15 days after spraying ethrel to determine leaves contents of chlorophyll a and B (Arnon, 1949), carotenoids (Rolbelen, 1957), reducing sugars and total soluble sugars (A. O. A. C., 1965).

B- Growth characters : final plant height and number of fruiting branches per plant.

C- Earliness parameters : number of days from sowing to first flower and open boll and earliness%.

D- Yield and its components : number of flowers/plant, number of open bolls/plant, boll retention%, boll weight, lint%, seed index, and seed cotton yield/faddan.

E- Fiber properties : micronaire value and pressely index.

All obtained data were computed as the procedure outlined by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

A- Effect of ethrel on leaves chemical composition :

Results presented in Table (1) reveal that leaves content of chlorophyll a, total chlorophylls, reducing sugars, and total soluble sugars were significantly influenced by ethrel concentration and by the interaction time of application x concentration. However, leaves content of chlorophyll b, carotenoids, and non-reducing sugars were not significantly affected by ethrel treatments. Time of application exert no significant effect on chemical composition of leaves.

It is clear from Table (1) that the action of ethrel on chlorophyll level was dependent upon ethrel dose and plant growth stage as there was a general decrease in chrolophyll level as ethrel concentration increased, but the significant reduction in chlorophyll was produced by the highest concentration (40 ppm) only. Also, such chlorophyll reduction was higher and more pronounced when ethrel was applied at early flowering stage as compared with at squaring stage. Ethylene has been shown to act as aging and senescence inducing hormone and the yellowing of leaves and fruits is a frequently observed effect of ethylene. The promoting effect of ethrel on chlorophyll degradation may be an indirect result of ethylene-inducing aging (Abeles *et al.*, 1992a), or by ethylene-aclivating effect on chlorophyllase, the enzyme which its main function is chlorophyll degradation (Drazkiewicz, 1994). Also, many workers obtained a reduction in chlorophyll with high ethrel (ethephon) concentration (Bondok, 1986; Bodok *et al.*, 1994 and Wahdan & Wassel, 2000). On the other hand, auxins, gibberellins, and cytokinins are considered as juvenility substances which could block ethylene-induced degradation of chlorophyll (Abeles *et al.*, 1992a). the higher reduction in chlorophyll level due to the application of ethrel at early flowering stage as compared with at squaring stage may be a reflection of decreasing juvenility hormones in cotton leaves as plant age progressed.

Table (1) : Effect of ethrel application on some chemical constituents of cotton leaves as mg/gm dry weight in 2002 season.

Ethrel treatments		Chlorophyll			Carotinoids	Carbohydrates		
Time of application (A)	Concentrations ppm (B)	a	b	Total		Reducing sugars	Non-reducing sugars	Total soluble sugars
Squaring stage	0	4.83	2.65	7.48	0.61	10.42	5.30	15.72
	10	4.89	2.58	7.47	0.61	12.80	5.32	18.12
	20	4.76	2.55	7.31	0.62	13.05	5.32	18.37
	40	4.59	2.56	7.15	0.64	12.72	5.48	18.20
	Mean	4.77	2.58	7.35	0.62	12.25	5.35	17.60
Early flowering stage	0	5.13	2.70	7.83	0.62	11.80	5.24	17.04
	10	5.15	2.61	7.76	0.66	12.49	5.47	17.96
	20	4.44	2.66	7.10	0.69	12.95	5.50	18.45
	40	3.87	2.56	6.43	0.68	12.27	5.36	17.63
	Mean	4.65	2.63	7.28	0.66	12.38	5.39	17.77
Averages of concentrations	0	4.98	2.68	7.66	0.62	11.11	5.27	16.38
	10	5.01	2.60	7.61	0.64	12.64	5.40	18.04
	20	4.60	2.61	7.21	0.66	13.00	5.41	18.41
	40	4.23	2.56	6.79	0.66	12.50	5.42	17.92
Overall Mean		4.71	2.61	7.32	0.64	12.32	5.37	17.69
L. S. D 5%	A	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.
	B	0.40	N. S.	0.50	N. S.	0.60	N. S.	0.73
	A x B	0.56	N. S.	0.75	N. S.	0.85	N. S.	1.04

With regard to ethrel effect on leaves content of carbohydrates, Table (1) shows that, in comparison with the control, all ethrel concentrations exhibit significant increases in leaves content of reducing sugars and total soluble sugars at both times of application but the magnitude of such increase was greater when ethrel was sprayed at squaring stage than at early flowering stage. Increasing carbohydrate level in cotton leaves treated with ethrel appears to be a secondary result of decreasing the translocation of carbohydrate from the source leaf toward the stem apex (Grodzinski & Woodrow, 1989 and Abeles *et al.*, 1992a), which may cause carbohydrate accumulation in leaves particularly when there were insufficient fruiting sinks to attract such accumulated assimilates like at squaring stage, while at flowering stage and increasing developing bolls the amount of accumulated carbohydrates could be reduced. Several previous reports showed that ethrel (ethephon) increased cotton leaves content of sugars (Abdel-Al *et al.*, 1987; Bondok *et al.*, 1994 and Wahdan & Wassel, 2000).

B- Effect of ethrel on growth characters :

Results shown in Table (2) indicate that plant height and number of sympodia per plant were not significantly affected by time of application or by the interaction time of application x ethrel concentration in both seasons. However, both characters were significantly affected by ethrel concentration only in 2001 season when plant height was gradually reduced with increasing ethrel concentration reaching the significant reduction with the highest concentration only, while number of sympodia per plant was increased by various ethrel concentration reaching the significant increase with spraying 10 or 20 ppm of ethrel.

In relation to ethrel effect on plant height, Grodzinsiki and Woodrow (1989) concluded that ethylene gas is associated with reduced plant growth and plant treatment with ethephon resulted in reduced growth in many systems. Abeles *et al.* (1992a) reported that ethephon inhibits stem elongation and reduces plant height in many crop species and thus it is used to increase the hardiness of transplanted seedlings and the resistance to lodging in cereal crops. It seems that reducing plant height was a result of ethrel effects on sink activities and assimilates translocation via altering levels and actions of other hormones of different classes. Ethrel (ethylene) decreased the levels of growth promoters; auxins, gibberellins, and cytokinis and increased the level of growth retardant abscisic acid (Bondok, 1986; Bondok *et al.*, 1994 and Abeles *et al.*, 1992a), inhibited the sink activity of apical meristem resulting in reducing assimilates movement toward shoot a pex (Grodzinski and Woodrow, 1989) which reduced plant height.

It is well agreed that both ethephon and ethylene inhibit apical dominance and encourage lateral growth by reducing the capacity of polar auxin transport probably through inhibiting the synthesis of auxin porters or suppressing protein synthesis in general (Abeles *et al.*, 1992a). Thus, ethephon is commercially used to release bud, rhizome and tuber dormancy in many plants (Abeles *et al.*, 1992b). loss of apical dominance could induce axillary bud break in cotton plant which is characterized by high number of dorman buds (Khafaga, 1983). Ethylene-inducing effects on bud break and on downward assimilates translocation (Abeles *et al.*, 1992a) could increase number of sumpodia per plant and further could encourage the leterally growth of a fruiting branch, forming more fruiting sites per branch. Similar results were obtained by Bondok *et al.* (1994).

C- Effect of ethrel on earliness parameters :

It is clear from Table (2) that ethrel application had no significant effect on number of days from sowing to first flower. Time of application significantly affected only earliness% in 2001 season only when spraying ethrel at early flowering stage enhanced earliness% compared with at squaring stage. Ethrel concentration significantly influenced earliness% in both seasons and number of days from sowing to first open boll only in 2001 season.

Table (2) : Effect of ethrel application on some growth and earliness parameters during 2001 and 2002 seasons.

Ethrel treatments		Plant height (cm)		No. of sympodia per plant		No. of days to first flower		No. of days to first open boll		Earliness %	
Time of application (A)	Concentrations ppm (B)	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Squaring stage	0	108.4	97.4	12.6	11.8	72.0	73.6	125.0	124.7	59.3	61.7
	10	105.9	96.5	13.5	12.2	71.0	72.7	124.1	123.8	61.0	65.0
	20	106.0	95.5	13.8	12.4	70.7	73.1	124.2	124.1	61.3	64.9
	40	103.0	95.0	13.5	12.4	70.7	72.8	123.3	123.7	63.1	64.7
	Mean	105.8	96.1	13.4	12.2	71.1	73.1	124.2	124.1	61.2	64.1
Early flowering stage	0	108.1	96.8	12.7	12.0	72.2	73.3	125.3	124.9	59.6	60.9
	10	107.5	96.2	13.0	12.4	71.9	73.1	123.6	123.9	62.9	65.1
	20	106.9	95.2	13.5	12.3	72.1	73.5	123.1	123.8	65.3	66.2
	40	104.6	96.4	12.9	12.0	71.8	73.4	123.2	123.8	65.7	67.1
	Mean	106.8	96.2	13.0	12.2	72.0	73.3	123.8	124.1	63.4	64.8
Averages of concentrations	0	108.3	97.0	12.7	11.9	72.1	73.5	125.2	124.8	59.5	61.3
	10	106.7	96.4	13.3	12.3	71.5	72.9	123.9	123.9	62.0	65.1
	20	106.5	95.4	13.7	12.4	71.4	73.3	123.7	124.0	63.3	65.6
	40	103.8	95.7	13.2	12.2	71.2	73.1	123.3	123.8	64.4	65.4
Overall mean		106.3	96.1	13.2	12.2	71.6	73.2	124.0	124.1	62.3	64.4
L. S. D 5%	A	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	2.0	N. S.
	B	2.3	N. S.	0.6	N. S.	N. S.	N. S.	1.1	N. S.	2.2	1.8
	A x B	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.

All ethrel concentrations increased earliness% and decreased number of days to first open boll in comparison with the control. Such effect of ethrel in enhancing boll opening and earliness of yield may be a result of its impacts on plant growth and carbohydrate level and partitioning which could create external and internal changes that induce boll growth and maturity. These results are in agreement with those of Abdel-Al *et al.* (1987), Bondok *et al.* (1994) and Wahdan & Ghourab (1995) who reported that ethrel (ethephon) increased earliness%.

D- Effect of ethrel on yield and yield components :

Data shown in Tables (3) and (4) reveal that, in both seasons, ethrel application foiled to show any significant effect on boll weight, lint%, and seed index. Also, neither time of application nor the interaction, time of application x concentration exerted significant effects on yield and its components in both seasons. However, ethrel concentration significantly affected numbers of flowers and open bolls per plant and seed cotton yield in both seasons and boll retention% in 2002 season only. In comparison with the control, all ethrel concentrations increased flowers and open bolls production but significance level was not always reached with the concentration of 40 ppm. Only 20 ppm significantly increased boll retention% over the control in the second season only. In both seasons, seed cotton yield was significantly increased by spraying 10 or 20 ppm, while it was increased only numerically by spraying 40 ppm ethrel, in comparison with the control.

It could be detected that ethrel increased plant productivity as a result of the sum of its morphological, biochemical and physiological effects on plant as previously discussed. Induction of flowering may be a form of ethylene-induced aging (Abeles *et al.*, 1992a). Ethrel-increased flowers and bolls production and retention could be owing to increasing number of sympodia per plant, sugar content, and earliness% which lead to increasing seed cotton yield/fad.

Similar results were reported by Bondok *et al.*, (1994), Wahdan and Ghourab (1995) and Wahdan & Wassel (2000).

E- Effect of ethrel on fiber quality :

It is obvious from Tables (3) and (4) that, in both seasons, various ethrel treatments, time of application, concentration and their interaction failed to exhibit any significant effects on fiber strength (pressely index) and fiber fineness (micronaire reading). These results are similar to those of Bondok *et al.* (1994), Wahdan & Ghourab, (1995) and Wahdan & Wassel (2000).

It could be concluded from the results of the present study that the treatment of late sown cotton plants with ethrel (ethephon) at the concentrations of 10 or 20 ppm at either squaring stage or early flowering stage improved the physiological and developmental balance of cotton plant which enhanced the plant fruiting efficiency and increased seed cotton yield under late planting conditions.

Table (3) : Effect of ethrel application on yield, yield components and fiber quality in 2001 season.

Ethrel treatments		No. of flowers plant	No. of open bolls plant	Boll retention %	Boll weight (gm)	Lint %	Seed index (gm)	Seed cotton yield (kg/fad.)	Microniare reading	Pressely index
Time of application (A)	Concentrations ppm (B)									
Squaring stage	0	17.3	9.9	57.23	2.50	39.38	11.12	7.82	5.15	9.50
	10	19.0	11.3	59.47	2.53	39.67	11.36	8.58	5.25	9.40
	20	19.3	11.9	61.66	2.51	39.49	11.27	8.69	5.20	9.65
	40	18.3	10.7	58.47	2.48	39.71	11.32	8.19	5.25	9.45
	Mean	18.5	10.9	59.21	2.51	39.56	11.27	8.32	5.21	9.50
Early flowering stage	0	16.7	9.7	58.08	2.52	39.51	11.21	7.74	5.25	9.40
	10	18.3	11.2	61.20	2.57	39.82	11.28	8.31	5.20	9.60
	20	19.2	11.6	60.42	2.61	39.78	11.41	8.47	5.10	9.45
	40	17.8	11.0	61.80	2.52	39.74	11.28	8.24	5.25	9.50
	Mean	18.0	10.9	60.37	2.56	39.71	11.29	8.19	5.20	9.49
Averages of concentrations	0	17.0	9.8	57.65	2.51	39.45	11.17	7.78	5.20	9.45
	10	18.7	11.3	60.33	2.55	39.75	11.32	8.45	5.23	9.50
	20	19.3	11.8	61.04	2.56	39.64	11.34	8.58	5.15	9.55
	40	18.1	10.9	60.14	2.50	39.73	11.30	8.22	5.25	9.48
Overall mean		18.3	10.9	59.79	2.53	39.64	11.28	8.26	5.21	9.50
L. S. D 5%	A	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.
	B	1.5	1.1	N. S.	N. S.	N. S.	N. S.	0.46	N. S.	N. S.
	A x B	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.

Table (4) : Effect of ethrel application on yield, yield components and fiber quality in 2002 season.

Ethrel treatments		No. of flowers plant	No. of open bolls plant	Boll retention %	Boll weight (gm)	Lint %	Seed index (gm)	Seed cotton yield (kg/fad.)	Microniare reading	Pressely index
Time of application (A)	Concentrations ppm (B)									
Squaring stage	0	17.2	10.6	61.63	2.62	39.69	11.27	8.62	5.05	9.40
	10	20.5	12.1	59.02	2.59	40.10	11.17	9.16	5.25	9.55
	20	19.7	12.7	64.47	2.68	39.79	11.22	9.38	5.20	9.30
	40	18.9	10.8	57.14	2.59	39.89	11.27	8.64	5.00	9.50
	Mean	19.1	11.6	60.57	2.62	39.87	11.23	8.95	5.13	9.44
Early flowering stage	0	17.9	10.8	60.34	2.56	39.65	11.30	8.69	4.95	9.15
	10	20.3	12.9	63.55	2.69	39.94	11.37	9.61	5.05	9.35
	20	19.2	12.6	65.62	2.68	39.85	11.40	9.40	5.20	9.35
	40	19.6	11.4	58.16	2.61	39.87	11.50	8.92	5.20	9.50
	Mean	19.3	11.9	61.92	2.64	39.83	11.39	9.15	5.10	9.34
Averages of concentrations	0	17.6	10.7	60.98	2.59	39.67	11.29	8.66	5.00	9.28
	10	20.4	12.5	61.28	2.65	40.02	11.27	9.38	5.15	9.45
	20	19.5	12.7	65.04	2.68	39.82	11.31	9.39	5.20	9.33
	40	19.3	11.1	57.65	2.60	39.88	11.39	8.78	5.10	9.50
Overall mean		19.2	11.8	61.24	2.63	39.85	11.31	9.05	5.11	9.39
L. S. D 5%	A	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.
	B	2.0	1.2	3.9	N. S.	N. S.	N. S.	0.44	N. S.	N. S.
	A x B	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.

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استجابة صنف القطن جيزة ٨٣ للمعاملة بالإثريل (الأثيفون) بتركيزات منخفضة تحت ظروف الزراعة المتأخرة

محمد محمد أحمد قاسم
معهد بحوث القطن – مركز البحوث الزراعية

أجرى هذا البحث بمحطة البحوث الزراعية بملوى - محافظة المنيا - خلال موسمى الزراعة ٢٠٠١، ٢٠٠٢ بهدف دراسة تأثير الرش بالإثريل بتركيزات منخفضة (صفر، ١٠، ٢٠، ٤٠ جزء فى المليون) فى مرحلة الوسواس أو فى مرحلة بداية التزهير على صنف القطن جيزة ٨٣ تحت ظروف الزراعة المتأخرة .

أظهرت نتائج هذه الدراسة أن الرش بالإثريل بالتركيزات المنخفضة (١٠، ٢٠ جزء فى المليون) لم يكن له تأثير معنوى على طول النبات ومحتوى الأوراق من الكلوروفيل وعدد الأيام من الزراعة حتى تتفتح أول لوزة بينما أدى الرش بالتركيز الأعلى (٤٠ جزء فى المليون) إلى نقص معنوى فى هذه الصفات . وقد أظهرت مختلف تركيزات الإثريل زيادة فى محتوى الأوراق من السكريات المختزلة والسكريات الذائبة الكلية وعدد الأفرع الثمرية وعدد الأزهار واللوز المتفتح للنبات وكذلك % لعقد اللوز، % للتبكير ومحصول القطن الزهر للفدان وقد كانت هذه الزيادة معنوية مع الرش بتركيز ١٠، ٢٠ جزء فى المليون حيث أن هذين التركزين حققا أعلى محصول وأعطيا أفضل النتائج لمكونات المحصول بشكل عام بينما لم تتأثر صفات التيلة (النعومة والمتانة للشعر) معنويا بالمعاملة بالإثريل خلال موسمى الدراسة .

لم يكن لميعاد الرش بالإثريل او للتفاعل بين ميعاد الرش وتركيز الإثريل تأثير ملحوظ على صفات النمو والمحصول فى كلا الموسمين .

تشير نتائج هذه الدراسة أن معاملة نباتات القطن بالإثريل بتركيز ١٠ أو ٢٠ جزء فى المليون سواء فى مرحلة الوسواس أو فى مرحلة بداية التزهير قد أدى إلى رفع كفاءة الحمل الثمرى وبالتالى زيادة محصول نبات القطن تحت ظروف الزراعة المتأخرة .