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EFFECT OF FOLIAR APPLICATION WITH POWER– I ON GROWTH YIELD, YIELD COMPONENTS , SOME CHEMICAL AND TECHNOLOGICAL CHARACTERS OF EGYPTIAN COTTON, GIZA 86 CULTIVAR

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ABSTRACT

Two field experiments were carried out at El-Gemmiza Agricultural Research Station , El- Gharbiya Governorate Egypt, during 2010 and 2011 seasons to study the effect of power – I foliar spraying at three concentrations (1 cm^3, 2 cm^3 and 3 cm^3 / liter water) once (at squaring stage) or twice (at squaring and start of flowering or at start of flowering and full flowering stages) comparison with untreated plants on growth, yield and yield components and some of chemical as well as technological characters of Giza 86 cotton cultivar.

The results could be summarized as follow :-

1-Power–1 treatments significantly increased leaf chlorophyll a, b and total chlorophyll contents in both seasons, in favour of applying power – I at the rate of 2 cm^3 / liter twice (during square and start of flowering)

2- Spraying power – I at any rate significantly decreased leaf reducing and total soluble sugar, while non-reducing sugars and N, P and K contents were increased with all power I treatments as compared with untreated plants in both seasons.

3- Applying power – I at the high rate (3 cm^3 / liter water) twice (during squaree and start of flowering stages) gave taller plants with high number of fruiting branches per plant as compared with the other treatments.

4- Power – I at the rate of (2 cm^3 / liter water) twice (during square and start of flowering stages) gave the most significant increase in number of flowers and open bolls / plant in the first season, while at 3 cm^3 / liter gave the highest number of flowers and open bolls / plant in the second season.

5- All treatments with power –I increased boll setting percentage and decreased boll shedding percent in both seasons.

6- Power –I at all rates during growth periods significantly increased boll weight, seed index, earliness and seed cotton yield / fed. in both seasons as compared with control.

7- Lint % and fiber properties (pressely index and micronaire value) were not significant in both seasons.

INTRODUCTION

Attempts had been made to increase growth, fruit retention and seed cotton yield by using some growth promoters application, but these attempts need some chemical groups of organic compounds, such as (Power- I) which is contents poly phenols, ethyl group, amino acids as glycine and alanine and boron element (Abdel Al 1998, Ahmed *et al* 2009, El-Masri *et al* 2005, and El- Shazly *et al* 2003).

Polyphenols led to an increasing in bolls setting and decreasing shedding percent (Abdel Al, 1981), because of its important role in inhibited creation of monophenols and other growth inhibitors (Abdel – Al, 1998), which may affect on increasing squaring and young bolls abscission. Polyphenols and some amino acids play as a promoter for increasing natural growth, like the promotion role of auxin, gibberlin and cytokinine (Djanaguiraman *et al* 2010)., trihydroxy phenols as Pyrogallol, caticole, tannins and cumarine (Abdel Al, 1998). Also, ethyle groups play as a helper role in dcreasing methyle groups which inhibit stem elongation and led to dwarf plant (Ghourab *et al*, 2000 and El – Bagowry *et al* , 2008).

Glycine has a specific role in increasing the plant tolerance to drought (Alia , Namich (2007) and salinity by increasing the ability of cells to ration water as well as lock the stomata and raising the efficiency of the composition of proline in plant which considers an indicator to the ability of plants tolerance to drought, high temperatures and salinity (Alia , Namich (2008).

This reflected on the increase in the yield and raises the curve of flowering efficiency with the reduction in the percentage of young bolls and flower buds dropping. Also, it leads to an increase in the average of boll weight and seed index, which are the main components for a high productivity cotton yields. While, it is not had a negative effect on leaf area and earliness characters and maintaining the technological characteristics and raise the efficiency of micronaire and pressley index (Alia , Namich (2003).

Power – I also includes one of the important micronutrients (boron) with a high rate which is enough for the cotton plants needs during the flowering and the composition of bolls. As the boron leads to raise the efficiency of calcium absorption and metabolism as well as composition of the cellular walls, while its deficiency results to fall young boll setting. Boron during mode of action helping the plant to raise the deposition of cellulose on the hair and improve the technological characteristics (Oostcehuis and Zhao, 2001).

All these collecting reasons, may be needed to use Power- I as a compound containing all these groups. The aim of this work were increasing growth, yield and yield components of cotton plants as well as iproving by fiber technological properties foliar spraying of Power-I.

MATERIALS AND METHODS

Two field experiments were conducted in El-Gemmiza Agricultural Research station at El- Gharbiya Governorate Egypt, during 2010 and 2011 seasons to study the effect of power – I foliar application treatments on growth, yield and yield components and some of chemical and technological characters of Giza 86 cultivar.

Active ingredient of power – I as follows :

Active ingredient	%
Phenolic compound	80
Boron	0.03
Amino acid	0.01
Ethyl group	1.00

The experimental design in both seasons was randomized complete blocks with three replications where the ten treatments were included :

1) Control (untreated plants, spraying tap water).
2) Spraying power–I at the rate of 1 cm^3/ liter once(during square stage)
3) Spraying power–I at the rate of 1 cm^3/ liter twice(during square and start of flowering stages)
4) Spraying power–I at the rate of 1 cm^3/ liter twice(start of flowering and full of flowering stages)
5) Spraying power–I at the rate of 2 cm^3/ liter once(during square stage)
6) Spraying power–I at the rate of 2 cm^3/ liter twice(during square and start of flowering stages)
7) Spraying power–I at the rate of 2 cm^3/ liter twice(at start of flowering and full of flowering stages)
8) Spraying power–I at the rate of 3 cm^3/ liter once(during square stage)
9) Spraying power–I at the rate of 3 cm^3/ liter twice(at during square and start of flowering stages)
10) Spraying power–I at the rate of 3 cm^3/ liter twice (at start of flowering and full of flowering stages).

Phosphorus fertilizer as ordinary superphosphate (15.5 % P_2O_5) at the rate of 22.5 kg P_2O_5 / fed. was incorporated during seed bed preparation.

Soil analysis of the experimental site in the two seasons are shown in table(1)

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

Properties	2010 seasons	2011 seasons
Texture	**Clayloam**	**Clayloam**
PH	7.6	7.5
Ecmmhos / cm	0.93	1.08
Ca Co3 %	1.30	1.50
Cations Meg/L		
Ca^{++}	1.65	3.60
Mg^{++}	0.90	1.89
Na^{+}	6.58	7.47
K^{+}	0.24	0.35
Anions Meg / L		
Co_3^{--}	------	-----
HCo_3^{--}	2.27	2.70
Cl^{-}	4.32	6.61
SO_4^{--}	2.78	4.00
Available N (ppm)	30.70	21.10
Available P (ppm)	11.80	10.7
Exchangable K (ppm)	360	410
Available Fe (ppm)	13.30	10.40
Available Mn (ppm)	11.50	9.10
Available Zn (ppm)	2.80	2.50
Available B (ppm)	0.50	0.45

Nitrogen Ferytilizer in the form of ammonium nitrate (33.5% N) at the rate of 45 kg N / Fed. was applied in two equal doses, immediately before the first and the second irrigations. Potassium fertilizer in the form of potassium sulphate (48% K_2O) at the rate of 24 Kg. K_2O / Fed. was side – dressed in a single dose before the second irrigation. Standard agricultural practices were followed through out the growing seasons.

The plot size was 14 m^2, (4 m × 3.5 m) including 5 ridges in both seasons. Sowing date was 1st April in both seasons in ridges 70 cm apart and the hills 25 cm. apart with two plants / hill after thinning.

Studied Characters:

I- Chemical composition of the leaf :

After 10 days from spraying power – I in each treatment a leaf sample of 5 leaves (blade + petiole) was taken from the youngest fully matured leaves (4th leaf from the apex of the main stem) from each plot. After samples preparation for analysis :

I- a. Leaf chloroplast pigments: Extraction and determination of :

1) Chlorophyll a (mg / g. dw.)
2) Chlorophyll b (mg / g. dw.)
3) Total Chlorophyll (mg / g. dw.)

These contents was determined following the method described by Arnon (1949)

I- b. Leaf carbohydrate content (mg / g. dw.)

1) Reducing sugars content (mg / g. dw.) was determined using the method described by A.O.A.C (1965)
2) Non Reducing sugars content (mg / g. dw.)
3) Total soluble sugars content (mg / g. dw.) was determined using the method described by Cerning (1975).

I-c. Leaf macronutients contents %(N.P.K)

II- Growth, yield and yield components:

1) Plant height at harvest in cm.
2) Number of fruiting branches / plant.
3) Number of Total flowers / plant.
4) Number of Total bolls / plant.
5) **Boll settings %** : calculated from the following equation according to Richmond and Radwan (1962).

$$\textbf{Boll settings \%} = \frac{\text{No of Total Bolls / plant}}{\text{No of Total flowers / plant}} \times 100$$

6) Boll shedding % calculated from the following equation :
   Boll shedding % = 100 - Boll settings %
7) Boll weight (gm).
8) Seed Index (weight of 100 cotton seeds in grams).
9) **Lint Percentage**: the seed cotton picking from the following equation percentage.

$$\textbf{Lint Percentage} = \frac{\text{Weight of lint cotton}}{\text{Weight of seed cotton}} \times 100$$

10) Seed cotton yield k. / fed. (Kentar = 157.5 Kg.)
11) **Earliness percentage** : it calculated from the following equation:

$$\textbf{Earliness Percentage} = \frac{\text{Yield of first pick}}{\text{Total yield}} \times 100$$

12) **Fiber quality** :

The studied fiber quality traits were pressely strength and micronaire value) were determined at laboratories of the Cotton Technology Research Division, Cotton Research Institute, Agricultural Research Center, Giza, Egypt. at constant relative humidity 65% ± 2 and temperature 21°C ± 2. (A.S.T.M,1975)

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.

RESULTS

Results in table (3) show that spraying Power – I treatments significantly increased leaf chlorophyll a, b and total chlorophyll content comparing with untreated plants in both seasons. The highest value of leaf chlorophyll a and total chlorophyll were obtained from spraying Power – I at the rate of 2 cm^3 / liter twice (at squaring and start of flowering stages) in the two seasons. However, the highest values of leaf chlorophyll b (2.96 and 2.93 mg / g dw.) were obtained from spraying power – I at the low rate (1 cm^3 / liter) once (at squaring stage) in the first and second seasons respectively.

Data in table (3) showed a significant effect of the tested treatments on reducing, non reducing and total soluble sugars concentrations in cotton leaves in both seasons. Spraying power –I at all rates significantly decreased reducing and total soluble sugar concentrations, while increased non reducing sugar as compared with untreated plants (control) in both seasons. However the lowest values of leaf reducing soluble sugars content (6.33 and 5.55mg / g dw.) and leaf total soluble sugars content (8.90 and 9.45 mg / g dw.) were obtained when cotton plants were sprayed with power –I at the high rate (3 cm^3 / liter) twice (at the start of flowering and full of flowering stages) With regard to leaf non reducing soluble sugars content, the highest values (3.16 and 3.25 mg / g dw.) were produced from plants received power-I at the rate of 2 cm^3 / liter twice (at squaring and start of flowering stages).

Data in table (4) show that the tested treatments gave a positive significant effect of leaf N, P and K contents in both seasons. The highest contents of leaf N and P % were obtained from spraying power –I at the rate of (2 cm^3 / liter) twice (at squaring and start of flowering stages), while the high rate of power –I (3 cm^3 / liter twice (at start of flowering and top of flowering) gave the highest value of K% in the two seasons.

3-4

Results in table (4) indicate that Power –I treatments gave significant effect on plant height at harvest time and number of fruiting branches / plant in both seasons where the taller plants (176.5 and 161.70 cm) carrying the highest number of fruiting branches (19.30 and 17.00) were produced from applying power –I at the rate of (3 cm^3 / liter water) twice (at squaring and start of flowering stages) in the first and second seasons, respectively.

Data in table (5) showed that the highest number of flowers (31.44 and 32.58) and total bolls (23.69 and 25) per plant were obtained from the plants which received power –I at the rate of (2 cm^3 / liter) twice (at squaring and start of flowering stages) twice (at squaring and start of flowering stages in the first and second seasons). Power -I treatments significantly increased boll setting % and decreased boll shedding % comparing with control.power-1 had a significant increase on earliness % in both seasons.

Data in table (6) show that the average of treatment boll weight and seed index exhibited significant increasing in both seasons due to variation in power –I concentrations and time of application. The highest values of boll weight (3.43 and 3.19 gm) and seed index (11.65 and 10.63 gm) were obtained from spraying power–I at the rate of (3 cm^3 / liter water) once (at squaring stage) in the two seasons With regard to seed index, data showed a significant increase at all power –I treatments comparing with the control. Data in table (6) also show that lint % did not significantly response to the power -I treatments in both seasons.

The tested treatments significantly effected seed cotton yield per Fadden in both seasons (table 6), in favour of power –I foliar application at the rate of (2 cm^3 / liter) twice (at squaring and start of flowering stages), where this treatment significantly increased by (19.33 %) in the first season and (18.03%) in the second season above the untreated plants (control).

Data in table (6) show that pressely index and micronaire value did not showed any significant effect to the tested treatments in both seasons.

Abd el-Al *et al* (1992) found that the application of phenolic compounds to cotton plants had no significant influence on micronaire and Pressely index in both seasons.

Abd el – Aal *et al* (2011) found that the foliar application of boron as boric acid (17.7 % B) at the rate of 1 gm / liter caused stimulative effect on technological character of fiber studied (fiber fineness and fiber strength).

5-6

DISCUSSION

The positive effect of foliar application with power –I on growth traits and boll set attributes is mainly attributed to the followings:

I- Phenols mode of action, where :

1) Polyphenols encouraged the abscission retardation by IAA and monophenols antagonized the retardation (Tomasweska, 1968)
2) Monophenols enhanced abscission in cotton explants and there is a role of phenols in the abscission process (Schwentner and Morgan, 1966).

In this concern, Abdel Al *et al* (1992) found that application of some polyphenolic compounds i.e. pyrogallic P. coumaric acid and tannic acid, at concentrations of 50 and 100 ppm of each had no significant influence on growth characters (plant height and number of sympodia / plant) in two seasons and number and length of internodes in one season only, where in the second season the maximum of both characters were obtained when the plants were treated with tannic acid (50 ppm) and pyrogallic acid (100 ppm) , respectively. Also, found that earlier in maturity as compared with the untreated plants (control).

Fadl *et al* (1982) found that application of coumarin at different concentrations i. e . 0, 50 , 125 , 250 and 500 ppm either after one, four or eight weeks from the start of flowering, slightly increased the flowering capacity and boll set of cotton plants in most spraying treatments. The greatest number of flowers and bolls per plant was obtained by spraying with 50 ppm after four weeks and 500 ppm after one week from flowering respectively. coumarin reduced the young boll shedding percentage, especially when it was sprayed with 250 ppm after one week from flowering.

II- Boron mode of action, where :

1- Boron enhances carbohydrate transportation through cells wall and consequently maximum production of starch and sugar.
2- In Boron absence the transport of nitrogenous and sugar compounds are stopped.
3- Boron is important in pollen germination and pollen tube growth which is necessary for successful fruit setting (Oostrehuis and Zhao, 2001).
4- Boron acts as activator of many enzymes which stimulates plant growth and flowers formation.
5- Shedding of young bolls occurs in case of boron deficiency.
6- The available boron in the experimental soil sites is low as shown in table (1). Therefore the boron in power –I helps the plant form abscission layers where leaf joints stalk. Plants deficient in boron hold their leaves on very tenaciously as opposed to plants receiving adequate boron. Plants treated with adequate boron shed their leaves very readily at the end of the season.

In this concern, El- Shazly *et al* (2003) found that the high level of boron significantly increased number of total bolls set / plant, boll setting % and earliness % as compared with untreated plants.

Ahmed *et al* (2009) found that spraying cotton with boron increased boll weight, number of bolls / plant, seed cotton yield, seed index and lint %.

Abdel – Aal *et al* (2011) found that the foliar application of boron as boric acid (17.7 % B) at the rate of 1 gm / liter caused significant increase in total number of squarees and total abscission percentage / plant, seed index, lint %, seed cotton yield per plant and Fadden, as compared to untreated plants (control). However boll weight was insignificantly affected.

III- Amino acids mode of action:

Abdel – Al *et al* (1981) found that foliar application of the amino acid methionine to cotton plants increased the flowering capacity, boll set and reduced boll shedding percentage.

Foliar application of glycine had a significant increase in chlorophylls, carbohydrates and protein contents of leaves. and increase in chemical contents due that glycine concerned as a good storage form of nitrogen because of it's metabolic proximity and ready conversion to glutamic acid, a key compound in nitrogen metabolism. These results are in parallel with the findings of Nayyar and Walia 2003, Meek *et al* 2003, and Ashraf and Fooled 2007. they reported that the increase in vegetative growth due to spraying glycine may be a result of increasing in photosynthesis pigments, photosynthesis rate of carbohydrates content.Glycine as a source of carbon(acetyl Co A) the availability of carbon in the vicinity of the leaf enhances the photosynthesis rate.

IV – Ethyl group mode of action:

Nonomura and Benson (1992) reported that one of the important effects of ethyl or methyl group as a precursor of CO_2 on the cotton plants to increase water use efficiency under intense sunlight conditions, due to the increase of turgidity which lead to a reduction in the transpiration and increase in sugar content availability of carbon in the vicility of the leaf enhances the photosynthesis rate.

This result showed that the use of ethyl group could significantly increase yield and yield components.

The positive effect of foliar application with Power –I on seed cotton yield and its attributes is mainly attributed to the followings:

a) Phenols mode of action, where they encouraged the abscission retardation and consequently increased boll setting percentages which reflect on boll number increase.
b) Boron mode of action, where it leads to increase fundamental metabolic reactions and acceleration protein synthesis which affects boll number and weight.
c) Amino acids mode of action, where they lead to an increase in the average of boll weight and seed index, which are the main components for a high productivity cotton yield.

As the result it is clear that the benefit from foliar application of power –I at the rate of 2 cm^3 / liter twice (at squaring and start of flowering stages) is the best treatment for cotton cultivar Giza 86 productivity.

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تأثير الرش بـ Power–I على النمو وبعض الصفات الكيماوية و التكنولوجية والمحصول و مكوناته على صنف القطن المصري جيزة 86.

محمد حامد عبد العال و على السيد الجعبيري
معهد بحوث القطن – مركز البحوث الزراعية – الجيزة – مصر

أقيمت تجربتان حقليتان في محطة البحوث الزراعية بالجميزة - محافظة الغربية خلال موسمي2010 ، 2011 م لدراسة تأثير الرش الورقي بمركب Power–I بثلاث تركيزات (1 سم3 ، 2سم3 ، 3 سم3 / لتر ماء) مرة واحدة (عند مرحلة الوسواس) او مرتين (عند مرحلة الوسواس وبداية التزهير) أو (عند بداية التزهير و قمة التزهير) مقارنةً بالنباتات الغير معاملة و ذلك على النمو وبعض الصفات الكيميائية و التكنولوجية والمحصول و مكوناته لصنف القطن جيزة 86.

و يمكن تلخيص النتائج فيما يلي :

- أدت معاملات Power–I إلى زيادة معنوية في محتوى الأوراق من كلوروفيل أ ، ب والكلوروفيل الكلي في كلا الموسمين و كانت أفضل المعاملات رشاً بمركب Power–I عند معدل 2 سم^3/لتر مرتين (عند مرحلة الوسواس و بداية التزهير).
- أدى رش المركب Power–I عند أي معدل إلى نقص معنوي في محتوى الأوراق من السكريات الذائبة المختزلة و الكلية و إلى زيادة معنوية في محتوى الورقة من السكريات الغير مختزلة وكل من عناصر النيتروجين و الفوسفور والبوتاسيوم مقارنة مع النباتات الغير معاملة في كلا الموسمين.
- أعطت المعاملة بمركب Power –I عند المعدل الأعلى (3 سم^3 / لتر) مرتين (عند مرحلة الوسواس و بداية التزهير) إلى أكبر زيادة في طول النبات و عدد الأفرع الثمرية على النبات بالنسبة لبقية المعاملات.
- أدت المعاملة بمركب Power –I عند المعدل (2 سم^3 / لتر) مرتين (عند مرحلة الوسواس وبداية التزهير) إلى زيادة معنوية في عدد الأزهار و عدد اللوز الكلي على النبات في الموسم الأول بينما أعطى تركيز 3 سم^3 / لتر في كلاالصفتين المذكورتين في الموسم الثاني ، و قد أعطت جميع المعاملات بمركب power-I إلى زيادة معنوية في صفة النسبة المئوية للعقد و أقل نسبة مئوية في عدد اللوز المتساقط في كلا الموسمين مقارنة بالنباتات الغير معاملة في الموسمين.
- أدت المعاملة بمركب Power–I بجميع تركيزاته خلال مراحل النمو المختلفة إلى زيادة معنوية في وزن اللوزة و معامل البذرة ومحصول القطن الزهر للفدان و النسبة المئوية للتبكير في كلا الموسمين بالنسبة للمقارنة.
- لم تظهر صفة النسبة المئوية للشعر ، معامل البريسلي ، قراءة الميكرونير لم تتأثر معنويا في كلا الموسمين.

التوصية :

من النتائج السابقة يمكن التوصية بأنه توجد استجابة موجبة عالية في صنف القطن جيزة 86 بمركب Power –I بمعدل (2 سم^3 / لتر) مرتين (عند مرحلة الوسواس و بداية التزهير) حيث أنها المعاملة الأفضل لانتاجية صنف القطن جيزة 86 تحت ظروف التجربة.

قام بتحكيم البحث

أ.د / عادل عبد الجواد سلامه	**كلية الزراعة – جامعة المنصورة**
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Table (3) : Effect of Spraying power – I on some chemical constituents of cotton leaves in 2010 and 2011 seasons.

Treatments	Chloroplact pigments (mg/g dw.)						Leaf Soluble sugars content (mg/g dw.)					
	Chlorophll a		Chlorophll b		T.Chlorophll		Reducing		Non Reducing		Total	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
1- Control (untreated, spraying with water)	7.00	6.96	2.58	2.54	9.58	9.50	6.55	8.12	2.55	2.34	9.1	10.46
2- Spraying Power-I 1 cm^3 / L once (at squaring stage)	8.14	8.10	2.96	2.93	11.10	11.03	5.96	7.11	3.10	3.08	9.06	10.19
3-Spraying Power–I 1 cm^3/L twice (at squaring + start of flowering)	8.30	8.32	2.82	2.81	11.12	11.13	6.07	7.10	3.30	3.03	9.37	10.13
4-Spraying Power–I 1 cm^3/L twice (at start and full of flowering)	8.20	8.15	2.85	2.81	11.05	10.96	6.05	7.01	3.12	3.00	9.17	10.01
5- Spraying Power– I 2 cm^3 / L once (at squaring stage)	8.05	7.99	2.74	2.80	10.79	10.79	5.99	6.88	3.00	2.98	8.99	9.86
6-Spraying Power–I 2cm^3/L twice (at squaring) + start of flowering)	8.35	8.40	2.78	2.75	11.13	11.15	6.10	6.91	3.25	3.16	9.35	10.07
7- Spraying Power – I 2 cm^3 / L twice (at start + full of flowering)	8.05	8.01	2.82	2.79	10.87	10.80	6.00	6.92	3.16	3.00	9.16	9.92
8- Spraying Power – I 3 cm^3 / L once (at squaring stage)	8.10	8.05	2.84	2.81	10.94	10.88	6.01	6.89	3.20	3.03	9.21	9.92
9- Spraying Power–I 3 cm^3/L twice(at squaring + start of flowering)	8.15	8.11	2.86	2.83	11.01	10.94	5.95	6.86	3.30	3.10	9.25	9.96
10- Spraying Power – I 3 cm^3 / L twice (at start + full of flowering)	8.13	8.08	2.83	2.81	10.96	10.89	5.55	6.33	3.35	3.12	8.9	9.45
LSD 0.05	0.13	0.09	0.08	0.09	0.11	0.12	0.60	0.53	0.50	0.33	0.54	0.60

Table (4) : Effect of spraying power – I on some chemical constituents of cotton leaves, plant height and No. of fruiting branches ' plant in 2010 and 2011 seasons.

Treatments	Leaf macronutrients content (%)						Plant height at harvest, (cm)		No. of fruiting branches/ plant	
	N		P		K					
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
1- Control (untreated, spraying to water)	2.98	3.00	0.30	0.26	1.25	1.33	171.50	150.90	17.30	15.30
2- Spraying Power-I 1 cm^3 / L once (at squaring stage)	3.90	3.78	0.33	0.29	1.46	1.49	169.60	152.80	17.80	16.70
3-Spraying Power–I 1 cm^3/L twice (at squaring + start of flowering)	3.58	3.38	0.35	0.30	1.49	1.51	171.30	158.60	18.00	16.70
4-Spraying Power–I 1 cm^3/L twice (at start and full of flowering)	3.70	3.62	0.32	0.29	1.50	1.52	168.30	160.40	17.80	16.20
5- Spraying Power– I 2 cm^3 / L once (at squaring stage)	4.30	4.28	0.31	0.28	1.36	1.38	170.30	157.30	18.30	16.00
6-Spraying Power–I 2cm^3/L twice (at squaring) + start of flowering)	4.99	5.00	0.38	0.34	1.39	1.41	171.30	157.00	18.40	16.10
7- Spraying Power – I 2 cm^3 / L twice (at start + full of flowering)	4.60	4.38	0.29	0.27	1.41	1.45	167.50	156.90	17.70	16.20
8- Spraying Power – I 3 cm^3 / L once (at squaring stage)	4.61	4.70	0.53	0.29	1.52	1.50	172.00	157.60	18.40	16.20
9- Spraying Power–I 3 cm^3/L twice(at squaring + start of flowering)	4.65	4.66	0.36	0.31	1.53	1.50	176.50	161.70	19.30	17.00
10- Spraying Power – I 3 cm^3 / L twice (at start + full of flowering)	4.53	4.60	0.37	0.32	1.56	1.54	174.30	155.70	18.80	15.50
LSD 0.05	0.20	0.15	0.04	0.03	0.03	0.02	4.00	4.40	0.60	0.70

Table (5) : Effect of power – I on No. of flowers, open bolls / plant, boll setting % , boll shedding % and Earliness % in 2010 and 2011 seasons.

Treatments	No. of flowers/plant		No. of open bolls/plant		Boll setting %		Boll shedding %		Earliness %	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
1- Control (untreated, spraying to water)	27.25	30.58	18.81	20.33	68.74	66.32	31.26	33.68	58.89	62.25
2- Spraying Power-I 1 cm^3 / L once (at squaring stage)	29.61	32.08	21.25	23.33	71.76	72.45	28.24	27.55	60.95	64.15
3-Spraying Power–I 1 cm^3/L twice (at squaring + start of flowering)	29.44	32.33	21.63	24.25	73.47	74.22	26.53	25.78	61.76	64.62
4-Spraying Power–I 1 cm^3/L twice (at start and full of flowering)	28.81	30.67	20.94	22.42	73.53	73.07	26.47	26.93	60.27	63.82
5- Spraying Power– I 2 cm^3 / L once (at squaring stage)	29.69	31.50	21.81	22.58	72.88	71.69	27.12	28.31	62.12	65.25
6-Spraying Power–I 2cm^3/L twice (at squaring + start of flowering)	31.44	32.58	23.69	25.00	75.36	76.70	24.64	23.30	63.25	67.33
7- Spraying Power – I 2 cm^3 / L twice (at start + full of flowering)	29.88	31.58	21.44	23.00	73.99	72.82	26.01	27.18	61.65	66.42
8- Spraying Power – I 3 cm^3 / L once (at squaring stage)	29.25	31.92	20.50	23.33	70.11	73.10	29.89	26.90	62.15	66.52
9- Spraying Power–I 3 cm^3/L twice(at squaring + start of flowering)	29.50	31.92	21.44	23.50	73.69	75.18	26.31	24.82	64.23	70.12
10- Spraying Power – I 3 cm^3 / L twice (at start + full of flowering)	29.06	32.50	20.94	23.67	72.28	73.12	27.72	26.88	63.15	68.31
LSD 0.05	1.24	1.48	1.15	1.29	1.87	1.73	1.81	1.22	1.89	1.82

Table (6) : Effect of spraying power–I on yield, yield components, Micronaire reading and Pressely index in 2010 and 2011 seasons.

Treatments	Boll weight (g)		Seed index (g)		Lint %		Seed cotton yield/fed (k)		Micronaire reading		Pressely Index	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
1- Control (untreated, spraying to water)	3.09	3..06	10.66	9.85	41.33	41.00	9.57	9.65	4.70	4.69	10.40	10.35
2- Spraying Power-I 1 cm^3 / L once (at squaring stage)	3.13	3.12	10.70	10.22	40.25	41.67	10.47	10.54	4.70	4.70	10.10	10.20
3-Spraying Power–I 1 cm^3/L twice (at squaring + start of flowering)	3.12	3.18	10.45	10.25	41.08	41.33	10.89	10.88	4.80	4.73	10.10	10.21
4-Spraying Power–I 1 cm^3/L twice (at start and full of flowering)	3.14	3.17	11.26	10.28	40.43	40.67	10.89	10.67	4.80	4.74	10.40	10.35
5- Spraying Power– I 2 cm^3 / L once (at squaring stage)	3.30	3.15	11.43	10.20	40.49	40.67	11.08	10.49	4.80	4.72	10.10	10.11
6-Spraying Power–I 2cm^3/L twice (at squaring) + start of flowering)	3.23	3.16	11.13	10.28	40.30	40.67	11.42	11.39	4.70	4.71	10.40	10.29
7- Spraying Power – I 2 cm^3 / L twice (at start + full of flowering)	3.23	3.17	11.16	9.90	40.54	41.33	10.86	10.80	4.70	4.72	10.40	10.39
8- Spraying Power – I 3 cm^3 / L once (at squaring stage)	3.43	3.19	11.65	10.03	41.73	41.00	10.93	10.71	4.80	4.79	10.30	10.41
9- Spraying Power–I 3 cm^3/L twice(at squaring + start of flowering)	3.26	3.13	11.30	10.11	40.52	40.67	10.96	10.80	4.80	4.79	10.30	10.41
10- Spraying Power – I 3 cm^3 / L twice (at start + full of flowering)	3.09	3.04	11.28	10.01	41.36	41.67	10.73	10.52	4.80	4.78	10.40	10.40
LSD 0.05	0.08	0.04	0.40	0.14	N.S	N.S	0.33	0.26	N.S	N.S	N.S	N.S