J. Plant Production, Mansoura Univ., Vol. 4 (6): 885 - 895, 2013

EFFECT OF FOLIAR APPLICATION OF ETHEREL AND COMBINATION OF SOME MICRO-NUTREINTS ON PRODUCTIVITY OF EGYPTIAN COTTON PLANT

Gebaly, Sanaa G.
Cotton Research Institute, Agricultural Research center, Giza.

ABSTRACT

Two field experiments were carried out at Sakha Agricultural Research station, during the two successive seasons of 2011 and 2012. The objectives of this investigation was aimed to study the effect of foliar application of boron (B 1gm/L), molybdenum (Mo 0.8 gm/L) and etherel (Eth.) at two levels (5 and 10 PPm) single or in combination in comparison with untreated (spraying water) as control on growth, earliness, seed cotton yield and it components and leaf chemical composition of Egyptian cotton hybrid (10229 x Giza 86) *G. barbadense* L.. The obtained results could summarized as follows:

Foliar application of B., Mo. and Eth. significantly increased No. of flowers/plant, boll retention, earliness %, No. of open bolls/plant, seed index and seed cotton yield/fed., but plant height, No. of fruiting branches/plant, lint % and boll weight were insignificantly increased. On the other hand, spraying cotton plants with B.at 1gm/L, Mo. at 0.8 gm/L and Eth. at 5 and 10 PPm tended to increase chemical content in cotton leaves i.e., chlorophyll a, b %, total chlorophyll and carotene, reducing and total soluble sugar, mono-phenol, poly and total phenols. Application of B., Mo., and Eth. tended to significant effects on fiber strength, upper half length and micronaire reading in both seasons. The highest values obtained from foliage spraying of cotton plant with Eth. 10 PPm + Mo. 8 gm/L at flowering stages improved performance and yield of cotton plant.

Keywords: Cotton, Boron, Molybdenum, etherel, growth, earliness, yield components, leaf chemical composition and fiber prorerities.

INTRODUCTION

Egyptian cotton *(G. barbadense* L.) is one of the most important fiber crops in the world for its best fiber quality. Cotton plants need critical requirements for Boron and many times to correct that deficiency. Boron (B) is an essential micronutrient required by cotton for optimal growth and development, particularly in the role of carbohydrate translocation. A deficiency in B may cause a decrease in fruiting index of cotton due to its direct role in flowering and fruiting (Johan, 1986). Boron availability to plants decreases with increasing soil PH, particularly in calcareous soils and soils with high clay content (Marschner, 1995).

Boron has been universally recognized as the most important micronutrient for cotton production and cotton plant requires B in relatively optimal growth and development, as compared with other plants (Niaz *et al*., 2002). Cotton plant shows a particular need for B during flowering and boll development stage owing to the central role of B in stimulating pollen germination and pollen tube growth resulting in successful fruit setting (Niaz *et al*., 2002 and Zhao and Oasterhuis, 2003). Many recent studies have demonstrated positive effects of foliar application of B on cotton growth, fruit retention, yield and yield components of cotton in Egypt (El-Menshawy and El-Sayed, 2007). Kassem, *et al*., 2009 and (Mesbah and El-Gebiery, 2011) they found that spraying boron showed positive effects and significantly increased plant height, number of fruiting branches and number of open bolls/plant and also increase boll weight and seed cotton yield/fed. Nehro and Godara (2010) indicated that foliar application of B at the commence flowering and two weeks after first flowering at 0.1 % concentration increased yield and yield components.

Molybdenum (Mo) is one of the six minor chemical elements required by green plants. The other five are iron, copper, zinc, manganese and boron. Molybdenum is needed in smaller quantities than any of the others. Molybdenum (Mo) is an essential element for higher plants and plays a vital role in many physiological and biochemical processes. Four of 40 Mo-enzymes have been found in higher plants. (Schworz and Mendel, 2006). These elements are termed minor because plants need them in only very small amounts (in comparison with the major elements as nitrogen, phosphorus, potassium, sulfur, calcium and magnesium). But they are essential for normal growth.

Etherel (Eth.) can be absorbed by various plant organs and breaks down within the tissues releasing ethylene as an end product. Ethylene is the simplest organic compound which affects plants. It is a natural product of plant metabolism. Ethylene in turn is considered as plant hormone characterized by its effective role on leaf abscission with high concentration, while, induction of flowering and fruit ripening with low concentration play as promoter hormone (Leopold and Kriedemann, 1980). Etherel is the main hormone that promotes abscission by inducing the production of various cell wall hydrolysis in the abscission zone to stimulate cell wall break down and eventual shedding; Roberts, *et al.* (2002). Sawan, *et al*. (1984) and Abdel Aal, *et al*. (1987) found that spraying etherel at various concentrations (i.e., 5, 10, 20 and 40 PPm) after 90 days from planting, lead to increase No. of flowers, No. of open bolls, lint percentage, seed index, earliness and and seed cotton yield, while, lower concentration as (5 and 10 PPm) increased micronaire value and chemical characters.

The present work was aimed to study the effects of foliar spraying at flowering stages of boron, molybdenum and etherel (single or in combinations) on growth, earliness, yield and yield components, and chemical.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricultural Research Station, during the two successive seasons of 2011 and 2012. The objectives of this study was aimed to the effect of foliar application of Boron (1 gm/L), Molybdenum (0.8 gm/L) and etherel at two levels (5 and 10 PPm) single or in combinations in comparison with untreated treatment (spraying with tap water) as control on growth, earliness, seed cotton yield and its components and leaf chemical composition of the Egyptian cotton hybrid (10229 x Giza 86 (*G. barbadense* L.). The experimental design was randomized complete blocks with four replicates.

Ten treatments were conducted as follows:

1. Control treatment (spraying with tap water).
2. Foliar spray with boric acid (17 % boron) at the rate of 1 gm/L.
3. Foliar spray with Molybdenum (Molipdate ammonium) at the rate of 0.8 gm/L.
4. Foliar spray with Etherel (2-chloroethyl phospharic acid) at the rate of 5 PPm.
5. Foliar spray with Etherel (2-chloroethyl phospharic acid) at the rate of 10 PPm
6. Foliar spray with boron at the rate of 1gm/L + Foliar spray with Molybdenum at the rate of 0.8 gm/L.
7. Foliar spray with Etherel at the rate of 5 PPm + Foliar spray with boron at the rate of 1 gm/L
8. Foliar spray with Etherel at the rate of 5 PPm + Foliar spray with Molybdenum at the rate of 0.8 gm/L.
9. Foliar spray with Etherel at the rate of 10 PPm + Foliar spray with boron at the rate of 1 gm/L.
10. Foliar spray with Etherel at the rate of 10 PPm + Foliar spray with Molybdenum at the rate of 0.8 gm/L.

Boron (B), Molybdenum (Mo.) and Etherel (Eth.) applications were sprayed at the start of flowering and the peak of flowering stages.

Cotton seeds were sown on 29^{th} April and 3^{rd} May in 2011 and 2012 seasons, respectively. Experimental unit area was 12 m^2 (4.0 x 3.0) and contained five ridges. Each ridge was 4 meter long, 60 cm wide with the hills 25 cm apart on one side of the ridge. Hills were thinned after three weeks from planting to two seedlings. Phosphorus fertilizer was added at the rate of (22.5 kg/fed. P_2O_5) as calcium superphosphate (15.5 % P_2O_5) during land preparation. Nitrogen fertilizer was applied at the rate of 60 kg N/fed as ammonium nitrate (33.5% N) in two equal splits after thinning and the second irrigation. Potassium fertilizer was added at the rate of 24 kg/fed K_2O as potassium sulphate (48% K_2O) in one dose with the 1^{st} dose of nitrogen fertilizer.

Studied parameters:

1. **Soil analysis:** The soil texture was clay loam and the results of soil analysis for the two seasons were carried out according to **Jackson (1973)**, as shown in Table (1).
2. **Growth characters:** Final plant height and number of fruiting branches per plant.
3. **Yield and yield components:** Number of flowers/plant, No. of open bolls/plant, boll shedding %, boll retention %, boll weight (gm), seed index (gm), Lint %, earliness % and seed cotton yield/fed.

Table 1: Chemical analysis of the experimental soil in 2011 and 2012 seasons.

properties	2011	2012
PH	7.50	7.20
Texture	Clay loam	Clay loam
E.C. (mm hos/cm at 25^{o}c)	0.36	0.323
Available N (PPm)	16.90	16.20
Available P (PPm)	17.20	14.50
Available K (PPm)	140.00	134.40
$CaCo_3$%	2.60	2.25
Available B (PPm)	0.070	0.065
Available Mo (PPm)	0.004	0.003

4. **Chemical constituents:** Pigments concentrations were determined according to (Arnon, 1949), sugars concentration in leaves (A-O-A-C, 1975), total phenols according to Siman and Ross (1971) and poly phenols according to (A.O.A.C. 1965).
5. **Testing cotton fiber properties:** The studied fiber quality traits were fiber length (Upper half length MHMum), fiber strength (g/tex) and micronaire reading which were measured by using High volum instrument (HVI) according to A.S.T.M. (1986).

The statistical analysis was computed according to Snedecor and Cochran (1981) and the treatment means were compared using L.S.D. values at 0.05 % level of probability.

RESULTS AND DISCUSSION

Growth characters:

Results in Table (2) showed that foliar application of boron (B) at 1gm/L , Molybdenum (MO) at 0.8 gm/L and Etherel (Eth) at two levels (5 and 10 PPm) significantly increased Number of flowers/plant, boll retention % and earliness percentage in the second one only as compared with the control, while, decreased significantly boll shedding percentage as compared with the control in both seasons. However, foliar application of B, Mo and Eth insignificantly effected plant height, No. of fruiting branches/plant and earliness percentage in the first season only as compared with the control. Highest growth characters were obtained from spraying plants with Eth 10 PPm + Mo. 0.8 g/L (treatment 10) as compared with the control in both seasons. It could be detected that etherel increased plant productivity as a result of the sum of its morphological, biochemical and physiological effects on plants. Etherel is commercially used to release bud, rhizome and tuber dormancy in many plants. Similar results were obtained by Kassem and Alia (2003) and Schworz and Mendel (2006) who indicated that Mo. Is an essential element for higher plants and plays a vital role in many physiological and biochemical processes while, Kassem *et al*. (2009), found that spraying boron showed positive effects on cotton which significantly increased plant height and number of fruiting branches per plant.

Table 2: Effect of foliar spraying of etherel, Boron, Molybdenum, and its combinations on cotton growth characters during 2011 and 2012 seasons.

Treatments	Plant height (cm)		No. of fruiting branches / plant		No. of flowers / plant		Boll retention %		Boll shedding %		Earliness %	
	2011	2012	2011	2012	2011	2012	2010	2012	2011	2012	2011	2012
1. Control (tap water).	119	116	13.25	12.87	27.80	25.00	69.06	66.92	30.94	33.08	65.44	52.72
2. Boron (B)	123	119	13.95	13.20	28.00	26.50	71.79	65.92	28.21	34.08	67.68	57.26
3. Molybdenum (Mo.)	117	117	13.85	13.12	27.90	26.30	71.68	66.16	28.32	33.84	67.65	56.04
4. Ethereal 5 PPm (Eth.)	117	118	13.30	12.97	27.85	25.05	69.30	66.79	30.70	33.21	65.60	54.04
5. Ethereal 10 PPm	119	117	14.40	13.27	27.96	26.90	71.88	66.17	28.12	33.83	68.24	58.47
6. B + Mo.	121	117	14.50	13.33	28.08	27.08	75.50	66.47	24.50	33.53	68.28	59.18
7. Eth. 5 PPm + B	122	118	14.57	13.37	28.50	27.10	74.74	66.79	25.26	33.21	68.38	59.30
8. Eth. 5 PPm + Mo.	124	120	14.90	13.73	30.50	29.00	74.43	67.93	25.57	32.07	69.16	59.71
9. Eth.10 PPm + B	123	119	14.65	13.47	30.20	28.10	73.84	66.08	26.16	33.92	68.51	59.37
10. Eth 10 PPm + Mo.	125	123	15.00	14.00	31.70	30.65	75.71	71.22	24.29	28.78	69.20	62.09
L.S.D. 5 %	N.S.	N.S.	N.S.	N.S.	0.72	0.65	0.85	0.50	0.70	0.60	N.S.	2.50

Yield and Yield components:

Results in Table (3) revealed that No. of open bolls/plant, seed index and seed cotton yield/fed. significantly increased on in both seasons. However, lint percentage and boll weight insignificantly affected as compared with control in the two seasons. Highest values of these traits were obtained from Eth. 10 PPm + Mo. 0.8 g/L (treatment 10), while the lowest values were obtained from the control. The increase percentage in seed cotton yield/fed. over control amounted to 26.41% in the first season and 24.29% in the second season. The increment in seed cotton yield/fed. which may due to the high level of Eth. application is mainly attributed to that this level of Eth. significantly increased plant growth traits, earliness and seed cotton yield components. In this concern, Gebaly *et al*. (2008) found that No. of open bolls/plant, boll weight and seed cotton yield/fed.

were increased significantly by spraying Eth. At the rate of 10 and 20 PPm as compared with control. The observed increment of seed cotton yield may be a result of the increase in No. of fruiting branches, No. of open bolls / plant, boll weight, seed index as well as lint percentage due to the important role of B stimulating pollen germination and pollen tube growth resulting in successful fruit setting. These results are similar to those obtained by Niaz *et al* (2002) and El-Menshawy and El-sayed (2007) and Kassem *et al*. (2009) indicated that spraying boron showed positive effects on cotton which significantly increased No. of open bolls/plant, boll weight and seed cotton yield/fed. Also, Mo. plays a vital role in many physiological and biochemical processes. These results may be due to the increase of the estimated attributes in leaves. In addition, it is directly related to metabolic function of nitrogen in the plant through nitrate reeducate enzyme that reduces the nitrate to nitrite and this the first step of the incorporation of nitrogen to proteins, Bambara and Ndakidemi (2010).

Table 3: Effect of foliar spraying of etherel, Boron, Molybdenum, and its combinations on yield and yield components during 2011 and 2012 seasons.

Treatments	No. of open bolls / plant		Seed index (gm)		Lint %		Boll weight (g)		Seed cotton yield (Kentar/fed.)	
	2011	2012	2011	2012	2011	2012	2010	2012	2011	2012
1. Control (tap water).	19.20	16.73	10.34	10.30	39.35	39.32	3.07	3.02	9.01	8.07
2. Boron (B)	20.10	17.47	10.51	10.46	39.50	39.44	3.09	3.04	9.77	8.95
3. Molybdenum (Mo.)	20.00	17.40	10.46	10.42	39.48	39.40	3.08	3.04	9.52	8.90
4. Ethereal 5 PPm (Eth.)	19.30	16.73	10.36	10.31	39.37	39.34	3.08	3.03	9.09	8.43
5. Ethereal 10 PPm	20.10	17.80	10.56	10.48	39.50	39.45	3.10	3.05	9.80	8.96
6. B + Mo.	21.20	18.00	10.59	10.49	39.52	39.49	3.10	3.08	10.03	8.97
7. Eth. 5 PPm + B	21.30	18.10	10.68	10.62	39.54	39.53	3.12	3.09	10.28	9.16
8. Eth. 5 PPm + Mo.	22.70	19.70	10.79	10.75	39.70	39.69	3.16	3.12	10.85	9.36
9. Eth.10 PPm + B	22.30	18.57	10.72	10.68	39.62	39.67	3.12	3.10	10.62	9.28
10. Eth 10 PPm + Mo.	24.00	21.83	11.28	10.79	39.74	39.71	3.17	3.15	11.39	10.03
L.S.D. 5 %	0.85	0.60	0.18	0.15	N.S.	N.S.	N.S.	N.S.	0.70	0.65

Chemical contents:

Results in Tables (4 and 5) clear that spraying B, Mo. and Eth significantly affect total chlorophyll, chlorophyll a %, chlorophyll b %, carotenoids, poly-phenols, mono-phenols, total phenols, reducing sugars and total soluble sugars in both seasons. The results generally indicated that chlorophyll a, chlorophyll b percentages, total chlorophyll and carotenoids contents were significantly increased as result of foliar application of B, Mo. and Eth. as compared with the control in both seasons, (Table 4). It could be stated that Eth. increased plant productivity as a result of the sum of its morphological, biochemical, physiological effects on plants. Induction of flowering may be a form of Eth. induced aging. However, changes in plant biochemical composition (i.e. accumulation of amino acids and organic acids), resulting from Mo. deficiency are more complex than with many other elements. The effects of carbohydrate accumulation on photosynthesis, (Schwerz and Mendel, 2006).

Results in Table (5) revealed that various foliar treatments of B, Mo. and Eth. significantly increased leaves content of phenols (poly, mono and total phenol) in comparison with the control in 2011 and 2012 seasons. While mono-phenol was insignificantly affected by B, Mo. and Eth. application. These results are agreement with Marschner (1995) who concluded that under low B condition there is a shift in metabolism toward the pentose phosphate cycle, which enhances phenol formation and accumulation while, increasing the activity of poly-phenol oxides. Niaz *et al*. (2002), indicated that

B helps in the biosynthesis of cell walls and there by cell division and elongation, in the rapidly growing, conductive and storage tissues and also aids in sugars and nutrients translocation, resulting in promoting growth of vegetative growing tissues and developing storage sinks. Blevins and Lukaszewski, (1998) conducted that cotton plant shows a particular need for B during flowering and boll development stage owing to the central role of B in stimulating pollen germination and pollen tube growth, resulting in successful fruit setting, Zhao and Oasterhuis (2003). Many recent studies have demonstrated positive effects of foliar application of B on cotton growth, fruit retention, yield and yield components of cotton, Kassem and Alia (2003) and El-Menshawy and El-Sayed (2007).

Results in Table (5) shows that foliar application of B, Mo. and Eth. significantly increased reducing sugar and total soluble sugar as compared with control. In this regard, Faris and Rakkadh (2008), found that B has been shown to increase uptake of sugars by leaves and is frequently attributed a role to play in short and long distance transport of sugars. Increased photosynthesis due to its role in energy transfer processes in both photosynthesis and respiration, consequently, enhances carbohydrate transport through cells walls and maximum production of starch and sugar.

Table (4): Effect of foliar application of etherel, Boron, Molybdenum, and its combinations on chemical constituents in leaves during 2011 and 2012 seasons.

Treatments	Total chlorophyll mg/g dry Wt.		chlorophyll (a) mg/g dry Wt.		chlorophyll (b) mg/g dry Wt.		Carotenoids mg/g	
	2011	2012	2011	2012	2011	2012	2011	2012
1. Control (tap water).	7.13	6.08	61.17	56.39	38.83	43.61	0.78	0.67
2. Boron (B)	7.66	6.62	61.82	56.46	38.18	43.54	0.89	0.80
3. Molybdenum (Mo.)	7.57	6.53	61.35	56.45	38.65	43.55	0.88	0.79
4. Ethereal 5 PPm (Eth.)	7.23	6.20	61.18	56.41	38.82	43.59	0.80	0.70
5. Ethereal 10 PPm	7.84	6.79	61.89	56.55	38.11	43.45	0.90	0.80
6. B + Mo.	7.97	6.89	62.02	56.74	37.98	43.26	0.90	0.82
7. Eth. 5 PPm + B	8.12	7.05	62.13	57.12	37.87	42.88	0.92	0.84
8. Eth. 5 PPm + Mo.	8.24	7.26	62.48	57.40	37.52	42.60	0.95	0.87
9. Eth.10 PPm + B	8.17	7.10	62.24	57.30	37.76	42.70	0.94	0.85
10. Eth 10 PPm + Mo.	8.32	7.35	62.66	57.55	37.34	42.45	0.97	0.89
L.S.D. 5 %	**0.35**	**0.30**	**0.55**	**0.50**	**0.35**	**0.25**	**0.13**	**0.15**

Table (5): Effect of foliar application of etherel, Boron, Molybdenum, and its combinations on chemical constituents in leaves during 2011 and 2012 seasons.

Treatments	Poly phenol mg/g dry wt.		Mono phenol mg/g dry wt.		Total phenol mg/g dry wt.		Reducing sugar mg/g		Total soluble sugars mg/g dry wt.	
	2011	2012	2011	2012	2011	2012	2010	2012	2011	2012
1. Control (tap water).	13.60	13.20	10.50	10.30	24.10	23.50	13.15	12.39	16.70	16.29
2. Boron (B)	14.50	14.23	10.72	10.52	25.22	24.75	13.85	13.36	18.50	17.58
3. Molybdenum (Mo.)	14.30	13.60	10.70	10.50	25.00	24.10	13.70	13.29	18.35	16.97
4. Ethereal 5 PPm (Eth.)	13.65	13.50	10.65	10.45	24.30	23.95	13.60	12.97	17.20	16.80
5. Ethereal 10 PPm	13.45	13.32	10.58	10.38	24.03	23.70	13.25	12.70	17.00	16.50
6. B + Mo.	14.70	14.40	10.75	10.55	25.45	24.95	14.00	13.50	19.09	18.85
7. Eth. 5 PPm + B	15.00	14.80	10.95	10.80	25.95	25.60	15.45	15.10	21.90	21.70
8. Eth. 5 PPm + Mo.	14.90	14.78	10.92	10.72	25.85	25.50	15.10	14.90	20.85	20.60
9. Eth.10 PPm + B	15.10	14.90	11.08	10.90	26.18	25.80	15.90	15.20	22.55	22.35
10. Eth 10 PPm + Mo.	14.80	14.45	11.80	10.60	25.60	25.05	14.20	13.80	19.35	19.29
L.S.D. 5 %	**0.20**	**0.15**	**N.S.**	**N.S.**	**0.25**	**0.22**	**0.35**	**0.32**	**0.42**	**0.35**

Fiber quality:

Results in Table (6) showed that foliar application of B, Mo. and Eth. had a significant effect on upper half mean length, uniformity index, strength and micronaire reading in both seasons, but did not exhibit any significant effect on elongation %. A deficiency of B can also affect fiber quality presumably because of the role of B in cell wall growth. Similar results were obtained by Faris and Rokkedh (2008) and Hamoda (2012) found that elongation of cotton fiber required the presence of B. On the other hand, a decrease in fiber length and micronaire was reported for plants not receiving adequate B.

Table (6): Effect of foliar application of etherel, Boron, Molybdenum, and its combinations on fiber properties during 2011 and 2012 seasons.

Treatments	Fiber length parameters				Fiber bundle tensile				Micronaire reading	
	Upper half mean (U.H.M.)		Uniformity index		Strength g/tex		Elongation %			
	2011	2012	2011	2012	2011	2012	2010	2012	2011	2012
1. Control (tap water).	33.17	33.10	85.70	86.00	40.20	40.17	7.27	7.23	4.10	4.00
2. Boron (B)	34.53	34.47	86.37	86.23	41.77	41.60	7.47	7.37	4.43	4.30
3. Molybdenum (Mo.)	34.13	34.07	86.17	86.17	41.50	40.90	7.42	7.28	4.37	4.30
4. Ethereal 5 PPm (Eth.)	33.80	33.77	86.13	86.07	40.83	40.67	7.37	7.27	4.27	4.17
5. Ethereal 10 PPm	34.80	34.33	86.47	86.33	42.13	41.73	7.50	7.37	4.47	4.40
6. B + Mo.	34.86	34.63	86.53	86.50	42.73	42.03	7.50	7.43	4.50	4.43
7. Eth. 5 PPm + B	35.10	34.90	86.87	86.80	43.20	42.70	7.53	7.50	4.57	4.50
8. Eth. 5 PPm + Mo.	35.50	35.30	87.20	87.13	43.13	43.00	7.53	7.60	4.80	4.67
9. Eth.10 PPm + B	35.30	35.33	87.07	87.03	43.53	42.87	7.63	7.52	4.50	4.57
10. Eth 10 PPm + Mo.	35.70	35.47	87.50	87.43	43.37	43.20	7.53	7.67	4.83	4.77
L.S.D. 5 %	**0.19**	**0.39**	**0.34**	**0.31**	**0.36**	**0.25**	**N.S.**	**N.S.**	**0.13**	**0.11**

REFERENCES

Abdel Aal, M.H.; F.M. Ahmed and M.A. Ashoub (1987). Response of cotton plants to Etherel treatments. Annals Agric. Fac. Agric., Ain Shams Univ., 32 (2): 1089 – 1105.

A.O.A.C. (1965). Association of Official Agricultural Chemists, 7th ed. Washington, DC.

A.O.A.C. (1975). Official Methods of analysis of Official Agricultural chemists 12th ed. Washington D.C. pp. 94 – 117.

Arnon, D.I. (1949). Copper enzyme in isolated chloroplasts. Plant Physiol., 24 (1): 1 – 15.

A.S.T.M. (1986). American society for testing and Materials. D 4605, 07 (1), Easton, MD, USA.

Bambara, S. and P.A. Ndakidemi (2010). The potential role of Lime and molybdenum on the growth, nitrogen fixation and assimilation of metabolites in modulated Legume, Aspecial reference to phaseolus vulgaris. African J. Biotech, 8: 2482 – 2489.

Blevins, D.G. and K.M. Lulaszewski (1998). Boron in plant structure and fuction. Annu. Rev. Plant Phsiol. Mol. Biol., 49: 481 – 500.

El-Menshawy, M.E. and E.A. El-Sayed (2007). Some trails for increasing cotton yield by foliar application of some micronutrients. J. Agric. Sci. Mansoura Univ., 32 (1): 1 – 9.

Faris, A.T.I. and M. Rakkadh (2008). Effect of boron on some productive and technological traits of Syrian cotton variety Dier 22. Arab Univ. J. Agric. Sci., 16 (2): 227 – 240.

Gebaly, Sanaa, G.; Namich, Alia A.A.; and M.M. Kassem 2008. Influence of mechanical topping and growth regulators on growth, yield and fiber properties of Egyptian cotton (*Gossypium barbadense* L.) Minufiya J. Agric. Res., 33 (2): 445 - 455

Hamoda, S.A.F. (2012). Tesponse of Giza 90 cotton cultivar to foliar application of some drought tolerance inducers under water stress and high temperature conditions in Upper Egypt. J. Plant production, Mansoura Univ., 3 (3): 493 – 507.

Jakson, M.L. (1973). Soil chemical analysis. (ed.) Prentice Hall of Indian Private limited, New Selhi.

Johan, H.E. (1986). Cotton physiology. Pp. 79 – 90. In: J.R. Mauney and J. McD. Stewart (Eds). The cotton foundation. Memphis, Tennessee.

Kassem, M.M.A. and Alia A.A. Namich (2003). Response of cotton cultivar Giza 83 to foliar application of Etherel (Ethephon) in low concentrations under later planting conditions. J. Agric. Sci., Mansoura Univ., 28 (8): 5945 – 5955.

Kassem, M.M.A.; M.A.A. Emara and S.A.F Hamoda (2009). Growth and productivity of Giza 80 cotton cultivar as affected by foliar feeding with boron and zinc. J. Agric. Sci., Mansoura Univ., 34 (2): 967 – 975.

Leopold, A.C. and P.E. Kriedemann (1980). Plant growth and development. (ed.) Tata McGraw Hill publishing Company Ltd., New Delhi, 2nd Ed., Pp. 245.

Marschner, H. (1995). Mineral nutrition of higher plants "Part 1: Nutritional physiology, functions of mineral nutrients. (ed.) Micronutrients PP. 269 – 340.
Mesbah, E.A.E. and A.E. El-Gabiery (2011). Effect of Boron concentrations and spraying time on yield, its components and quality of Giza 86 cotton cultivar. Egypt J. of Appl. Sci. 26 (4): 309 – 322.
Nehro, P.L. and S.P. Godara (2010). Integrated nutrient management in hirsutum cotton under cotton-wheat cropping system. J. Cotton Res. And Dev. 24(1): 41 – 47.
Niaz, A; M. Ibrahim N. Ahmed and A. Anwar (2002). Boron contents of light and medium texture soils and cotton plants. Inter. J. Agric. & Biol., 4 (4): 534 – 536.
Roberts, R.K.; J.U. Gesman and D.D. Haward (2002). Soil and foliar application boron in cotton production. J. Cotton Sci, 4: 171 – 177.
Sawan, Z.M., R.A. Sakr and M.A. El-kady (1984). Effect of etherel treatment on the yields components and fiber properties of the Egyptian cotton. Z. Ackerund Pdlanzenbau. (J. Agronomy and Crop Science), 153: 72 -78.
Simans, T.J. and A.F. Ross (1971). Change in phenol metabolism associated with enclosed systemic resistance to tobacco-mosaic virus Samson N. tobacco. Phytopothology , 61: 1261 – 1265.
Schworz, C. and R.R. Mendal (2006). Molybdenum cofactor biosynthesis and Molybdenum enzymes. Annual Review of Plant Biology, 75: 623 – 647.
Snedecor, G.W. and W.G. Cochran (1981). Statistical Method. 7th Ed. Iowa State Univ. Press. Iowa, U.S.A.
Zhao, D. and D.M. Oasterhuis (2003). Cotton growth and physiological response to boron deficiency. J. Plant Nutrition, 26 (4): 855 – 867.

تأثير الرش بالإثيريل وبعض العناصر الصغرى على إنتاجية القطن المصرى

سـناء جمعه جبـالى
معهد بحوث القطن – مركز البحوث الزراعية – جيزة - مصر

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسخا خلال الموسمين الصيفيين 2011 – 2012 ، لدراسة تأثير الرش بالبورون (1 جم/لتر) والمولبيدنم (0.8 جم/لتر) والإثيريل بمعدلين (5 ، 10 جزء فى المليون) منفردا أو فى خليط وذلك بالرش مرتين عند مرحلة بداية التزهير وعند قمة التزهير مقارنة بعدم الرش (رش ماء) كمعاملة مقارنه ، وتأثيرهما على صفات النمو والمحصول ومكوناته ودلائل التبكير والصفات الكيماويه للأوراق على هجين من القطن المصرى (10229 × جيزة 86).

ويمكن تلخيص نتائج الدراسة كما يلى:

١. أوضحت النتائج أن الرش بالبورون والموليبدنم والإثيريل أدى إلى زيادة معنوية فى عدد الأزهار على النبات ، والنسبة المئوية للتبكير ، عدد اللوز المتفتح على النبات ، وزن 100 بذرة وكذلك محصول القطن الزهر للفدان. بينما أعطى تأثير غير معنوى على طول النبات ، عدد الأفرع الثمرية على النبات ، تصافى الحليج ومتوسط وزن اللوزة.
٢. أظهرت النتائج أن جميع معاملات الرش أدى إلى زيادة معنوية فى محتوى الأوراق من الكلورفيل أى النسبه المئوية للكلورفيل (أ ، ب) ، وكذلك محتوى الأوراق من الكلورفيل الكلية والكاروتين ، وأيضا زيادة معنوية فى السكريات الكلية والفينولات.

٣. أشارت النتائج إلى أن جميع المعاملات أدت إلى زياده معنوية فى نسبة الألياف ، وصفات التيلة (الطول ، معدل إنتظام الطول والمتانة).
٤. أظهرت النتائج أن معاملة الرش بالإثيريل (10 جزء فى المليون) + الرش بالموليبدنم (0.8 جم/لتر) أعلى القيم فى جميع الصفات مقارنة بباقى المعاملات ومعاملة المقارنه.
٥. أظهرت النتائج أن معاملة الرش بالإثيريل (10 جزء فى المليون) + الرش بالموليبدنم (0.8 جم/لتر) زيادة معنوية فى عدد الأفرع الثمرية ، وعدد اللوز المتفتح على النبات ، ومتوسط وزن اللوزة ، ومحصول القطن الزهر للفدان مقارنة بباقى المعاملات ومعاملة المقارنه ، بينما أظهرت تأثير غير معنوى على طول النبات وتصافى الحليج ، والنسبة المئوية للتبكير ، وصفات التيلة.

توصى هذه الدراسة لتعظيم إنتاجية محصول القطن من وحدة المساحة وذلك بالرش بالبورون (1 جم/لتر) وبالإثيريل (10 جزء فى المليون) + الرش بالموليبدنم (0.8 جم/لتر) تحت ظروف محافظة كفر الشيخ.

قام بتحكيم البحث

أ.د / على السعيد الشريف	**كلية الزراعة – جامعة المنصورة**
أ.د / اسامه محمد واصل	**مركز البحوث الزراعية**