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EFFECT OF POTASSIUM MINERAL AND ORGANIC FERTILIZERS ON COTTON PRODUCTIVITY UNDER CALCAREOUS SOIL CONDITIONS

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ABSTRACT

Two field experiments were carried out on a highly calcareous sandy clay loam soil in Nubaria Agricultural Research Station, Agricultural Research Center, Alexandria Governorate, Egypt, during 2011 and 2012 seasons to study the effect of potassium sources (mineral and organic) fertilizers and application times on growth, earliness, yield, yield components and fiber properties of Egyptian cotton cultivar Giza 86 (*Gossypium barbadense, L.*). The experimental design was a split-plot with four replications. The main plots involved the two potassium sources treatments of fertilization namely; A- Potassium mineral (K-Sulphate) and B- Potassium organic (K-Humate), and the sub plots involved three treatments of potassium application method and time namely; 1- Soil application at thinning. 2- Foliar spraying two times (at initiation of flowering and two weeks after flowering). 3- Foliar spraying three times (at squaring, initiation of flowering and two weeks after flowering).

The most important results obtained could be summarized as follows:

1) The potassium organic (K-humate) had positive effects, where it significantly decreased first sympodial position in first season only, no. of days from sowing to the first flower as well as, to the first open boll and boll age and significantly increased earliness percentage in 2011 and 2012 seasons. The K-humate produced the highest values for plant height at harvest, no. of sympodia/plant, no. of open bolls/plant, boll weight, seed cotton yield/plant and seed cotton yield/fed. in both seasons. The sources of potassium did not exhibit significant effect on lint percentage and seed index in both seasons.

2) The foliar application three times (at squaring, start and peak of flowering stages) significantly decreased days from sowing to the first flower as well as, to the first open boll and boll age, and increased earliness % compared to the other potassium application treatments, and significantly increased plant height at harvest, no. of sympodia/plant, no. of open bolls/plant, boll weight, seed cotton yield/plant and seed cotton yield/fed. in both seasons and seed index in first season only. While, the foliar application sprayed three times did not exhibit any significant effect on lint percentage in both seasons.

3) The interaction between potassium sources and application method and time had insignificant effect on first sympodial position, boll age, lint percentage and seed index in both seasons but, the interaction gave significant effect on plant height at harvest, days to the first flower and first open boll, earliness percentage and no. of open bolls/plant in 2011 and 2012 seasons.

4) The potassium sources fertilizers, application method and time and the interaction between them did not exhibit significant effect on fiber properties under study.

It could be concluded that the foliar application of 500 cm^3 potassium humate/fed. sprayed three times at squaring, start and peak of flowering stages gave high productivity of cotton (Giza 86 variety) under calcareous soil in Nubaria region.

Keywords:*Cotton, potassium (sulphate and humate), growth, earliness, yield, fiber and calcareous soil.*

INTRODUCTION

In Egypt, cotton is one of the most important crops for both local industry and export. Also, it is considered the main source of fiber and oil. Egyptian cotton is facing severe problems. Two major decisions should be taken to restore the situation of the Egyptian cotton. The first is the improvement of the growing conditions of the crop or simply improving the crop management. The second is the reduction of production cost, especially cost of mineral fertilizers (Abou-Zaid, 1999). Soil fertility and crop management are the two most important factors of modern agricultural activity (Sawan *et al.*, 2006).

The soil under the present investigation was characterized by high calcium carbonate and low fertility status that could influence crop growth. Among the management practices, one factor is very essential, this is potassium (K) fertilizer. Foliar potassium (K) application is one of the solution to improve the growing condition of the crop or simply improving the crop management , reduction of the environmental pollution and production cost (Abou-Zaid *et al.*, 2009). The Nile silt was a source for K-bearing minerals that enriched the soil during the seasonal floods (Abd El-Hadi *et al.*, 1997). Continuous crop removal without replenishment of these nutrients can lead to an irreparable damage to soil fertility (Sawan *et al.*, 2006). Recently, K deficiencies became a problem because of K deficiency in soil due to crop uptake, runoff, leaching and soil erosion (Sheng and Huang, 2002).

Potassium (K) is an important nutrient that has favorable effects on the metabolism of nucleic acids, proteins, vitamins and growth substances. Furthermore, K plays an important role in the translocation of photsynthates from sources to sinks (Bednarz and Oosterhuis, 1999 and Morteza *et al.*, 2005). Many studies have shown increased yield and cotton productivity in response to potassium fertilization as reported by Khalifa and Abou-Zaid (2002), El-Masri *et al.* (2005), Kassem and Ahmed (2005), Sary *et al*. (2008), Abou-Zaid *et al.* (2009), Emara (2012), Emara and Hamoda (2012), Sema *et al.* (2012), Sawan (2013), Abdel-Aal *et al.* (2014), Sawan (2014), Gomaa *et al.* (2014) and Abd El-Gayed and Awadalla (2014) and Emara (2014). Gebaly (2012) stated that added potassium fertilizer as foliar spraying improved growth, yield and its components of cotton plant.

The stimulatory effects of humic acid have been directly correlated with enhanced uptake of macronutrients, such as nitrogen, phosphorus and sulphur (Chen and Aviad, 1990), and micronutrients, that are, Fe, Zn, Cu and Mn (Chen *et al.*, 1999). Humic acid is not a fertilizer, but considered a compliment to fertilizer (Mackowiak *et al.*, 2001). Also, Hermann *et al*. (2000) stated that, the positive effect of humic acid and organic fertilization on the yield capacity of cotton consists of many components. First, these components concern nutrient supply to plants. Second, physical soil properties are affected resulting in differences in root penetration, gas exchange and water supply. Many studies have shown increased yield and cotton productivity in response to potassium fertilization as reported by Basbag (2008), Temz *et al*. (2009), Haroon *et al*. (2010), Gebaly (2012), Emara and Hamoda (2012) and Abou-Zaid *et al.* (2013) stated that added potassium humate fertilizer as soil application or foliar spraying improved growth, yield and its components of cotton plant.

Our objectives were to determine the influence of some potassium sources (mineral and organic) fertilizers and application method and time on growth, earliness, yield, yield components and fiber properties of Egyptian cotton Giza 86 cultivar in the newly reclaimed calcareous soil of west Nubaria and south west of Alexandria governorate.

MATERIALS AND METHODS

Two field experiments were carried out on a highly calcareous sandy clay loam soil in Nubaria Agricultural Research Station, Alexandria Governorate, Egypt, during the two growing seasons of 2011 and 2012 to study the effect of some potassium sources (mineral and organic) fertilizers and application method and time on growth, earliness, yield, yield components and fiber properties of Egyptian cotton cultivar Giza 86 (*Gossypium barbadense*, L.). The experimental design was a split-plot with four replication.

The main plots involved the two potassium sources treatments of fertilization namely:

A- Potassium mineral (Potassium sulphate 48% K_2O).
B- Potassium organic (Potassium humate 8% K_2O and 20% Humic acid).

The sub plots involved three treatments of potassium application method and time namely:

1- Soil application after thinning.
2- Foliar application two times (at initiation of flowering and two weeks after flowering).
3- Foliar application three times (at squaring, initiation of flowering and two weeks after flowering).

Potassium sulphate was applied at the rate of 24 and 5 Kg K_2O/fed. for the soil and foliar applications, respectively. Potassium humate was applied at the rate of 2 and 0.5 L/fed. for the soil and foliar applications, respectively.

Some soil properties were determined according to the method described by Page *et al.* (1982) and are presented in Table (1). In both seasons, the soil texture was sandy clay loam, low content of organic matter, very high calcium carbonate and non-saline. The available amounts of macro- elements were moderate for nitrogen, low for phosphorus and potassium. Regarding, available amounts of micro-nutrients, Fe, Cu and Mn were of medium levels in the soil, while Zn was of low amounts.

Table (1): Soil properties of the experimental sites at Nubaria in 2011 and 2012 seasons.

Mechanical analysis					
Season	Clay (%)	Silt (%)	Sand (%)	Organic matter (%)	Texture class
2011	23.30	23.10	50.80	0.49	Sandy clay loam
2012	25.47	24.18	56.82	0.69	

Chemical analysis												
Season	pH	EC (mmhos/cm)	HCO_3^- (%)	Ca CO_3 (%)	Available element (ppm)							
					N	P	K	Fe	B	Zn	Cu	Mn
2011	8.25	2.03	11.42	26.38	30.6	4.84	124.1	5.3	0.71	0.69	0.35	2.57
2012	8.65	1.82	13.41	23.70	22.3	6.48	178.2	4.3	0.92	0.83	0.26	3.02

The area of each plot was 16.25 m^2 (including five ridges each of 0.65 m wide x 5 m long). The distance between hills was 25 cm. Seeds of Egyptian long staple cotton cultivar Giza 86 (*Gossypium barbadense,* L.) were planted on 15 and 22 April after Egyptian clover (*Trifolium alexandrinum,* L.) in 2011 and 2012 seasons, respectively. Cotton was irrigated, during the whole growing season, eight times in addition to planting irrigation. The first irrigation was

applied after 21 day from planting irrigation, while the other seven irrigations were given at 15-day interval. Before the second irrigation, the plants were thinned to two plants/hill. Hand hoeing was carried out three times during the season before the first, second and third irrigations, respectively.

Phosphorus in the form of superphosphate (15.5% $P_2 0_5$) was applied during land preparation at the rate of 31 kg $P_2 0_5$/fed. Nitrogen fertilizer in the form of ammonium nitrate (33.5% N) was applied at the rate of 75 Kg N/fed. in two equal doses (37.5 + 37.5 Kg N/fed.), i.e., the first dose after thinning and before the second irrigation, and the second dose before the third irrigation. Potassium was added to sub-main plots according to the experimental treatments (type method, rate and date of application). The other standard agricultural practices were followed throughout the growing seasons. The first pick of seed cotton yield was performed by hand, on September 30, while the second pick on October 15 for the first season. The respective dates of picking for the second season were October 13 and 30.

In both seasons, five representative hills (10 plants/sub-main plot) were taken at random in order to study the following traits; plant height at harvest (cm), no. of sympodia/plant, first sympodial position in nodes, days from sowing to the first flower, as well as to the first open boll, boll age, earliness percentage, no. of open bolls/plant, boll weight (g), seed cotton yield/plant (g), lint percentage and seed index (g). The yield of seed cotton in kentars/fed. was estimated from the three inner ridges, (One kentar = 157.5 kg.). The fiber properties i.e., upper half mean length (U.H.M) in mm, uniformity index (U.I), fiber strength (g/tex.), fiber elongation percentage, micronaire reading, reflectance (Rd %) and yellowness (+b) were measured by HVI apparatus according to (A.S.T.M., 1986) in the fibers technology laboratory at Cotton Research Institute, Giza.

The obtained data were subjected to statistical analysis according to the procedures outlined by Snedecor and Cochran (1980) using M Stat-C microcomputer program for a split plot, L.S.D. values at 5% level of significance ($P \leq 0.05$) were used to compare between treatments means.

RESULTS AND DISCUSSION

The results of growth traits, earliness parameters, yield, yield components and fiber properties as affected by potassium sources (mineral and organic) fertilizers and application method and time and the interaction between treatments on cotton Giza 86 during 2011 and 2012 seasons are shown in Tables (2) to (6).

A-Growth traits:

A-1-Effect of potassium sources:

The results in Table (2) show that potassium mineral and organic fertilizers had a significant effect on plant height at harvest and no. of sympodia/plant. The tallest plants (168.66 and 159.41cm) were produced from potassium organic (Humate), while the shortest plants (153.75 and 147.33 cm) were produced from potassium mineral (Sulphate) in 2011 and 2012 seasons, respectively. The highest values of no. of sympodia/plant (14.70 and 15.31) were obtained from potassium organic (Humate), while the lowest values (13.76 and 13.69) were obtained from potassium mineral (Sulphate) in both seasons. Such increase in plant height due to potassium humate may be attributed to stimulation of cell division and internode elongation, and potassium is needed in photosynthesis and the synthesis of protein. Similar results were obtained by Abou-Zaid *et al.* (2009), Emara (2012), Emara and Hamoda (2012), Abou-Zaid *et al.* (2013), Abd El-Gayed and Awadalla (2014), Emara (2014) and Gomaa *et al.* (2014).

A-2-Effect of application method and time:

The results in Table (2) show that potassium application method and time had a significant effect on plant height at harvest and no. of sympodia/plant in 2011 and 2012 seasons. The tallest plants (168.37 and 156.62 cm) were produced from foliar application three times, while the shortest plants (151.25 and 149.87 cm) were produced from soil application after thinning in 2011 and 2012 seasons, respectively.

A-3-Effect of the interaction:

The results in Table (2) show that, the interaction between potassium source and application method and time gave significant effect on plant height at harvest in 2011 season only, and no. of sympodia/plant in 2012 season only in favor of potassium humate when applied at the rate of 0.5 L/fed. foliar application three times.

B-Earliness parameters:

B-1-Effect of potassium sources:

The results in Table (3) show that, potassium mineral and organic fertilizers had a significant effect on earliness parameters; days to the first flower and days to the first open boll and earliness % in 2011 and 2012 seasons, but sources of potassium gave insignificant effect on first sympodial position in nodes in both seasons. Potassium organic (Humate), significantly decreased days to the first flower (79.05 and 77.08 days), days to the first open boll (128.05 and 123.95 days) and boll age (49.00 and 46.87 days) while significantly increased earliness percentage (65.75 and 67.51%) in 2011 and 2012 seasons, respectively, compared with the potassium mineral (Sulphate).

The primitive effect of potassium humate on earliness percentage may be due to the useful role of organic matter which creates suitable conditions for plant growth such as increasing soil nutrients. These results are in partial agreement with those obtained by Abou Zeid *et al.*(2009); Emara and Hamoda (2012);Abou-Zaid *et al.* (2013), Abd El-Gayed and Awadalla (2014); Emara (2014) and Gomaa *et al.* (2014)where they found that the earliness were insignificant affected by addition of potassium humate the soil application with foliar application sprayed three times.

B-2-Effect of application method and time:

The results in Table (3) show that potassium application method and time had a significant effect on days to the first flower, days to the first open boll, boll age and earliness % in 2011 and 2012 seasons. First sympodial position was insignificantly affected.

Foliar application three times, significantly decreased days to the first flower (77.20 and 78.02 days), days to the first open boll (126.17 and 126.02 days) and boll age (48.97 and 48.00 days) while significantly increased earliness percentage (68.00 and 64.58%) in 2011 and 2012 seasons, respectively, compared with the soil application after thinning and foliar application twice treatments.

B-3-Effect of the interaction:

The results in Table (3) show that, the interaction between potassium source and application method and time had a significant effect on days to the first flower, first open boll and boll age in 2011 season only, and earliness percentage in 2011 and 2012 seasons. Foliar potassium humate was applied at the rate of 0.5 L/fed. of three times, significantly decreased days to the first flower (74.77 days), days to the first open boll (123.25 days) and boll age (48.47 days) in

2011 season and significantly increased earliness percentage (71.62 and 69.52%) in 2011 and 2012 seasons, respectively, compared with the other treatments.

C- Yield and yield components:

C-1-Effect of potassium sources:

The results in Table (4) show that, potassium mineral and organic fertilizers had a significant effect on no. of open bolls/plant, boll weight and seed cotton yield/plant in 2011 and 2012 seasons, but sources of potassium gave insignificant effect on lint percentage and seed index in both seasons. The highest values of no. of bolls/plant (19.06 and 18.10), boll weight (2.55 and 2.52 g) and seed cotton yield/plant (48.85 and 45.62 g) were produced from potassium organic (Humate), while the lowest values of no. of bolls/plant (17.03 and 15.13), boll weight (2.40 and 2.38 g) and seed cotton yield/plant (41.28 and 36.15 g) were obtained from potassium mineral (Sulphate), in 2011 and 2012 seasons, respectively.

From results in Table (4) the superiority was found in favor of potassium organic (Humate), as compared to the potassium mineral (Sulphate). This treatment produced the highest yield (8.34 and 7.14 kentar/feddan), while the lowest yields (7.43 and 6.54 kentar/feddan) in 2011 and 2012 seasons, respectively. The increase in seed cotton yield due to this interaction is mainly due to the significance decrease in all the earliness parameters and the increase in plant height at harvest, no. of sympodia/plant, no. of open bolls/plant, boll weight and seed cotton yield/plant. These results are in accordance with those outlined by Abou-Zaid *et al.* (2009); Emara and Hamoda (2012); Abou-Zaid *et al.* (2013) and Emara (2014).

C-2-Effect of application method and time:

The results in Table (4) show that potassium application method and time had significant effects on no. of open bolls/plant, boll weight, seed cotton yield/plant and /fed. in both seasons, and seed index in 2011 season, but lint percentage was insignificantly affected by the tested treatments in both seasons.

Foliar application three times, significantly increased no. of open bolls/plant (19.61 and 17.01), boll weight (2.61 and 2.49 g), seed cotton yield/plant (51.19 and 42.59 g) and seed cotton yield/feddan (8.76 and 7.54 kentar/feddan) in 2011 and 2012 seasons, respectively, compared with the soil application after thinning treatment, while the lowest values of no. of open bolls/plant (16.31 and 16.21), boll weight (2.28 and 2.41 g), seed cotton yield/plant (37.54 and 39.17 g) and seed cotton yield/feddan (6.85 and 6.24 kentar/feddan) in 2011 and 2012 seasons, respectively. The increase in seed cotton yield due to the former treatment was significant where this treatment gave positive effect on decrease in all the earliness parameters and the increase in plant height at harvest, no. of sympodia/plant, no. of open bolls/plant, boll weight and seed cotton yield/plant.

C-3-Effect of the interaction:

The results in Table (4) show that, the interaction between potassium sources and application times had a significant effect on no. of open bolls/plant, boll weight, seed cotton yield/plant in 2011 season only. Lint % and seed index were insignificantly affected by the interaction treatments in the two seasons.

The highest values of no. of open bolls/plant (20.05), boll weight (2.63 g) and seed cotton yield/plant (52.73 g) were produced from potassium humate when applied at the rate of 0.5 L/fed. of three times. Seed cotton yield/feddan was significantly affected by the interaction in 2011 and 2012 seasons, where the superiority was found in faver of potassium humate when

applied as foliar at the rate of 0.5 L/fed. three times, as compared to the other treatments. This interaction produced the highest yield (9.17 and 7.74 kentar/feddan), while the lowest yields (6.56 and 5.97 kentar/feddan) were obtained from soil application of 24 Kg potassium sulfate/fed., after thinning in 2011 and 2012 seasons, respectively.

The positive effects of potassium humate on seed cotton yield due to foliar feeding could be explained in view of the following points:

1- Foliar feeding to cotton plants on soils low in K (Table 1) seems to be proper rate at which the response of cotton yield to foliar feeding with potassium may occur.

2- Earlier-maturing higher yielding, faster-fruiting cotton varieties creating a greater demand than the plant system is capable of supplying.

3- This point explains the positive response of the cotton Giza 86 which characterized by its earlier-maturing and higher yielding to foliar feeding with the different sources of potassium.

D- Fiber properties:

The results in Tables (5 and 6) indicate that potassium sources (mineral and organic) fertilizers, application method and time and interaction between their did not exhibit significant effect on fiber properties under study in both seasons. This may be attributed to the realization that these characteristics were less affected by the environmental factors. These results are in agreement in one or more characters with those obtained by El-Masri *et al.*, (2005), Abou-Zaid *et al.*, (2009), Emara (2012), Emara and Hamoda (2012), Abdel-Aal *et al.*, (2014), Emara (2014). Gebaly (2012) found that fiber properties were insignificant affected by the tested potassium treatments.

CONCLUSION

The results obtained in this study could lead us to a package of recommendations, which seemed to be useful for increasing the cotton yield production in quantity and quality. It could be concluded the foliar application three times (at squaring, start and peak of flowering stag) with potassium humate at the rate of 500 cm^3/fed. each spray for producing high productivity of cotton (Giza 86 variety), under Nubaria region and south west of Alexandria governorate.

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Table (2): Cotton growth attributes as affected by the potassium source, application method and time as well as their interaction during 2011 and 2012 seasons.

Characters		Plant height at harvest (cm)		No. of sympodia/ plant	
Seasons / Treatments		2011	2012	2011	2012
Potassium sources (A)	Application method and time (B)				
(Mineral) Potassium sulfate	Soil after thinning.	142.00	144.00	13.05	13.15
	Foliar two times.	156.75	147.75	13.70	13.77
	Foliar three times.	162.50	150.25	14.55	14.15
	Mean	153.75	147.33	13.76	13.69
(Organic) Potassium humate	Soil after thinning.	160.50	155.75	13.77	14.12
	Foliar two times.	171.25	159.50	14.92	15.82
	Foliar three times.	174.25	163.00	15.42	16.00
	Mean	168.66	159.41	14.70	15.31
General mean of (B)	Soil after thinning.	151.25	149.87	13.41	13.63
	Foliar two times.	164.00	153.62	14.31	14.80
	Foliar three times.	168.37	156.62	14.98	15.07
LSD at 0.05 for	A	4.38	2.32	0.26	0.32
	B	1.70	1.89	0.36	0.22
	A x B	2.41	N.S	N.S	0.32

Table (3): Earliness parameters as affected by the potassium source, application method and time as well as their interaction during 2011 and 2012 seasons.

Characters		First sympodial position (Node)		Days to the first flower appearance		Days to the first opened boll		Boll age		Earliness percentage (%)	
Seasons / Treatments		2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Potassium sources (A)	Application method and time (B)										
(Mineral) Potassium sulfate	Soil after thinning.	7.87	7.20	86.10	85.45	139.92	140.62	53.82	55.15	57.52	52.85
	Foliar two times.	785	7.65	80.57	82.12	131.97	134.15	51.40	52.02	63.00	59.15
	Foliar three times.	7.75	7.45	79.62	80.60	129.10	131.30	49.47	50.70	64.37	59.65
	Mean	7.82	7.43	82.10	82.72	133.66	135.35	51.56	52.62	61.63	57.21
(Organic) Potassium humate	Soil after thinning.	7.52	7.20	82.02	79.12	131.57	127.90	49.55	48.77	61.70	63.95
	Foliar two times.	7.42	7.70	80.35	76.67	129.32	123.22	48.97	46.55	63.92	69.07
	Foliar three times.	7.42	7.27	74.77	75.45	123.25	120.75	48.47	45.30	71.62	69.52
	Mean	7.45	7.39	79.05	77.08	128.05	123.95	49.00	46.87	65.75	67.51
General mean of (B)	Soil after thinning.	7.70	7.20	84.06	82.28	135.65	134.26	51.68	51.96	59.61	58.40
	Foliar two times.	7.63	7.67	80.46	79.40	130.65	128.68	50.18	49.28	63.46	64.11
	Foliar three times.	7.58	7.36	77.20	78.02	126.17	126.02	48.97	48.00	68.00	64.58
LSD at 0.05 for	A	N.S	N.S	1.41	0.58	1.23	0.64	2.41	0.89	1.75	0.91
	B	N.S	N.S	1.52	0.73	1.81	0.95	1.49	1.09	1.25	0.48
	A x B	N.S	N.S	2.15	N.S	2.56	N.S	2.11	N.S	1.77	0.68

Table (4): Seed cotton yield and its components as affected by the potassium source, application method and time as well as their interaction during 2011 and 2012 seasons.

Characters		No. of open bolls/plant		Boll weight (g)		Seed cotton yield/plant (g)		Seed cotton yield (Kentar/fed.)		Lint percentage		Seed index (g)	
Seasons / Treatments		2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Potassium sources (A)	Application method and time (B)												
(Mineral) Potassium sulfate	Soil after thinning.	15.00	14.72	2.09	2.34	31.47	34.49	6.56	5.97	39.29	40.36	9.82	9.62
	Foliar two times.	16.92	15.17	2.52	2.39	42.69	36.38	7.39	6.31	39.09	40.72	9.86	9.71
	Foliar three times.	19.17	15.50	2.59	2.42	49.66	37.58	8.34	7.34	39.67	40.77	10.00	10.02
	Mean	17.03	15.13	2.40	2.38	41.28	36.15	7.43	6.54	39.35	40.61	9.89	9.78
(Organic) Potassium humate	Soil after thinning.	17.62	17.70	2.47	2.47	43.61	43.85	7.15	6.51	39.52	40.15	9.87	9.59
	Foliar two times.	19.52	18.07	2.57	2.51	50.23	45.41	8.72	7.19	39.97	40.36	10.07	10.07
	Foliar three times.	20.05	18.52	2.63	2.57	52.73	47.61	9.17	7.74	39.24	40.72	10.14	10.16
	Mean	19.06	18.10	2.55	2.52	48.85	45.62	8.34	7.14	39.58	40.41	10.02	9.94
General mean of (B)	Soil after thinning.	16.31	16.21	2.28	2.41	37.54	39.17	6.85	6.24	39.41	40.25	9.84	9.61
	Foliar two times.	18.22	16.62	2.54	2.45	46.46	40.89	8.05	6.75	39.53	40.54	9.96	9.89
	Foliar three times.	19.61	17.01	2.61	2.49	51.19	42.59	8.76	7.54	39.46	40.74	10.07	10.09
LSD at 0.05 for	A	1.00	0.26	0.08	0.03	1.89	0.85	0.22	0.28	N.S	N.S	N.S	N.S
	B	0.45	0.19	0.05	0.01	1.69	0.60	0.26	0.21	N.S	N.S	N.S	0.52
	A x B	0.63	N.S	0.07	N.S	2.40	N.S	0.36	0.30	N.S	N.S	N.S	N.S

Table (5): Cotton fiber length parameters and micronaire reading as affected by the potassium source, application method and time as well as their interaction during 2011 and 2012 seasons.

Characters		Fiber length parameters				Micronaire reading	
		Upper half mean (mm)		Uniformity index (%)			
Seasons / Treatments		2011	2012	2011	2012	2011	2012
Potassium sources (A)	Application method and time (B)						
(Mineral) Potassium sulfate	Soil after thinning.	34.3	33.5	85.8	85.9	4.76	4.83
	Foliar two times.	33.8	33.1	85.9	85.9	4.60	4.83
	Foliar three times.	33.6	33.1	85.8	85.5	4.70	4.73
	Mean	33.9	33.2	85.8	85.7	4.68	4.80
(Organic) Potassium humate	Soil after thinning.	33.3	33.5	85.1	85.5	4.86	4.73
	Foliar two times.	33.6	33.1	84.7	84.3	4.83	4.80
	Foliar three times.	33.2	33.8	86.6	85.1	4.66	4.63
	Mean	33.3	33.4	85.4	84.9	4.78	4.72
General mean of (B)	Soil after thinning.	33.8	33.5	85.4	85.7	4.81	4.78
	Foliar two times.	33.7	33.1	85.3	85.1	4.71	4.81
	Foliar three times.	33.4	33.4	86.2	85.3	4.68	4.68
LSD at 0.05 for	A	N.S	N.S	N.S	N.S	N.S	N.S
	B	N.S	N.S	N.S	N.S	N.S	N.S
	A x B	N.S	N.S	N.S	N.S	N.S	N.S

Table (6): Cotton fiber quality properties as affected by potassium source, application method and time as well as their interaction during 2011 and 2012 seasons.

Characters		Fiber bundle				Colour			
		Fiber strength (g/tex)		Fiber elongation (%)		Reflectance (Rd %)		Yellowness (+b)	
Seasons / Treatments		2011	2012	2011	2012	2011	2012	2011	2012
Potassium sources (A)	Application method and time (B)								
(Mineral) Potassium sulfate	Soil after thinning.	45.8	44.5	7.26	7.23	75.3	77.3	9.53	9.60
	Foliar two times.	45.8	45.6	7.36	7.20	75.8	75.5	9.36	9.23
	Foliar three times.	44.1	45.2	7.40	7.26	75.7	76.2	9.40	9.06
	Mean	45.2	45.2	7.34	7.23	75.6	76.3	9.43	9.30
(Organic) Potassium humate	Soil after thinning.	45.6	45.4	7.23	7.36	76.2	77.3	9.46	8.96
	Foliar two times.	46.0	45.8	7.36	7.40	75.4	76.7	9.43	8.83
	Foliar three times.	45.6	44.4	7.36	7.36	77.4	75.2	9.46	9.03
	Mean	45.7	45.2	7.32	7.37	76.3	76.4	9.45	8.94
General mean of (B)	Soil after thinning.	45.7	44.9	7.25	7.30	75.7	77.3	9.50	9.28
	Foliar two times.	45.9	45.9	7.36	7.30	75.6	76.1	9.40	9.03
	Foliar three times.	44.9	44.8	7.38	7.31	76.5	76.7	9.43	9.05
LSD at 0.05 for	A	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
	B	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
	A x B	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Emara M.A.A.

تأثير التسميد بالبوتاسيوم المعدني والعضوي علي أنتاجية القطن تحت ظروف الأراضي الجيرية

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بالنوبارية خلال موسمي النمو 2011، 2012 وذلك لدراسة أستجابة صنف القطن المصري جيزة 86 للتسميد بالبوتاسيوم (المعدني والعضوي) وذلك تحت ظروف الاراضي الجيرية، وأثر ذلك علي النمو، التبكير، المحصول ومكوناته وصفات التيلة. زُرعت التجارب في تصميم القطع المنشقة مرة واحدة في أربعة مكررات حيث وضعت معاملات مصادر التسميد البوتاسي أ- المعدني (سلفات بوتاسيوم)، ب- العضوي (هيومات بوتاسيوم) فى القطع الرئيسية ووضعت معاملات مواعيد الاضافة

1. أرضي بعد الخف،
2. رش مرتين (بداية التزهير + بعد التزهير بأسبوعين)
3. رش ثلاث مرات (عند مرحلة الوسواس + بداية التزهير + بعد التزهير بأسبوعين) فى القطع المنشقة.

وتتلخص أهم النتائج المتحصل عليها فيما يلى:

أعطي التسميد بالبوتاسيوم العضوي (هيومات البوتاسيوم) تأثيرات إيجابية حيث كانت معنوية علي دلائل النمو في موسمي الدارسة 2011 و 2012. وأدي الي نقص معنوي لصفات عدد الايام حتي أول زهرة وكذلك حتي تفتح أول لوزة وعمر اللوزة مما أدي بالتالي الي أرتفاع النسبة المئوية التبكير في كلا الموسمين. والبوتاسيوم العضوي (هيومات البوتاسيوم) أعطي أعلي القيم بالنسبة لعدد اللوز المتفتح علي النبات، متوسط وزن اللوزة ومحصول النبات الفردي مما أدي الي الحصول علي أعلي إنتاجية من القطن الزهربالقنطار/فدان خلال موسمي الدراسة.

أعطت طريقة الإضافة بالرش ثلاث مرات تأثيرات معنوية علي صفتي ارتفاع النبات النهائي وعدد الافرع الثمرية علي النبات في كلا الموسمين. كما أدت الي تأثير إيجابي حيث أدت الي أنخفاض معنوي لصفات عدد الأيام من الزراعة حتى أول زهرة وتفتح أول لوزة وعمر اللوزة كما أدت بالتالي الي زيادة النسبة المئوية للتبكير بالمقارنة بطرق الاضافة الاخري، كما أدت الي زيادة معنوية في عدد اللوز المتفتح علي النبات، متوسط وزن اللوزة ومحصول النبات الفردي مما أدي الي الحصول علي أعلي إنتاجية من القطن الزهر بالقنطار/فدان وذلك خلال موسمي الدراسة.

أعطي التفاعل بين مصادر البوتاسيوم ومواعيد الاضافة تأثيرات معنوية علي صفات أرتفاع النبات عند الجني، عدد الأيام من الزراعة حتى أول زهرة، وتفتح أول لوزة، وعمر اللوزة، عدد اللوز المتفتح علي النبات، ومتوسط وزن اللوزة ومحصول النبات الفردي في موسم 2011 فقط، وعدد الافرع الثمرية في موسم 2012 فقط، وعلي النسبة المئوية للتبكير ومحصول القطن الزهر بالقنطار/فدان وذلك خلال موسمي الدراسة.

لم يكن لمصادر البوتاسيوم ومواعيد الاضافة وكذلك التفاعل بينهما أي تأثيرات معنوية علي صفات التيلة تحت الدارسة وذلك خلال موسمي الدراسة.

من النتائج المتحصل عليها يمكن التوصية بإضافة البوتاسيوم العضوي (هيومات البوتاسيوم) رشاً ثلاث مرات (عند مرحلة الوسواس + بداية التزهير + بعد التزهير بأسبوعين) بمعدل 500 سم3/فدان في كل رشة وذلك لزيادة إنتاجية محصول القطن صنف جيزة 86 تحت ظروف الاراضي الجيرية المستصلحة حديثاً في مساحات القطن المنزرعة.