J. Agric. Sci. Mansoura Univ., 27 (4): 2703 - 2712, 2002

EFFECT OF BIOFERTILIZERS, MICRONUTRIENTS AND NPK FERTILIZATION ON COTTON YIELD

Abd El-Magid, A.A.
Plant Nutrition Section, Soil, Water and Environment Research Institute Agricultural Research Center, Giza, Egypt

ABSTRACT

Two field experiments were conducted in both 2000 and 2001 summer seasons at Sakha Exper. Station to study the effect of some nutritional treatments on cotton plant growth (var. Giza 86), seed cotton yield, lint percent, oil content of seeds, protein content of kernel seeds and the net return. The treatments included N, P, K, micronutrients (coatengien) and 3 biofertilizers being, Nitrobien, Phosphorine and Rhizobacterien such products are produced by the General Organization for Agriculture Equalization. These products were examined in combination with half recommended dose of NPK in order to improving seed cotton yield, quality, reducing the required mineral fertilizer by about 50%, increasing the highest net return and protect the agroecosystem from pollution.

The obtained results reveal that:

1. Each of the tested biofertilizer and micronutrient treatments could compensate more than one half the NPK need of cotton plant accompanied with a notable yield increased.
2. The balanced fertilization including micronutrients (Fe: Mn: Zn) used as coating and macronutrients (NPK), could increase the NPK fertilizers efficiency, obtaining high seed cotton yield under both NPK levels and increase lint percent, plant height, No. of open bolls/plant and boll weight.
3. The study showed the vital importance of soil analysis, which have low levels of available N, P, K and some micronutrients it must be fertilized with the economically beneficial amounts of these nutrients, when we cropped with cotton.
4. Protein, oil content in seeds and N, P & K content of cotton fully developed leaves at the beginning of flowering stage were increased by 1/2 NPK (35 - 15 + 12 kg/fed.), micronutrients (coatengien) and biofertilizers (Nitrobien, Phosphorine and Rhizobacterien) applications.
5. The highest cotton seed yield and net return were obtained by full cofertilization with $N_{70}P_{30}K_{24}$ and $N_{35}P_{15}K_{12}$ + biofertilizer (a + b + c) and micronutrients (coatengien).
6. These clearly confirmed that the biofertilizer treatments could be used under the Egyptian conditions as effective tool to compensate the quantities of used the chemical fertilizers and consequently reduce the consumption of these fertilizers which turn minimizing the agricultural costs as well as the Egyptian environmental pollution.

Keywords: Cotton, biofertilizers, micronutrients, chemical fertilizers, yield components

INTRODUCTION

Egyptian cotton *Gossypium barbadense* L. is an important cash crop for the Egyptian farmer and a vital source of raw material for Egyptian textile industry and thus plays an important role in the Egyptian economy. Its contribution to the national income is so great to the extent that we should study all the factors that affect cotton yield in order to maximize the yield per unit area. In addition, Egyptian cotton quality gives us a relative advantage for cotton marketing worldwide. The intensive cultivation depletes the Egyptian soil of some plant nutrients, which could be compensated by fertilizer application. The early recorded results on cotton fertilization under local conditions indicated that nitrogen is one of the most important factors that exerts marked effects on the yield and yield components of cotton (Eid and Hamissa, 1969, Baker and Mahmoud 1977, Mahmoud *et al.* 1985, Yassen *et al.*, 1990, Gindy *et al.*, 1991 and El-Akabawy *et al.*, 2000).

The response of cotton to phosphorus and potassium is lower than that of nitrogen, but it is still profitable to the farmers.

Application of micronutrients to cotton was studied by several researchers who indicated that cotton plants responded positively to micronutrients (El-Aggory and Monged, 1980; Abd El-Hadi *et al.*, 1985 and Monged *et al.*, 1991).

Nowadays, on the way of clear agriculture with minimum pollution effects, the use of biofertilizers is recommended by several investigators to substitute the chemical fertilizers (Saber, 1993 and El-Aggory *et al.*, 1996 and 2001).

Therefore the present investigation was designed to study the ability of some biofertilizers and some micronutrients alone or combined with chemical fertilizers for covering the N, P and K requirements of cotton plants on cotton yield production and the net return and saving the environment against pollution by extra chemical fertilizers application.

MATERIALS AND METHODS

Two field experiments were conducted during 2000 and 2001 summer seasons at the Exper. Farm of Sakha Agriculture Research Station using cotton var. Giza 86 to study the effect of some biofertilizers [Nitobien, Phosphorine, Rhizobacterien and Coatengien] alone or combined with $^1/_2$ NPK levels [35 kg N + 15 kg P_2O_5 + 12 kg K_2O/fed. (half recommended dose)] on cotton plant growth, seed cotton yield, some components and the net return. The experiment was designed in complete randomized block with four replicates. The plot size was 1/400 feddan.

The treatments were:

1. Control (without any fertilizers).
2. N + P + K = 70 kg N + 30 kg P_2O_5 + 24 kg K_2O/fed.
3. 1/2 NPK.
4. 1/2 NPK + Nitrobien (a)
5. 1/2 NPK + Phosphorine (b)
6. 1/2 NPK + Rhizobacterien (c)
7. 1/2 NPK + Coatengien (d)
8. 1/2 NPK + a + b + c + d.

The tested biofertilizers and micronutrient are:

1. Nitrobien: a set of nonsymbiotic N -fixing bacteria (*Azospirillium* sp. + *Azotobacter* sp.).
2. Phosphorine: a set of P-dissolving bacteria (*Bacillus megatheruim* var. *phosphaticum*).

3. Rhizobacterien: containing symbiotic N-fixing bacteria (*Rhizobium leguminosarum*).
4. Coatengien: a chelating micronutrient fertilizer contains Fe, Mn and Zn at the ratio of 2: 1: 2 by weight and used at the rate of 15 g/1 kg seeds.

All these materials are produced and distributed commercially by the General Organization Equalization Fund. Ministry of Agriculture, Egypt.

The nitrogen as ammonium sulphate (20.5% N) was side dressed in two equal doses, the first after thinning (33 days after sowing) and the second after one month later. Phosphorus and potassium fertilizers were added during soil preparation.

Inoculation with biofertilizers were performed through mixing seeds with the appropriate amount of them after coating with Arabic gum as an adhesive material just prior to sowing. Sowing took place at April 19 and 18 in both seasons of 2000 and 2001, respectively. A soil sample from the experimental field was taken before P and K application to investigate soil fertility status. Soil and plant analysis were conducted according to Jackson (1973). The physical and chemical analysis of the soil are given in Table (1). Seeds content of soil was determined according to A.O.A.C. (1970). Lint percentage (%) was calculated as the ratio between weight of lint (g) and seed cotton weight (g). Data obtained were subjected to analysis of variance (Snedecor and Cochran, 1980). The treatment means were compared using the least significant differences test (L.S.D) at the 5% level of probability (Waller and Duncan, 1969).

Table 1: Some physical and chemical properties of the soil samples taken from the experimental field.

Seasons	Texture Class	O.M (%)	PH (1: 2.5)	$CaCO_3$ (%)	EC dS m^{-1}	Macronutrients			Micronutrients		
						Total	Available ppm				
						N ppm	P	K	Fe	Mn	Zn
2000	Clayey	1.9	7.9	3.3	2.60	550	5.6	380	11.9	4.2	0.75
2001	Clayey	1.8	8.2	3.0	2.65	450	5.4	370	10.1	3.6	0.65

RESULTS AND DISCUSSION

Effect of nitrogen phosphorus and potassium on seed cotton yield:

Seed cotton yield, the most important parameter, was affected positively and significantly by NPK application and its splitting. Positive response of yield to NPK application of 70 + 30 + 24 kg/fed. rate in the two seasons are recorded in Table 2 177.83% increase over the control. However, the % increase value reached to 143.13% with biofertilizers combined with chemical fertilizers (1/2 NPK + a + b + c + d) treatment. This means that combination of biofertilizers with suitable does of chemical fertilizers could help to increase the efficiencies of these fertilizers, saving the environment from the high chemical fertilizers (saving about 50% of chemical fertilizers) and accordingly producing satisfactory and good seed cotton yield. The results of El-Akabawy *et al.* (2000), Abd El-Hadi *et al.* (1997), Gindy *et al.* (1991), Makram *et al.* (1994) and Abd El-Hadi *et al.* (1987) on cotton crop confirm these findings. The data of cotton seed yield also indicate that the application of chemical fertilizers alone yielded a significantly better effect than that of biofertilizers alone, this may be attributed to the slow release of biofertilizers can not provide the N, P and K requirements of cotton crop alone (Prasad and Prasad, 1995).

Similar results were recorded in Egypt (El-Aggory *et al.*, 1996). As presented in Table (2) seed cotton yield show marked increases due to micronutrient fertilizers treatment. The increases range between 116.04% (Coatingien alone) and 143.13% (with combination of 1/2 NPK + a+ b+ c + d) in comparison to control treatment. Similar results were reported by several researchers (Abd El-Latif *et al.*, 1990; Monged *et al.*, 1991; Genaidy *et al.*, 1994; Abd El-Hadi *et al.*, 1997 and El-Akabawy *et al.*, 2000).

Cotton yield and its components:

Regarding lint percent, the results in Table (2) show clearly that the increases in lint % were insignificant when Coatingien, Nitrobien, Phosphorine and Rhizobacterien. Remarkable higher lint % was gained by NPK (18.85%). The increase became higher (15.15%) under the 1/2 NPK + a + b + c + d treatment . It is interesting to note that the highest lint % was obtained with biofertilizer when associated with both coatingien and 1/2 NPK.

As shown in Table (3), cotton plant characteristics were significantly affected by biofertilizers and micronutrients (coatingien). All of the characters increased compared with that of the control treatment. NPK and 1/2 NPK + a + b + c + d treatments had the greater influence on growth than other treatments. The plant height, open bolls per plant, boll weight and seed cotton yield increased with the biofertilizers and micronutrients in both seasons.

As seen in Table (4) the mean values of N, P, K and ten leaves dry weight as influenced by biofertilizers and micronutrients NPK and 1/2 NPK + a + b + c + d treatments applications were cased the greater influenced on N, P, K and dry weight. These increase in N, P, K and dry weight contents in the developed cotton leaves at the beginning of flowering stage were cased increase in cotton yield may be due to the biofertilizers and micronutrients treatments to cotton plants which led to the deplition of N, P and K in the soil solution during the growth period of plants. Therefore the N, P and K contents in the developed cotton leaves were in the range of satisfactory nutrients content. Cotton yield response to biofertilizers and micronutrients has been recorded by several Egyptian authors (El-Agory *et al.*, 1996; El-Akabawy *et al.*, 2000; Abdel-Reheem *et al.*, 1991; Ragaa, 1976 and Mahmoud *et al.*, 1985). Also in India Prasad and Prasad (1995) found that, N-fixing bacteria was reported as improving cotton yield factor, by several investigators.

Seeds content of oil and kernel seeds content of protein:

Data in Table (5) indicate that addition of chemical fertilizers and biofertilizers to cotton crop leads generally to an increase in oil and protein percentage in the seeds compared with that of the control regardless of the rate of application. Protein percent increased to somewhat by splitting NPK.

Table 2: Seed cotton yield per feddan and lint percent as affected by different fertilization treatments.

Fert .Treatments	Rates kg/fed.	Seed cotton yield/fed. kg				Lint %			
		2000 season	2001 seasons	Average	Increase %	2000 season	2001 seasons	Average	Increase %
Control	00	425.5	695.6	682.3	-	31.53	32.35	31.94	-
NPK	70+30+24	1215.2	1473.5	1344.4	177.83	37.40	38.52	37.96	18.85
1/2 NPK	35+15+12	813.6	985.4	899.5	85.89	33.65	35.10	34.38	7.64
1/2 NPK + Nitrobien (a)	35+15+12	985.4	1095.3	1040.4	115.00	35.45	36.45	35.95	12.55
1/2 NPK + Phosphorine (b)	35+15+12	1030.2	1062.5	1046.4	116.24	35.30	36.60	35.95	12.55
1/2 NPK + Rhizobacterien (c)	35+15+12	1095.3	1121.8	1108.6	129.10	35.75	37.10	36.43	14.06
1/2 NPK + Coatengien (d)	35+15+12	915.5	1065.3	990.4	104.67	34.80	35.35	35.08	9.83
1/2 NPK + a + b + c + d.	35+15+12	1117.5	1235.4	1176.5	143.13	36.10	37.45	36.78	15.15
L.S.D. 0.05		19.60	21.34	20.92	20.82	0.58	0.87	0.75	12.32

Table 3: Cotton characteristics as affected by different fertilization treatments.

Cotton characteristics / Fert. Treatments	Rates kg/fed.	First season (2000)						Second season (2001)					
		Plant height cm.	Ten leaves dry wt. g.	OB	BW g	SCP g	SCF kg	Plant height cm.	Ten leaves dry wt. g	OB	BW g	SCP g	SCF kg
Control	0	65.00	4.32	3.9	1.53	6.08	425.5	68.52	4.65	4.8	1.63	7.75	542.3
NPK	70+30+24	81.45	7.86	7.4	2.36	17.36	1215.2	89.16	7.94	8.8	2.38	21.05	1473.5
1/2 NPK	35+15+12	73.16	6.35	4.7	2.47	11.62	813.6	75.95	6.89	5.7	2.45	14.08	985.4
1/2 NPK + Nitrobien (a)	35+15+12	78.52	7.17	5.8	2.43	14.08	985.4	81.20	7.28	6.5	2.42	15.65	1095.3
1/2 NPK + Phosphoren (b)	35+15+12	71.50	6.77	6.2	2.39	14.72	1030.2	72.42	6.95	6.4	2.39	15.18	1062.5
1/2 NPK + Rhizobacterin (c)	35+15+12	77.30	7.20	6.6	2.36	15.65	1095.3	79.15	7.37	6.7	2.38	1603	1121.8
1/2 NPK + Coatingin (d)	35+15+12	78.16	6.90	5.3	2.47	13.08	915.5	82.13	7.15	6.3	2.41	15.22	1065.3
1/2 NPK + a + b + c + d	35+15+12	79.60	7.05	6.8	2.35	15.96	1117.5	82.93	7.18	7.4	2.37	17.65	1235.4
L.S.D. 0.05		6.14	2.13	1.15	0.31	1.06	19.60	5.52	2.35	0.56	0.36	1.72	21.34

OB = Open bolls per plant
BW = Boll weight
SCP = Seed cotton yield per plant
SCF = Seed cotton yield per feddan.

Table 4: Mean values of N, P, K and dry weight contents of fully developed cotton leaves at the beginning of flowering stage as affected by different fertilization treatments.

Fert. Treatments	Rates kg/fed.	Ten leaves dry weight g		Concentration %					
				N		P		K	
		2000 season	2001 season	2000 season	2001 season	2000 season	2001 season	2000 season	2001 season
Control	00	4.32	4.65	3.10	2.80	0.19	0.17	1.90	1.80
NPK	70+30+24	7.86	7.94	4.30	4.90	0.32	0.39	3.40	3.90
1/2 NPK	35+15+12	6.35	6.89	4.10	3.80	0.25	0.27	2.80	3.10
1/2 NPK + Nitrobien (a)	35+15+12	7.17	7.28	4.50	4.80	0.24	0.26	3.20	3.40
1/2 NPK + Phosphoren (b)	35+15+12	6.77	6.95	4.30	4.70	0.29	0.30	3.10	3.50
1/2 NPK + Rhizobacterin (c)	35+15+12	7.20	7.37	4.20	4.60	0.23	0.27	2.70	3.40
1/2 NPK + Coatingin (d)	35+15+12	6.90	7.15	4.10	4.40	0.26	0.28	2.90	3.30
1/2 NPK + a + b + c + d	35+15+12	7.05	7.18	4.60	4.80	0.28	0.35	3.10	3.40
L.S.D. 0.05		2.13	2.35	0.22	0.32	0.07	0.08	0.38	0.45

Table (5): Oil and protein contents of the cotton seeds as affected by different fertilization treatments.

Fert. Treatments	Rates kg/fed.	Oil %				Protein %			
		2000 season	2001 seasons	Average	Increase %	2000 season	2001 seasons	Average	Increase %
Control	00	17.93	18.15	18.04	-	41.35	42.52	41.94	-
NPK	70+30+24	21.23	22.45	21.84	21.06	57.15	59.15	58.15	38.65
1/2 NPK	35+15+12	19.23	20.42	19.83	9.92	55.65	57.25	56.45	34.60
1/2 NPK + Nitrobien (a)	35+15+12	19.56	20.80	20.18	11.86	56.15	57.95	57.05	36.03
1/2 NPK + Phosphorine (b)	35+15+12	19.42	21.10	20.26	12.31	55.95	57.35	56.65	35.07
1/2 NPK + Rhizobacterien (c)	35+15+12	19.65	21.75	20.70	14.75	56.90	58.20	57.55	37.22
1/2 NPK + Coatengien (d)	35+15+12	18.95	20.65	19.80	9.76	56.05	56.95	56.50	34.72
1/2 NPK + a + b + c + d.	35+15+12	19.82	21.75	20.79	15.24	56.95	58.45	57.70	37.58
L.S.D. 0.05		0.54	0.58	0.55	1.58	0.83	0.95	0.87	1.98

Table (6): Cost benefit of different treatments applied to cotton plants.

Fert. Treatments	Kentar/fed.				Economical value L.E./fed.											
					Treatment costs						Yield increase value		Net return return of treatment			
	Yield		Yield increase		Total price		Cost of application		Total cost							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd		
Control	2.70	3.44	-	-	-	-	-	-	-	-	-	-	-	-		
NPK	7.72	9.36	5.02	5.92	215.1	215.1	20.0	24.0	235.1	239.1	2259.0	2664.0	2023.9	2424.9		
1/2 NPK	5.17	6.26	2.47	2.82	107.6	107.6	15.0	18.0	122.6	125.6	1111.5	1269.0	988.9	1143.4		
1/2 NPK + Nitrobien (a)	6.26	6.95	3.56	3.51	109.6	109.6	25.0	30.0	134.6	139.6	1602.0	1579.5	1467.4	1439.9		
1/2 NPK + Phosphorine (b)	6.54	6.75	3.84	3.31	109.6	109.6	25.0	30.0	1346.6	139.6	1728.0	1489.5	1593.4	1349.9		
1/2 NPK + Rhizobacterien (c)	6.95	7.12	4.25	3.68	109.6	109.6	25.0	30.0	134.6	139.6	1912.5	1656.0	1777.9	1516.4		
1/2 NPK + Coatengien (d)	5.81	6.76	3.11	3.32	109.6	109.6	25.0	30.0	134.6	139.6	1399.5	1494.0	1264.9	1354.4		
1/2 NPK + a + b + c + d.	7.10	7.84	4.40	4.40	115.6	115.6	25.0	30.0	140.6	145.6	1980.0	1980.0	1839.4	1834.4		

Kentar of seed cotton yield 157.5 kg **450.0 L.E. (local price, 2000 and 2001)**

1 kg N = 1.35 L.E **Biofertilizer = 2 L.E. (local price of pure chemicals).**

1 kg P = 2.5 L.E **1st = First season (2000)**

1 kg K = 1.90 L.E **2nd = Second season (2001)**

Coatingin=2L.E

Seed content of protein reached the maximum (on an average of about 38.65% and 37.58%) when plants received NPK (70 + 30 + 24) kg/fed. and 1/2 NPK (35 + 15 + 12 kg/fed.) + biofertilizers (Nitrobien, Phosphorine and Rhizobacterien) + micronutrients (Coatingien). The increase in protein percent over the control amounted reached to 57.15% in the first season and to 58.12% in the second one. On the other hand, it can be noticed from Table (5) that there is a little increase association between oil content in the seeds. This result is in good agreement with that obtained by El-Akabawy *et al.* (2000) and Ragaa (1976).

Economic benefit study:

Data presented in Table (6) show the net return values obtained by different treatments. It is clearly shown that higher values "net return" were gained by the treatment NPK (70 + 30 + 24 kg/fed), compared with that 1/2 NPK (35 + 15 + 12 kg/fed.). In addition, the highest benefit value was obtained with the treatment of biofertilizers (Nitrobien + Phosphorine + Rhizobacterien) associated with micronutrients (Coatingien) under the 1/2 NPK (35 + 15 + 12 kg/fed.). Similar economical trend on cotton seed yield was reported by El-Akabawy *et al.* (2000); Genaidy *et al.* (1994) and Abd El-Latif *et al.* (1990).

CONCLUSION

These clearly confirmed that the biofertilizer treatments could be used under the Egyptian conditions as effective tool to compensate the quantities of used the chemical fertilizers and consequently reduce the consumption of these fertilizers which turn minimizing the agricultural costs as well as the Egyptian environmental pollution.

REFERENCES

Abd El-Hadi, A.H.; K.G. Asy; H.W. Doering; M.S. Khadr; Y.S. Mohamed; A.A. Moustafa and M.H. Taha (1985). Effect of zinc, manganese, iron and different foliar fertilization on the production of some main field crops in some soils of Egypt. Proceeding of the First International Symposium on Foliar fertilization, Berlin, March 14-16, 1985.

Abd El-Hadi, A.H.; A.A. Moustafa and Y.H. Mohamed (1987). Effect of N, P and K on cotton yield production in Egyptian soils. First Conf. of Fertilizers "Available and Needs", April 13-16 Cairo, Egypt.

Abd El-Hadi, A.H.; M.S. Khadr and M.H. Taha (1997). Cotton fertilization under the intensive cropping systems in Egyptian agriculture. Proc. IRCRNC Joint Meeting of the Working Groups on Cotton. Cairo, Egypt, pp. 147-154.

Abd El-Latif, E.A.; A.Y. El-Bashbishy, K.G. Asy and M.A.M. Abo-Shelbaya (1990). Evaluating different methods of micronutrient application to cotton, wheat and corn. Proc. of Soil Fertility and Foliar Fertilization Conf. Giza, Egypt, 14-15 Jan. 1990.

Abdel-Reheem, M.A.; E.N. Gendy and F.G. Youns (1991). Effect of phosphorus and zinc application on some plant constituents and yield of dandara cotton variety grown on alluvial soils. Egypt. J. Agric. Res., 69(2): 455-464.

A.O.A.C. (1970). Association of Official Agricultural Chemists. Official Method of Analysis. Washington, D.C., p. 138.

Baker, M.A. and M. Mahmoud (1977). Studies on the mineral nutrition of cotton plant in sand culture. Part 1; A comparative study on the growth and some macronutrients N and P content of two cotton varieties. Agric. Res. Rev. Vol. 55, 4: 105-127.

Eid, M.T. and M. R. Hamissa (1969). Nitrogen fertilization for cotton. Congress Book Supreme Council of Soil, Cairo.

El-Aggory, E. and N.O. Monged (1980). Studies on the mineral nutrition of cotton plant in sand culture. Part. IV, Calcium, magnesium and boron, accumulation and distribution in two cotton varieties. Agric. Res. Rev. 58, 39-66.

El-Aggory, E.M.; Y.M.Y. Abido; M.N.A. Omar; M.H. El-Kholy; M.Y.H. Gbraiel; H.G. Abu El-Fotoh; K.G. Aasi; G.M. El-Shebiny; M.R. Dardiry and E.A.Y. El-Kabbany (2001). Effect of using some Egyptian biofertilizers on wheat response to N-fertilizer. Egypt. J. Appl. Sci. 16(3): 138-152.

El-Aggory, E.M.; S. Allam; N.O. Monged and A.Kh. Ahmed (1996). A comparative study on using biofertilizers and micronutrients to reduce the rate of mineral N-fertilizer for wheat plant on sandy soil. Egypt J. Appl. Sci. 11: 286-300.

El-Akabawy, M.A.; S.M.M. Allam and N.O. Monged (2000). Some nutritional studies on cotton plant. Egypt. J. Appl. Sci., 15(7): 34-43.

Genaidy, S.A.; A.A. Abd El-Magid and M.H. Hegazy (1994). Comparative study on some mineral fertilizers for two different crops. Zagazig J. Agric. Res. 21(2): 583-591.

Gindy, E.N.; M.A. Abdel-Reheem and F.G. Younis (1991). Effect of rate and time of nitrogen application on yield and some constituents of dandara cotton variety. Egypt. J. Agric. Res., 69(2): 369-378.

Jackson, M.L. (1973). Soil Chemical Analysis, Prentice-Hall Inc. of Indian, Provate Limited New Delhi.

Mahmoud, M.H.; I. Abdel-Aziz and M.A. Ashoub (1985). Effect of P and Zn on growth, mineral content and yield of Egyptian cotton (*Gossypium barbadense* L.) Annals Agric. Sci. Fac. Agric. Ain Shams Univ., Cairo Egypt, 30(2): 993-1010.

Makram, E.A.; H.A. Abd El-Aal; K.A. Zidan and A.A. Darwish (1994). The interrelationship between planting date and each of hill spacing and nitrogen fertilization doses for the Egyptian cotton cultivar Giza 15. Annals Agric. Sci. Ain Shams Univ., Cairo, 39(2): 609-622.

Monged, N.O.; M.S.M. Baza; B. Azza and T.E. Eid (1991). The response of cotton yield to micronutrients application under the conditions of eight governorates in A.R.E. Egypt J. Appl. Sci. 6(8): 135-144.

Prasad, M. and R. Prasad (1995). Response of Upland cotton to biofertilizer and nitrogen fertilization. Indian Journal of Agronomy. 39(2): 334-336.

Ragaa, O.O. (1976). Studies on lint, seed development and oil and protein synthesis in Egypt cotton seeds. Plant Lab. National Research Center, Egypt, Egyptian Cotton, Gazette Jan. 1976.

Saber, M.S.M. (1993). A multi-strain biofertilizer. The Sixth International Symposium on nitrogen Fixation with Non-Legumes. Ismailia, Egypt. 6-10 September.

Snedecor, G.W. and W.G. Cochran (1980). Statistical Methods, 6th edition, Iowa, St. Coll. Press Ams. Iowa, USA.

Waller, R.A. and D.B. Duncan (1969). A bays rule for the symmetric multiple comparison problem. Am. State Assoc. J. Dec., 1469-1503.

Yassen, A.I.H.; A.Y. Negm and A.A. Hosny (1990). Effect of increasing population density and nitrogen on growth yield of Giza 76 cotton variety. Annals of Agric. Sci. Fac. Agric., Ain Shams Univ., Cairo, Egypt 35(2): 761-769.

تأثير التسميد بالمخصبات الحيوية والعناصر الصغرى والاسمدة النتروجينية والفوسفاتية والبوتاسية على إنتاجية محصول القطن

عبدالمجيد أبوالمعاطى عبدالمجيد
قسم بحوث تغذية النبات ـ معهد بحوث الأراضى والمياه والبيئة ـ مركز البحوث الزراعية ـ الجيزه ـ مصر

أقيمت تجربتان حقليتان بالمزرعة البحثية لمحطة البحوث الزراعية بسخا ـ محافظة كفرالشيخ خلال موسمى ٢٠٠٠ ، ٢٠٠١م لدراسة تأثير استخدام ثلاثة من المخصبات الحيوية التجارية من انتاج هيئة صندوق الموازنة الزراعية وهى النيتروبين ، الفوسفورين ، الريزوبكتيرين وكذلك بعض العناصر الصغرى فى صورة كوتنجين مع استخدام مستويين من السماد النيتروجينى والفوسفور والبوتاسيوم وهما ٧٠+٣٠+٢٤ ، ٣٥+١٥+١٢كجم/الفدان وذلك على تحسين انتاجية وجودة محصول القطن من ناحية خفض معدل السماد المعدنى وتقليل النفقات والتلوث البيئى من ناحية أخرى.

وقد أوضحت النتائج المتحصل عليها كما يلى:

١- باستخدام المخصبات الحيوية وأسمدة العناصر الصغرى أمكن تعويض أكثر من نصف الاحتياجات السمادية المعدنية لمحصول القطن مع زيادة واضحة للمحصول.

٢- التسميد المتوزن المتضمن العناصر الكبرى (ن ـ فو ـ بو) والعناصر الصغرى (ح ـ من ـ ز) خلط مع البذرة عمل على زيادة كفاءة السماد المعدنى والحصول على محصول أعلى تحت كل مستوى من ن ـ فو ـ بو بجانب زيادة محصول القطن الزهر وكذلك زيادة تصافى الحليج ومعدل التيلة. وزيادة طول النبات وزيادة عدد اللوز المتفتح وزيادة وزن اللوزة.

٣- أظهرت الدراسة الأهمية الكبرى لاختبارات التربة قبل عمل التوصيات السمادية.

٤- زيادة نسبة البروتين والزيت فى بذور القطن ومحتوى أوراق القطن كاملة النمو من الازوت والفسفور والبوتاسيوم عند بداية الازهار نتيجة استخدام نصف معدل ن ـ فو ـ بو والعناصر الصغرى والمخصبات الحيوية إلا أن زيادة نسبة الزيت فى البذور كانت أقل .

٥- أعلى محصول القطن الزهر وعائد اقتصادى تم الحصول عليه كان فى حالة التسميد المشترك بـ (ن٧٠ ـ فو٣٠ ـ بو٢٤) وكذلك بـ (ن٣٥ ـ فو١٥ ـ بو١٢) كجم /فدان مع الأسمدة الحيوية والعناصر الصغرى خلطا مع البذرة.

٦- هذه النتائج تؤكد بوضوح مدى فاعلية استخدام الأسمدة الحيوية تحت الظروف المصرية فى توفير الإسراف من استخدام الأسمدة الكيماوية المضافة مما يؤدى إلى تقليل التكاليف الزراعية والتلوث البيئى فى مصر.