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RESPONSE OF COTTON GIZA 70 TO APPLICATION OF TWO SOURCES OF ORGANIC MANURES AND NITROGEN FERTILIZER LEVELS

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ABSTRACT

Two field experiments were carried out at Kafr El-Dawar Centre, El-Beheria Governorate, Egypt, for two seasons to study the effect of nitrogen fertilization and organic manure, i.e farm yard Manure (F.Y.M) and Chicken Manure (C.M) on cotton plants.

The experiment included 7 treatments which were control, 30 kg N/fed., 60 kg N/fed., 24 m^3 F.Y.M../fed, 12 m^2 F.Y.M./fed + 30 kg N/fed, 8 m^3 C.M/fed and 4 m^3 C.M/fed + 30 kg N/fed.

The results could be summarized as follows :

- The treatments had a significant positive effect on N,P,K and Cu leaf contents but no significant effect on Mg, Fe and Mn leaf contents in both seasons, but on Zn leaf content in one season only.
- In most cases, 30 kg N and 60 kg N/fed increased leaf nutrient contents significantly compared with the control.
- In most cases, leaf nutrient contents were increased significantly by using organic manure with or without nitrogen.
- Applying F.Y.M at the rate of 12 m^3/fed + 30 kg N/fed as ammonium nitrate applied in one dose after thinning increased significantly final plant height, number of fruiting branches/plant, seed cotton yield/fed. and its components in both seasons.
- It can be concluded, that F.Y.M was more effective than chicken manure. Meanwhile organic manure + nitrogen proved to be more effective than organic manure alone on growth and cotton production especially the treatment of 12m^3 F.Y.N./fed + 30 kg N/fed.

INTRODUCTION

Excessive application of mineral N fertilizers in the cotton plantings may cause soil and water pollution. Wallace, (1994) cleared that nitrates which find their way into groundwaters create pollution. High amounts of nitrates were detected in summer being 59 ppm and 152 ppm in surface and underground systems, respectively, especially under cotton and maize. Pollution with nitrates was very high, in summer reaching 240 ppm NO_3 in ground water (10m depth) in manually pumped water for drinking in the village (Abd El-Ghani *et al*., 1993). For this, it is needed to limit mineral N fertilization by using organic manures. Tiessen *et al*., (1994) added that organic matter improves the physical, chemical and biological conditions of the soil and this improves plant growth. Talha *et al.,* (1978); El-Fouly, (1983) and El-Sayed *et al.,* (1992) have been carried out the effect of soil properties on nutrients availability. El-Mowelhi (1997) reported that beside the chemical fertilizers, there are other means for maintaining or increasing the productivity

of the soil by applying various organic manures. However, the value of these sources varies enormously according to the nature of the manure and its constituents. Chicken manure (C.M) is known to be a valuable source of organic matter and contains a vast of organisms that added to the biological activity of plant nutrients (Zublena *et al*., 1995). Chicken manure was more easily decomposed than other manures (Ismail *et al*., 1988).

Fatma *et al*., (1994) found that DTPA extractable Fe and Mn values increased by addition of chicken manure at rate of 20 g/kg soil and they attributed this increase to the fact that chicken manure has a high content of nutrient elements. Farm yard manure (FYM) is another source of organic manure. Koriem, (1993) found that application of farm yard manure significantly reduced soil pH values composed with control treatment. Also, he reported that extractable DTPA Zn, Cu, Ni, Cd and Pb in soil had increased with increasing application rate of farm yard manure. Many authors studied positive responses for applying various organic manures and N fertilizers on nutritional status (Adolph *et al.,* 1969; Azevedo and Stout, 1974; Kirchmann, 1985, Kerby and Adams, 1985; Kofoed and Klausen, 1986; Sutton *et al.,* 1986; Apthorp *et al.,* 1987; Kuzeva and Mitovska, 1990; Davis-Carter *et al.,* 1992; El-Naggar *et al.,* 1994; Somda *et al.,* 1997 and Feng-Min *et al.,* 1998.

In addition, the positive results of the yield and yield component of cotton might reflect the influence of using organic manure and nitrogen fertilization (Rodrigues Filho and Sabind, 1984; Tailakov and Meredov, 1984 and Matha, 1997).

The objective of this study was to investigate the effect of two organic manures and N fertilization on leaf nutrient content, growth, yield and yield components of cotton, Giza 70.

MATERIALS AND METHODS

Two field experiments were conducted at Kafr El-Dawar Centre, EL-Beheira Governorate, Egypt, during 1998 and 1999 seasons to study the effect of organic manures, i.e. farm yard and chicken manures alone or with N fertilizer in comparison with N fertilizer alone to evaluate their effects according to their effect on cotton leaf nutrient contents, growth, yield and its components of Egyptian extra long staple cotton cultivar Giza 70.

The plot size was 27.3 m^2, including 7 ridges 65 cm apart and 6 meters long. The two outer rows were left as borders. The remaining five rows were used to determine growth, yield and its components. The experiments were arranged in a complete randomized block design with 4 replicates including :

T_1 : Control (without N fertilization)
T_2 : 30 Kg N/fed. (half of the recommended dose)
T_3 : 60 Kg N/fed. (recommended)
T_4 : 24 m^3 F.Y.M (farm yard manure)/fed.
T_5 : 12 m^3 F.Y.M (farm yard manure)/fed. + 30 Kg N/fed.
T_6 : 8 m^3 C.M (chicken manure)/fed.
T_7 : 4 m^3 C.M (chicken manure)/fed.+ 30 Kg N/fed.

Cotton was fertilized with 22.5 Kg P_2O_5/fed as calcium superphosphate (15.5 % P_2O_5) during land preparation, 24 Kg K_2O/fed. as potassium sulphate (48 % K_2O) in one dose with the 1st dose of nitrogen. Nitrogen rates (zero, 30 and 60 Kg N/fed.) were added as ammonium nitrate (33.5 % N). The recommended rate (60 Kg N/fed) was split into two equal portions. The portion was added after thinning but the second one was added after 15 days. While, the half rate (30 Kg N/fed) added after thinning in one dose. Farm yard manure and chicken manure were incorporated with ridges soils at the studied rates after ridging before sowing. Sowing date was at 1st April in both seasons in hills 20 cm apart. Leaf samples were taken representatively from the youngest fully matured leaves on the main stem at 100 days after sowing and prepared for chemical analysis according to Chapman and Pratt (1961). Representative soil samples from one layer 0-30 cm as well as from organic manures were analysed according to Piper (1953) and Jackson (1973). The results in table 1 shows some physical and chemical properties of the experimental soil while, Table 2 shows the organic manures analysis.

Table 1: Soil properties of the experimental site in the two seasons 1998 and 1999.

Properties	1998	1999
Sand %	28.2	26.2
Silt %	33.3	29.3
Clay %	38.5	44.5
Texture	clay loam	clay
PH (1 : 2.5 soil : water)	7.8	8.0
E.C (1 : 2.5 soil : water) mmhos/cm	1.08	0.58
Calcium carbonate %	2.4	1.6
Organic matter %	1.8	1.77
Total N (mg/100 g soil)	54.2	52.0
Available P (mg/100 g soil)	1.2	1.14
Available K (mg/100 soil)	26.30	26.34
Available Ca (mg/100 g soil)	245.5	218.5
Available Mg (Mg/100 g soil)	120.4	121.6
Available Na (mg/100 g soil)	40.1	34.9
Available Fe (ppm)	15	14
Available Mn (ppm)	10	11
Available Zn (ppm)	1.3	1.0
Available Cu (ppm)	5.4	4.7

Table 2 : Characteristics of different organic manures in two seasons 1998 and 1999

Properties	Chicken Manure (C.M)		Farm yard manure (F.Y.M)	
	1998	1999	1998	1999
pH (1 : 10 organic manure : mater)	8.0	8.5	7.60	7.40
E.C (1 : 10 soil : water) mmhos/cm	1.8	2.0	1.10	1.49
$CaCO_3$ %	6.0	5.6	1.20	1.20
O.M %	54.6	43.6	24.6	20.0
Total N %	1.91	1.53	0.86	0.70
Available P %	0.097	0.098	0.05	0.04
Available K %	1.09	1.31	0.54	0.45
Available Ca %	0.01	0.01	0.02	0.03
Available Mg %	0.13	0.12	0.18	0.17
Available Na %	0.018	0.020	0.03	0.03
Available Fe ppm	80.7	87.6	37.0	34.5
Available Mn ppm	113.3	107.9	89.9	79.0
Available Zn ppm	89.7	87.2	23.7	20.1
Available Cu ppm	13.3	9.6	8.9	8.5

Characters estimated :

A. Total leaf nutrient contents (chapman and Pratt, 1961)

B. Growth, yield and its components in both seasons.

Ten representative cotton plants were taken at random within each plot to determine the following traits : final plant height at harvest (cm), number of fruiting branches/plant, number of open bolls/plant, boll weight (g), seed cotton yield/plant (g), lint % and seed index (g). The yield of seed cotton/fed in kentar was calculated from the five inner rows of each plot.

Data were statistically analysed using the procedures outlined by Sendecor and Cochran (1967). The treatment means were compared using Duncan's multiple range tests at the 5 % and 1 % levels of probability (Duncan, 1955).

RESULTS AND DISCUSSION

A. Leaf nutrient concentrations :

Table 3 shows the effect of the treatments under study on the cotton leaf content in the both seasons. The results presented indicate significant differences among treatments in both seasons. The treatments of 30 Kg N and 60 Kg N/fed increased N concentration in the two seasons as compared with control without any significant difference among them in the first season. In the two season, it is pointed that all treatments of organic manure either with or without nitrogen increased significantly N concentration. Farm yard manure with nitrogen was more effective than applied alone.

These results are in harmony with those of Kuzeva and Mitovska (1990). In Table (2), results show big differences in pH and $CaCO_3$ % between chicken manures and animal manures in the two seasons. This has probably contributed to more loss of N leading to reduction of its availability

and thus, lower available concentration to plants. The fertilizer value of manure is reduced by the loss of N through ammonia (NH_3) volatilization and denitrification (Kirchmann, 1985). While, Azevedo and Stout (1974) reported that poultry manure was about 50 % as effective as ammonical N fertilizers, Adolph *et al*., (1969) reported that poultry manure applied to a N deficient soil performed equally to that of inorganic fertilizers. Kofoed and Klausen, (1986) reported that excessive rates of manure application result in loss of highly mobile NO_3 due to leaching. In this respect, Sutton *et al*., (1986) added that a greater dounward movement of mineral N occurs from inorganic fertilizers than manures.

Table 3 : Concentration of macronutrients in cotton leaves applied with organic and mineral fertilizers.

Dose/fed.	N		P		K		Mg	
	1998	1999	1998	1999	1998	1999	1998	1999
T_1	2.64c	2.28c	0.22ab	0.19a	0.90b	1.37cd	0.46	0.52
T_2	2.90bc	2.57bc	0.24a	0.16b	0.99b	1.33d	0.49	0.48
T_3	2.91bc	2.97ab	0.14d	0.15b	1.05b	1.58ab	0.55	0.53
T_4	3.39ab	3.27a	0.19bc	0.19a	1.02b	1.37cd	0.51	0.50
T_5	3.47a	3.27a	0.19bc	0.15b	1.36a	1.48bc	0.49	0.51
T_6	3.14abc	2.76abc	0.16cd	0.20a	1.10b	1.70a	0.52	0.54
T_7	3.07abc	2.79abc	0.19bc	0.19a	1.25a	1.33d	0.52	0.52
F.test	*	*	**	**	**	**	N.S	N.S

***. ** and N.S indicate P < 0.05, 0.01 and not significant, respectively. Means designated by the same letter are not significantly different at 5 % level, according to Duncan's Multiple Range Test.**

Statistical analysis indicated that phosphorus was affected significantly by the treatments in the two seasons. The treatment of 30 Kg N/fed increased P concentration in the first season and this treatment was more effective than the treatment 60 Kg N/fed in the two growing seasons. In most cases of the two seasons, the treatments of organic manure either with or without nitrogen decreased P concentration, except for chicken manure treatment in second season. These decreases were significant. These results may be attributed to available P was not affected with organic matter content. Similar results were obtained by Feng-Min *et al*., (1998), another explanation, may be due to high pH of soil and clay content (table 1) leading to reduced ability of P absorption from soil, Mengel and Kirkby (1987). On the other hand, Apthorp *et al*., (1987) mentioned that produced protons which may have enhanced the dissolution of manure-P. Also, Somda *et al*., (1997) pointed out that mineral urine application to soils increased available P-levels. The values in Table 3 reflect the influence of organic manures and N-application on leaf content of K. The results show that potassium concentration was significantly affected in 1998 and 1999 seasons. In the first season, it is pointed out that all treatments of organic manure either with or without nitrogen increased K content and the treatments of organic manure with nitrogen were more effective than each of them alone. In second season, the treatment of chicken manure alone induced higher amount of k than animal manure alone. This may be attributed to high K concentration in

chicken manure than animal manure in Table 2. The total quantity of K taken up by the plants is related to the level of available soil and fertilizer K (Kerby and Adams, 1985). As for Mg concentration, it is evident in Table 3 that there were no significant differences among the different treatments in the two seasons.

Table 4 : Concentration of micronutrients in cotton leaves applied with organic and mineral fertilizers.

Treatments	Fe		Mn		Zn		Cu	
	1998	1999	1998	1999	1998	1999	1998	1999
T_1	151.1	161.6	40.5	48.8	21.5	19.0 bcd	7.5 c	9.2 ab
T_2	147.4	198.8	43.9	54.0	21.4	27.1 a	7.3 c	8.9 b
T_3	166.9	178.5	44.7	48.4	23.0	14.6 de	8.7 a	8.9 b
T_4	175.1	145.5	49.7	47.5	21.3	13.7 e	9.2 a	9.5 ab
T_5	158.3	186.8	43.3	52.7	17.6	19.8 bc	9.2 a	10.1 a
T_6	155.3	160.9	43.2	45.2	23.4	22.9 ab	9.5 a	9.0 b
T_7	184.9	155.3	42.0	55.3	22.4	15.2 cd	9.2 a	10.0 a
T.test	N.S	N.S	N.S	N.S	N.S	**	**	*

***, ** and N.S. indicate P < 0.05, 0.01 and not significant, respectively. Mean designated by the same letter are not significantly different at 5 % level, according to Duncan's Multiple Range Test.**

The treatments of chicken manure either with or without nitrogen were higher than the treatments of animal manure either with or without nitrogen. This may be attributed to high K content in chicken manure than in animal manure and its antigonism with Mg. In this connection Davis-Carter *et al*., (1992) showed that excessive K application to soil can induce magnesium deficiency.

Results on micronutrients concentration in leaves (Table 4) indicate that non significant differences were recorded between the different treatments for Fe and Mn concentrations.

In the first season, values in Table (4) show no significant differences between all treatments on Zn content. The trial fields had clay loam and clay with high pH (Table 1). Such conditions are known to reduce the availability of Fe, Mn and Zn to plants (El-Fouly, 1983). However, mean contents of available Fe, Mn and Zn are not deficient in such alluvial soils. Compactness of soil due to high clay proportion was suggested to hinder root growth, leading to shortage of plant nutrients needed for high yield (Talha *et al*., 1978). This might explain why cotton leaves could not take up enough quantity of available micronutrients (El-Sayed *et al*., 1992).

The results in Table 4 show that Cu concentration was affected significantly by all treatment. The treatments of organic manurs either with or without nitrogen application were effective than the treatments of nitrogen alone. This may be attributed to beneficial effect of organic manures to the production of chleting agents forming soluble complexes with Cu which are efficiently utilized by the plants.

B. Growth, yield and yield components :

Plant height at harvest and number of fruiting branches per plant were increased significantly in favour of applying 12 m^3 F.Y.M/fed + 30 Kg

N/fed followed descendingly by applying 24 m^3 animal manure/fed, chicken manure alone or with 30 Kg N/fed, 60 Kg N/fed, 30 Kg N/fed and control (Table 5). This result due to that F.Y.M. and C.M. had a high contents of nutrient elements as shown in Table 2. In this concern, El-Naggar *et al*. (1996), found that the highest values of final plant height and number of fruiting branches/plant were recorded by F.Y.M treatment as compared with control (60 Kg N/fed).

The results in Table 5 show that mixing of F.Y.M. and the half dose of the recommended mineral N increased significantly number of open bolls/plant, boll weight, seed cotton yield/plant, lint percentage and seed index compared to the recommended rate of N (60 Kg/fed) or the half dose of the recommended rate of N (30 Kg/fed) in both seasons. Concerning the effect of kind of manure, the same results indicate that F.Y.M. increased significantly these traits as compared with C.M. results used alone or with 30 Kg N/fed In both seasons, the lowest values of these traits were obtained from untreated plants. In this respect, El-Naggar *et al*. (1996) found that F.Y.M increased significantly number of open bolls/plant, and seed index and decreased boll weight as compared with 60 Kg N/fed. F.Y.M alone or with 30 kg N/fed caused significant increase in lint % as compared with other treatments in both seasons.

Results in Table (5) show that seed cotton yield/fed was significantly affected by fertilization treatments in both seasons, where applying 12 A.M m^3/fed+30 Kg N/fed out-yielded significantly other treatments. The yield/fed. increased by 3.06 kentars (46.86%) and 1.84 kentars (26.06 %) from the recommended mineral N rate (60 Kg N/fed) in 1998 and 1999 seasons, respectively.

Concerning the kind of organic, manures effect on seed cotton yield/fed the results show that farm yard (F.Y.M) manure increased significantly yield as compared with chicken manure (C.M) when used alone or with 30 Kg N/fed. In this concern, Rodrigues Filho and Sabino (1984) used various combinations of 0, 50 or 75 Kg N/ha, 0, 80 or 120 Kg P_2O_5, 0, 50 or 75 Kg K_2O, 400 or 800 Kg chicken manure (C.M) and they found that application of these manures gave increases of 5.44 % and were significant in some years. Manure alone gave similar yields to F.Y.M+NPK fertilizers. Tailakov and Meredov (1984) found that application of NPK in combination with 20 t F.Y.M or 30 t F.Y.M-soil-superphosphate compost/ha increased the yield of fine fibred cotton [*Gossypium barbadense*]. El-Naggar *et al*., (1996) found that FYM increased significantly seed cotton yield/fed as compared with 60 Kg N/fed. Mathur (1997) reported that application of farm yard manure (F.Y.M) improved soil properties. Full dose of NPK was on a per with 1/2 F.Y.M + 1/2 NPK dose in influencing cotton yield.

CONCLUSION

The previous results revealed that chicken and animal manures as sources of organic manures can not be used as immediate substitute for chemical fertilizers but it could be applied as a supplement. Animal manure will be useful for best growth and cotton production for any cultivation region has similar conditions to that of Kafr El-Dawar region where the experiments were carried out if it is added at the rate of 12 m^3/fed with mineral N fertilizer at the rate of 30 Kg N/fed.

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استجابة القطن جيزة ٧٠ لإضافة مصدرين من السماد العضوى ومستويات للتسميد النيتروجينى

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*** قسم النبات - المركز القومى للبحوث - الدقى - الجيزة - مصر**

**** معهد بحوث القطن ٠ مركز البحوث الزراعية - الجيزة - مصر**

أجريت تجربتان حقليتان بمركز كفر الدوار بمحافظة البحيرة خلال الموسيمن الزراعين ١٩٩٨، ١٩٩٩ وذلك لدراسة تأثير مصدرين من السماد العضوى والتسميد الأزوتى: سماد المزرعة وسماد زرق الدواجن ومستويات التسميد النيتروجينى على محصول ومكونات القطن واشتملت التجربة على ٧ معاملات حيث كانت (كنترول) و (٣٠ كجم ن/ف)، و (٦٠ كجم ن/ف) و (٢٤م٣ سماد مزرعة/ف) و (١٢ م٣ سماد مزرعة/ف + ٣٠ كجم ن /ف) و (٨ م^{٣} سماد زرق دواجن/ف) و (٤م^{٣} سماد زرق دواجن + ٣٠ كجم ن/ف). ويمكن تلخيص النتائج فيما يلى :

- كان للمعاملات تأثير معنوى على محتوى الورقة من (ن، فو، بو، نح) بينما لم يكن هناك تأثير معنوى على محتوى الورقة من (مغ، ح، من) فى كلا الموسمين وعلى محتوى الورقة فى خ فى موسم واحد فقط.
- فى معظم الحالات ٣٠ كجم ن، ٦٠ كجم ف/ف أحدث زيادة للمحتوى الغذائى للورقة معنوياً مقارناً بالكنترول.
- فى معظم الحالات وجد أن المحتوى الغذائى للورقة ازداد معنوياً باستخدام السماد العضوى مع أو بدون الأزوت.
- إضافة سماد المزرعة بمعدل ١٢ م^{٣} سماد مزرعة + ٣٠ كجم ن/ف فى صورة نترات أمونيوم دفعة واحدة بعد الخف أحدث زيادة معنوية للطول النهائى للنبات وعدد الأفرع الثمرية للنبات ومحصول القطن الزهر ومكوناته فى كلا الموسمين.

ويمكن أن يستخلص بأن سماد المزرعة كان أكثر فاعلية من سماد الدواجن، وكان السماد العضوى مع الأزوت أكثر فاعلية من وجوده بمفرده وذلك على النمو والمحصول ومكوناته وبالأخص معاملة ١٢ م٣ سماد المزرعة + ٣٠ كجم ن/ف.

Table 5 : Means of some cotton plant growth characters, yield and yield components as affected by organic manures and nitrogen fertilizer rates in 1998 and 1999 seasons.

Treatments	No. of open bolls/ plant		Boll weight (g)		Seed cotton yield/plant (g)		Lint %		Seed index (g)		Seed cotton yield (Kentar/fed)		Final plant height (cm)		No. of fruiting branches/ plant	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
T_1	6 f	5.8 f	1.89 d	1.94 e	11.34 f	11.25 f	32.9 e	33.5d	8.33e	8.05d	3.38f	3.41f	122.8d	115.5e	7.5e	8.2 c
T_2	7.5 e	7.3 e	2.03 c	2.10 d	15.22 e	15.33 e	35.2 d	35.3c	8.5de	8.58c	4.17e	4.24e	122.8d	116.8e	9.3d	8.9 c
T_3	10.6 c	11.0 c	2.25 b	2.4 b	23.85 c	26.4 c	36.7bc	36.4b	9.58bc	9.48b	6.53c	7.06c	123.0d	121d	13.4ab	11.7a
T_4	12.3 b	12.4 b	2.28 b	2.53 a	28.04 b	31.37 b	37.4ab	37.8a	10.01ab	10.53a	7.7b	7.97b	131.5b	127.8b	13.7a	12.0a
T_5	15.5 a	14.4 a	2.65 a	2.59 a	41.07 a	37.30 a	37.8a	37.9a	10.11a	10.77a	9.59a	8.90a	138.5a	131.2a	13.9a	12.3a
T_6	7.6 e	9.0 d	2.09 c	2.22 c	15.88 e	19.98 d	35.4d	35.7bc	8.85d	8.88c	4.68e	5.10d	127.5bc	123.3cd	10.7c	10.1b
T_7	9.4 d	10.6 c	2.13 c	2.28 c	20.02 d	24.17 c	36.4c	36.2b	9.46c	9.48b	5.93d	6.73c	127cd	124.5c	12.5b	11.7a
F. test	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

**** indicates P < 0.01**

Means designated by the same letter are not significantly different at 5 % level, according to Duncan's Multiple Range Test.

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