*J. Agric. Sci. Mansoura Univ., 32 (11): 9407 - 9425, 2007*

# INFLUENCE OF INTEGRATED SYSTEM OF ORGANIC MANURES AND NITROGEN FERTILIZER FOR ENHANCING GROWTH, YIELD AND ACTIVITY OF SOME MAJOR MICROORGANISMS IN THE RHIZOSPHERE OF COTTON PLANT.

**Al-Kahal, A. A.[1]; Alia A. M. Namich[2] and M. Y. Abou-zeid [1]**
**1- Soil, Water and Environment Res. Instit. A.R.C. Giza.**
**2- Cotton Res. Instit. A.R.C. Giza**

## ABSTRACT

Two Field trials were conducted in two successive season to study the influence of integrated use of two sources of organic manures e.g. compost I (prepared from rice straw as a basic waste) and poultry manure at rates of 0, 1, 2, 3, 4 ton/ fed combined with 3 levels of N fertilizer 15, 30, 60 Kg N / fed on some cotton growth traits, yield and yield components, fiber quality as well as the effect of these treatments on the activity of selected soil microorganisms in the rhizosphere of cotton plants. The results could be summarized as follows:

Application of either compost 1 or poultry manure at different levels led to an increase in plant height, No. of fruiting branches / plant, No. of open bolls/plant and bolls weight, cotton seed yield, seed index, chemical composition of leaf increased compared with plants fertilized with 60 Kg N/ fed in both seasons.

In most cases, application of poultry manure at a rate of 2 Ton/fed combined with 30 Kg N/fed gave the highest yield and yield components in both seasons.

Soil amended with organic manures did not affect fiber quality.

Integrated use of organic manures and N-fertilizer stimulate the total number of bacteria, fungi and actinomycetes in the rhizosphere of cotton plants.

Finally, these results in order to be practical, the high transportation costs limit the application of organic manures. Composting cotton wastes especially cotton stalks in cotton field may be a solution of high costs of purchase organic manures.

## INTRODUCTION

Cotton is considered one of the major crops which play an important role in Egyptian economy. Cotton produces nearly 50% of global fiber requirements. The cotton production in Egypt relies on excessive use of chemical fertilization, especially nitrogen fertilizer. Nitrogen is generally considered a yield limiting factor in cotton production.

However such high requirements of nitrogen are not only so expensive, but also hazards to agro ecosystem. Thus, there is a global need for reducing the dependence of agricultural production on chemical fertilizers especially its production in Egypt falls short and widening gap between supply and demand is increased and is going to continue.

Organic manures are the alternative sources that can supply macro and micronutrients in adequate quantities, Furthermore, application of organic manures to soil caused a reduction to soil pH (Khalifa, 1993, Koriem 1993 and Mehana 1998), increasing water holding capacity (Badawi, 2002), improving soil structure. Soil amended with organic manure resulted in 1) supplying N and other nutrients to the soil for use the following crop (Mostafa, 2002), 2) increasing the general level of fertility by mobilizing minerals and

building up the organic matter and nitrogen content and preventing weed seedling growth (Waksman, 1952, Rogers and Giddens, 1957). Application of organic manures to soil enhanced their biological activities. It was found by Mahmoud *et al.*(2003) that the residual effect of all the used organic fertilizers (compost and biogas manure) had a significant increase in soil biological activity expressed as dehydrogenase enzyme after application of manure compost or biogas manure to cotton plants over control treatment (unfertilized plots) and/or mineral fertilization. However, high prices of organic manures led to low investment in manure production and substituting it by high doses of nitrogen (El-Fouly *et al.*, 1997).

Excess N tends to accelerate vegetative development at the expense of reproductive development especially at bloom or at early boll fill (Mullins and Burmester, 1990; Towolde and Fernandez 1997 and Howard *et al.*, 2001). Excess N can indirectly affect lint yield by enhancing aphid infestation, which can complicate cotton defoliation (Cisneros and Godfrey, 2001) and can cause sticky cotton problems because of aphid honeydew secretions (univ of Arizona) 1999, Slosser *et al.*, 1999) applying organic manure may be assist in improving N use efficiency.

Hence, scientific management of these invaluable resources has assumed a greater significance over time and will be environmentally benign approach for nutrient management of cotton crop and ecosystem function.

Therefore, the aim of the present study was to find out the effect of two different kinds of organic manure with or without different doses of mineral N fertilizer on:

1- Cotton plant growth traits and yield and its components.
2- Chemical composition of cotton leaf.
3-Assess the effects of these treatments on the activity of selected soil microorganisms.

## MATERIALS AND METHODS

In two successive seasons 2004 – 2005 and 2005-2006 two field experiments were conducted on Egyptian cotton cultivar Giza 80 at Sids Agricultural Res. Station, Beniswif Governorate, Egypt. to study the effect of graded levels of two kinds of organic manures compost(1) which prepared from rice straw as a basic waste and enriched with farmyard manure, bentonite, rock phosphate, elemental sulphur and urea and compost (II), poultry manure, either alone or in combination with N (ammonium sulphate) on growth, yield, and seed quality of the Egyptian cotton cultivar .

Before planting and during plant bed preparation, a soil sample was taken from the the surface layer (0-30) cm and analyzed for the most proper mechanical and physiochemical properties as recorded in table (1)

The plot area was 7.5m$^2$ (5 rows, 4m long, 60 cm apart and hill spacing was 25 cm). The two outer rows were left as a border. The remaining three rows were used to determine yield and its components.

The experimental design used was randomized complete blocks design with four replicates for each treatment.

**Table (1): Physical and chemical properties of soil**

| Properties | Value |
|---|---|
| Sand % | 19.77 |
| Silt % | 38.90 |
| Clay % | 40.09 |
| $CaCo_3$ | 1.24 |
| Textural class | Clay loam |
| pH | 7.58 |
| E.C. (dS $m^{-1}$) | 0.96 |
| O.C. % | 0.56 |
| O.M. % | 0.96 |
| Total soluble – N (ppm) | 42.58 |
| Soluble cations ($meql^{-1}$) | |
| $Ca^{++}$ | 3.72 |
| $Mg^{++}$ | 2.23 |
| Na+ | 2.50 |
| K+ | 1.19 |
| Soluble anions ($meql^{-1}$) | |
| $CO^{-}$ | 0.00 |
| $HCO_3^{-}$ | 3.28 |
| $CL^{-}$ | 2.83 |
| $SO_4$ | 3.52 |

While compost II (poultry manure) was obtained from Chicken Farm, Fac. Of Agric. Cairo Univ. the chemical analysis of organic manure are presented in Table (2).

The two kinds of organic manures was added 15 days before sowing at a rate of 0, 1, 2, 3, 4 Ton/fed and mixed with soil as possible.

All plots were fertilized by recommended doses of super phosphate at a rate of 22.5 Kg $P_2O_5$/fed as calcium super phosphate (15.5% $P_2O_5$) during land preparation. While potassium sulphate (48% $K_2O$) was added at rate of 24 Kg $K_2O$/fed in one dose with the first dose of nitrogen.

Inorganic nitrogen fertilizer 15, 30 and 60 Kg N/fed were applied as ammonium sulphate (33.5% N). The recommended rate (60 Kg N/fed) was split into two equal portions. The 1$^{st}$ portion was added after thinning and the second one was added after 15 days. Sowing date was 26$^{th}$ March in both seasons.

The cotton seeds were supplied by Cotton Res. Instit. ARC. Giza.

Treatments of organic manures and N-fertilizer and their combinations are shown as follows:

1- Control (60 Kg N/fed).
2- 1 Ton compost I + 45 Kg N/fed.
3- 2 Ton compost I + 30 Kg N/fed.
4- 3 Ton compost I + 15 Kg N/fed.
5- 4 Ton compost I without N-fertilizer.
6- 1 Ton compost II + 45Kg N/fed.

7- 2 Ton compost II + 30Kg N/fed.
8- 3 Ton compost II+ 15Kg N/fed.
9- 4 Ton compost II without N-fertilizer.

Where compost I was obtained from Soil, Water and Environ. Res. Instit. while compost II (poultry manure) was obtained from Chicken Farm, Fac. Of Agric. Cairo Univ.

Leaf samples were taken representatively from the upper fourth node from the apex, at 100 days after sowing and prepared for chemical analysis.

**Table (2): Main characters of organic manure and poultry manure used for the field experiment**

| Character | Compost I | Poultry manure |
|---|---|---|
| W.H.C. (%) | 163 | 192 |
| pH | 6.53 | 6.97 |
| E.C.(ds $m^{-1}$ at 25°C) | 4.42 | 6.32 |
| O.C. % | 28.64 | 35.60 |
| Organic matter % | 49.26 | 61.23 |
| Total-N % | 1.50 | 2.80 |
| C/N ratio | 19.10 | 12.71 |
| **Soluble N (ppm)** | | |
| NH4+ | 1460 | 1690 |
| NO3- | 24 | 32 |
| Total | 1484 | 1722 |
| Total-P % | 0.64 | 0.90 |
| Total-K % | 2.54 | 3.16 |
| **Total cation (ppm):** | | |
| Fe | 265 | 488 |
| Mn | 168 | 220 |
| Zn | 124 | 157 |
| Cu | 56 | 82 |

**Measurements:**

**I) Yield and its components in both seasons:**

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

Micronaire value and pressley index were measured at the laboratories of cotton Research Institute, under standard conditions of test (65± 2% relative humidity and 67°C) according to A.S.T.M. (1975).

**II) Chemical constituents**

Chemical constituents were determined at the cotton physiology lab i.e, chlorophylls (Arnon, 1949), carotenoids (Rolbelen, 1957), total soluble sugars (A.O.A.C. 1965), total amino nitrogen was determined according to method described by Rosen (1957) and leaf nutrient contents (Chapman and pratt, 1961). Seeds oil content was determined according to A.O.A.C. (1975)

method and seed protein content was determined using the method outlined by A.O.A.C. (1965).

**III) Total count of bacteria, fungi and actinomycetes.**

Total count of bacteria, fungi and actinomycetes in cotton rhizosphere were determined using soil extract agar medium (Allen 1953), Rosebengal Streptomycin agar (Martin, 1950) and Jensens medium, respectively. The microbiological assay was carried out at two interval periods, the first one after 30 days while the second period after 90 days from planting .

The statistical analysis of the data in the two successive season were done according to Snedecore and Cochran(1980).

## RESULTS AND DISCCUSION

**Growth characteristics of cotton Giza 80 as affected by application of organic manures alone or in combination with different levels of N-fertilizeration.**

**A. Plant growth parameters:-**

Data in table (3) showed that the lowest value of cotton plant height was recorded in plants fertilized with recommended dose of N-fertilizer (60 Kg N/fed) in both seasons compared with those fertilized with even compost I or poultry manure alone or in combination with any rate of N-fertilizer. The highest values of plant growth were obtained from the combination of compost I at a rate of 2 Ton / fed plus 45 Kg N / fed in the first season. The average plant height was increased from105.5 cm to 123.5 cm when 2 Ton / fed of compost I was applied with 30 Kg N / fed in the second season. Generally, there was a non-significant increase among all treatments in both seasons.

Concerning to No. of fruiting branches / plant , data presented in Table (3) clarified that No. of fruiting branches / plant was increased by application of organic manures in combination with mineral N fertilizer, as well as the treatment that received only organic manures. N- fertilization at recommended dose (60 kg N/fed) achieved the lowest values, being on the average 13.9 No. of fruiting branches /plant (the average of two seasons). Such character was strengthen by application of organic manures in combination with N-fertilization. The highest value was recorded in plants fertilized with 2Ton / fed of poultry manure combined with 30 Kg N/fed, reaching values of 13.98 No. of fruiting branches / plant in season 2004 and 15.8 No. of fruiting branches /plant in season 2005. The synergetic combined effect of No. of fruiting branches was confirmed by significant increase in both seasons.

These results are in agreements with those obtained by El-Naggar *et al.*(1996), Nofal and Ziadah (2000).

Table (3): Response of some growth characters of cotton Giza 80 to application of two kinds of organic manures and different nitrogen fertilizer levels

| Treatments | | | Plant height (cm) | | No. of fruiting branches / plant | | No. of open bolls / plant | | Boll weight (g) | | Seed cotton yield (Kantar/fed) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compost | | N fertilizer Kg/fed | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 |
| Without | | 60 | 101.5 | 105.5 | 12.87 | 13.50 | 13.30 | 15.40 | 2.44 | 2.44 | 7.92 | 9.26 |
| Compost I (Ton / fed) | 1 ton | 45 | 115.4 | 121.5 | 12.93 | 14.20 | 13.90 | 15.80 | 2.47 | 2.43 | 7.93 | 9.43 |
| | 2 ton | 30 | 105.8 | 123.5 | 13.28 | 13.70 | 14.00 | 15.90 | 2.49 | 2.49 | 8.07 | 9.88 |
| | 3 ton | | 106.9 | 107.8 | 13.90 | 14.50 | 14.20 | 16.00 | 2.47 | 2.49 | 8.14 | 9.89 |
| | 4 ton | 0 | 110.3 | 116.1 | 13.89 | 14.70 | 14.12 | 16.00 | 2.48 | 2.50 | 8.33 | 10.10 |
| Mean | | | 108.0 | 114.9 | 13.37 | 14.10 | 13.90 | 15.80 | 2.47 | 2.47 | 8.08 | 9.69 |
| Without | | 60 | 101.5 | 105.5 | 12.87 | 13.50 | 13.30 | 15.40 | 2.44 | 2.44 | 7.92 | 9.26 |
| Compost II (Ton / fed) | 1 ton | 45 | 109.8 | 116.9 | 13.30 | 14.30 | 14.20 | 16.30 | 2.53 | 2.45 | 8.46 | 9.93 |
| | 2 ton | 30 | 105.3 | 115.9 | 13.98 | 15.80 | 14.90 | 16.90 | 2.84 | 2.60 | 8.83 | 10.89 |
| | 3 ton | 15 | 106.1 | 108.5 | 13.34 | 14.80 | 14.73 | 16.90 | 2.70 | 2.43 | 8.46 | 10.64 |
| | 4 ton | 0 | 109.2 | 123.2 | 13.80 | 15.10 | 14.89 | 16.60 | 2.70 | 2.49 | 8.68 | 10.82 |
| Mean | | | 106.4 | 114.0 | 13.46 | 14.70 | 14.40 | 16.42 | 2.46 | 2.47 | 8.46 | 10.31 |
| L.S.D. at 5% | | | N.S. | N.S. | 0.75 | 1.17 | 0.81 | 0.77 | 0.12 | N.S. | N.S. | 0.52 |

**B. No. of open bolls plant and bolls weight:**

The results in Table (3 ) show that application of either compost I or poultry manure with and without different rates of N fertilizer exhibited significant increase in No. of open bolls in both seasons compared with those plants fertilized with 60 Kg N fertilizer as a recommended dose. Concerning bolls weight, there was a significant increase in the first season; however, the increase in boll weight was non- significant in the second season. The lowest value in No. of open bolls / plant and boll weight were recorded in plants fertilized with 60 kg N / fed in both seasons. Application of poultry manure at different levels gave a higher No. of open bolls or bolls weight compared to these fertilized with compost I at different levels. The highest No. of open bolls / plant or boll weight was observed in treatments amended with 2 Ton of poultry manure / fed combined with fertilization with 30 Kg n/fed in both seasons.

Increasing No. of open bolls/plant as a result of application of organic manures is probably due to: **(1)** increasing the uptake of N when organic manure was applied to the soil with and without N-fertilizer. It is well known that N is an important nutrient for new growth as regard by Borowski, 2001 and abscission of squares bolls. The increase in boll weight may be due to N-induced increase in mineral uptake (Breitenbeck and Boquet, 1993).**(2)** A reference to Table (5), it is obvious that chlorophyll was increased as a result of application of organic manure compared with application of 60 Kg N/ fed. Increasing chlorophyll a pigment responsible for photosynthesis increasing photosynthesis process and consequently enhanced flowering and boll retention (Kler *et al.*, 1989). Soil amended with organic manure increased leaf photosynthetic rates. This might account for a higher accumulation of metabolites which directly impacted boll weight. **(3)** From the data recorded in Table (5) it is observed that N is increased with increasing the level of organic manures. It is well known that organic manure can enriched the soil with appreciable amounts of N an other nutrients, This could be observed from data presented in table (5) as by increasing the levels of organic matter led to an increase of N content in soil. The role of K in plants suggests that is affects abscission of yield. In this respect, Guim (1985) indicated that nutritional stress increases boll shedding (an important aspect of cut-out) through an increase in ethylene production. However, K fertilizer has been reported to reduce boll shedding as reported by Zengi (1996). Regarding boll weight, potassium nutrition has pronounced effect on carbohydrates partitioning by affecting either phloem export of photosynthesis (sucrose) or growth rate of sink and/or sources organ (Cakmak *et al.*, 1994).

**C: Seed cotton yield:**

Data in Table (3) show that there was an increase in seed cotton yield Kentar / fed in the first and second seasons by increasing the organic fertilizer rate in combination with descending rate of N-fertilizer. The increase was significant in the second season. However, treatment that received 2 ton of poultry manure + 30 kg N/ fed achieved highest seed cotton yield which recorded 8.83 kentar/fed and 10.60 Kentar / fed in the first and

second season, respectively, while the control treatment achieved only 8.59 kentar/ fedan ( average of the two seasons).

Concerning the effect of the form of organic manures on seed cotton yield, it is obvious that poultry manure gave higher seed yield compared with fertilization with compost I. The superiority of organic manure over mineral fertilizer could be attributed to the following considerations: (1) The high number of open bolls / plant heavier bolls which were obtained by the complementary effect of organic manure and N-fertilizer causing an increase in seed cotton yield. This means that there is a complementary effect of both mineral N and organic manure. (2) Application of poultry manure may improve soil physical properties such as water holding capacity and soil structure. Also addition of organic matter decreased seasonal transport losses of nutrients from soil during the growing seasons (Wood, 1992; Wood *et al.*, 1999 and Flymm, 1995), which may result in yield increase (Kingery *et al.*, 1993 and 1994). (3) Organic manures are important to facilitate chemical reaction processes by improving the nutrient status of the soil which enhanced leaf concentrations of N, P, K, Mn contents (Table 5) and consequently increase vegetation and plant production. On the other hand, reduction in seed cotton yield at a rate of 60 Kg N / fed may be due to a shading effect caused by a pushing type of vegetative growth by cotton plants or cotton plants utilized excessive nitrogen fertilizer in producing more vegetative growth than seed cotton yield as reported by Taha, 1971.

**D: Lint percentage:**

Data in Table (4) show that lint % was significantly affected by application of organic manure with or without nitrogen fertilizer. Plants received 60 Kg N / fed had lower lint % compared with other treatments. In this respect, Reedy *et al.*, 2007 evaluated three sources of nitrogen: urea, fresh poultry litter and composted poultry litter at 40, 80 and 120 Kg N / he for cotton growth and yield, in general, they found that the three sources of nitrogen significantly increase lint yield compared with control treatment (without nitrogen). Significantly, higher lint yield was obtained with fresh poultry litter compared with urea.

**E: seed index:**

Seed index increased by adding either compost I or poultry manure with or without fertilizer in both seasons. The increase was significant in the second season. In both seasons, the highest value was recorded in plants received poultry manure at a rate of 2 Ton + 30 Kg N / fed. The increase in seed index may be due to increased photosynthetic activity which increases accumulation of metabolites with direct impact on seed weight. With reference to Table (5), it is observed that K is increased after application of organic manures. Possible explanation for increasing seed index due to increasing of K may be attributed to part to its favorable effect on photosynthetic activity rate of crop leaves as reported by Bednarz and Oosterhuis (1999) and $CO_2$ assimilation, which improves mobilization of photosynthates and directly influence boll weight that directly affect seed weight.

Table (4): Response of some characters of cotton Giza 80 to application of two kinds of organic manures and different nitrogen fertilizer levels

| Treatments | | | Earliness% | | Lint% | | Seed index | | Micronair reading | | Pressley index | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compost | | N/fed | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 | 2004 | 2005 |
| Without | | 60 | 86.49 | 67.64 | 40.42 | 40.75 | 9.23 | 9.39 | 4.2 | 4.3 | 9.4 | 9.7 |
| Compost I (Ton / fed) | 1 ton | 45 | 68.58 | 66.16 | 39.73 | 40.16 | 9.23 | 9.50 | 4.4 | 4.4 | 9.8 | 9.9 |
| | 2 ton | 30 | 68.27 | 63.26 | 40.44 | 40.78 | 9.26 | 9.47 | 4.4 | 4.4 | 9.9 | 9.8 |
| | 3 ton | 15 | 69.03 | 64.76 | 40.73 | 40.22 | 9.65 | 9.80 | 4.4 | 4.3 | 10.2 | 10.1 |
| | 4 ton | 0 | 69.16 | 67.62 | 40.68 | 40.18 | 9.60 | 9.81 | 4.2 | 4.6 | 10.3 | 10.2 |
| Mean | | | 68.71 | 65.89 | 40.40 | 65.89 | 9.39 | 9.59 | 4.32 | 4.4 | 9.92 | 9.94 |
| Without | | 60 | 68.49 | 67.64 | 40.42 | 40.75 | 9.23 | 9.39 | 4.2 | 4.3 | 9.4 | 9.7 |
| CompostII (Ton / fed) | 1 ton | 45 | 68.30 | 63..64 | 39.89 | 40.51 | 9.20 | 9.85 | 4.5 | 4.6 | 9.7 | 9.7 |
| | 2 ton | 30 | 68.12 | 68.50 | 40.00 | 10.51 | 9.70 | 10.17 | 4.4 | 4.5 | 9.4 | 9.8 |
| | 3 ton | 15 | 67.98 | 63.72 | 40.37 | 40.70 | 9.36 | 10.01 | 4.3 | 4.4 | 9.9 | 9.8 |
| | 4 ton | 0 | 68.41 | 68.05 | 40.72 | 40.52 | 9.30 | 10.10 | 4.2 | 4.3 | 9.5 | 9.9 |
| Mean | | | 68.26 | 66.31 | 40.28 | 66.31 | 9.36 | 9.90 | 4.3 | 4.4 | 9.6 | 9.8 |
| L.S.D. at 5% | | | N.S. | 0.72 | 0.71 | 0.72 | N.S. | 0.17 | N.S. | N.S. | N.S. | N.S. |

Table (5): Response of some chemical composition of cotton Giza 80 to application of two kinds of organic manures and different nitrogen fertilizer levels

| Treatments | | | Chlorophyll (mg/g dry wt.) | | | Caroten-oid | Carbohydrate (mg/g dry wt.) | | | Elements percentage | | | | | Oil % | Protein % | Total amino N(mg/g dry wt.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compost | | N/fed | a | b | Total | (mg/g | R.S. | NR.S | TSS | N | P | K | Mg | Ca | | | |
| Without | | 60 | 3.58 | 2.03 | 5.61 | 0.80 | 5.30 | 7.82 | 13.12 | 2.5 | 0.27 | 2.65 | 0.44 | 2.53 | 20.01 | 18.75 | 5.44 |
| Compost I (Ton / fed) | 1 Ton | 45 | 3.58 | 2.15 | 5.73 | 0.80 | 5.32 | 7.18 | 13.50 | 2.5 | 0.28 | 2.66 | 0.43 | 2.70 | 20.24 | 18.75 | 5.51 |
| | 2 Ton | 30 | 3.67 | 2.09 | 5.85 | 0.81 | 5.31 | 7.19 | 13.50 | 2.6 | 0.27 | 2.67 | 0.44 | 2.80 | 20.07 | 18.75 | 5.57 |
| | 3 Ton | 15 | 3.78 | 2.28 | 6.06 | 0.91 | 6.04 | 7.86 | 13.90 | 2.7 | 0.28 | 2.67 | 0.45 | 2.47 | 20.19 | 21.78 | 5.63 |
| | 4 Ton | 0 | 4.01 | 2.48 | 6.49 | 0.80 | 6.16 | 8.16 | 14.32 | 2.7 | 0.28 | 2.68 | 0.44 | 2.63 | 20.82 | 21.78 | 6.19 |
| Mean | | | 3.72 | 2.21 | 5.95 | 0.82 | 5.63 | 7.64 | 13.67 | 2.6 | 0.28 | 2.67 | 0.44 | 2.63 | 20.27 | 19.96 | 6.67 |
| Without | | 60 | 3.58 | 2.03 | 5.61 | 0.80 | 5.30 | 7.82 | 13.12 | 2.5 | 0.27 | 2.65 | 0.44 | 2.53 | 20.01 | 18.75 | 5.44 |
| Compost II (Ton / fed) | 1 Ton | 45 | 4.34 | 2.28 | 6.72 | 0.81 | 5.90 | 9.19 | 15.09 | 2.8 | 0.29 | 2.78 | 0.42 | 2.47 | 20.91 | 21.78 | 6.13 |
| | 2 Ton | 30 | 4.76 | 2.17 | 6.93 | 0.91 | 7.00 | 9.19 | 16.19 | 3.4 | 0.33 | 2.88 | 0.43 | 2.73 | 21.99 | 21.78 | 7.88 |
| | 3 Ton | 15 | 4.37 | 2.07 | 6.44 | 0.84 | 7.25 | 9.62 | 16.87 | 3.2 | 0.31 | 2.97 | 0.43 | 2.55 | 21.07 | 20.75 | 7.44 |
| | 4 Ton | 0 | 4.74 | 2.14 | 6.88 | 0.87 | 7.18 | 8.85 | 16.03 | 3.2 | 0.32 | 2.99 | 0.43 | 2.62 | 21.28 | 20.87 | 7.00 |
| Mean | | | 4.36 | 2.14 | 6.52 | 0.85 | 6.53 | 8.93 | 15.45 | 2.98 | 0.30 | 2.85 | 0.43 | 2.68 | 21.05 | 20.79 | 6.78 |
| L.S.D. at 5% | | | 0.11 | 0.09 | 0.10 | 0.05 | 0.38 | 0.33 | 0.37 | 0.10 | 0.03 | 0.02 | 0.02 | 0.13 | 0.41 | 0.41 | 0.03 |

**F: earliness percentage:**

Earliness % was decreased in the first season among all treatments compared with plants received 60 Kg N / fed. In the second season, applications of poultry manure at a rate of 2 Ton + 30 Kg N / fed increased significantly earliness % compared with plants received 60 Kg N / fed.

**G: Fiber quality:**

Application of organic manure at different levels resulted in non-significant increase in micronair reading and pressley index in both seasons.

**H: Leaf nutrients concentration:**

Application of organic manures with or without N-fertilizer increased the concentrations of N, P, K, Ca and Mg in cotton leaves compared with those fertilized with 60 Kg N / fed as shown in Table (5). Soil amended with poultry manure gave higher concentrations of N, P and K than those fertilized with compost I. Such results indicate that compost I or poultry manure can offer most of nitrogen requirements in available form to cotton plants, even in the absence of N-fertilizer. . Poultry manure considered a rich source of N for cotton plants. Increasing N due to application of organic manure led to increase protein content. Stitt (1999) indicated that nitrate ($NO^-_3$) induces genes involved in different aspects of carbon metabolism, including the synthesis of organic acids used for amino acids synthesis. These results suggest that the high N rate increases amino acid synthesis in leaves and this stimulate the accumulation of protein in the seed. Increasing K level due to application of organic manure also increase protein. This could be attributed to the role of K in biochemical pathway in plants.

Seed oil percentage was significantly increased by adding organic manure combined with different rate of N-fertilizer. Application of poultry manure gave high oil % than those in plants treated with compost I. Nitrogen is an essential nutrient in creating plant dry matter, as well as many energy rich compounds which regulate photosynthesis and plant production this influencing boll development, increase No. of bolls and boll weight. Synthesis of fat requires both N and carbon Skelton during the course of seed development as reported by Patil *et al.*, (1996).

Data in Table (5) show that chlorophyll A, b and total chlorophyll and carotene were significantly increased among all treatments compared with plants received 60 Kg N / fed. The highest value of total chlorophyll and carotene was observed in plants fertilized with 2 Ton of poultry manure / fed combined with 30 Kg N /fed. It is also observed from data in Table (5) that reducing or non-reducing sugar and total soluble sugar were increased due to application of organic manure at different rate with and without N-fertilization. The increase in chlorophyll, carotene and carbohydrate due to application of organic manure could be attributed to increasing N and K in leaves. Nitrogen is an essential nutrient in creating plant dry matter, as well as many energy rich compounds which regulate photosynthesis. There is an optimal relationship between nitrogen contents in the plant and $CO_2$ assimilation as reported by Greef (1994), where decreases in $CO_2$ fixation are well documented for N-deficient plants. K increases the photosynthetic rates of crop leaves, $CO_2$ assimilation and facilitates carbon movement (Sangakkara

*et al.*, 2000) Furthermore, K has an important role in translocation of photosynthates from sauces to sink as stated by Bednarz and Oosterhuis (1999). Notable improvements in cotton yield and quality resulting from K input were reported by Mullins *et al.*,(1991) and Cassman *et al.*, (1992).

**I. microbial populations in the rhizosphere of cotton plants:**

The total numbers of bacteria, fungi and actinomycetes in the rhizosphere of cotton plants is illustrated by Fig (1) and (2).

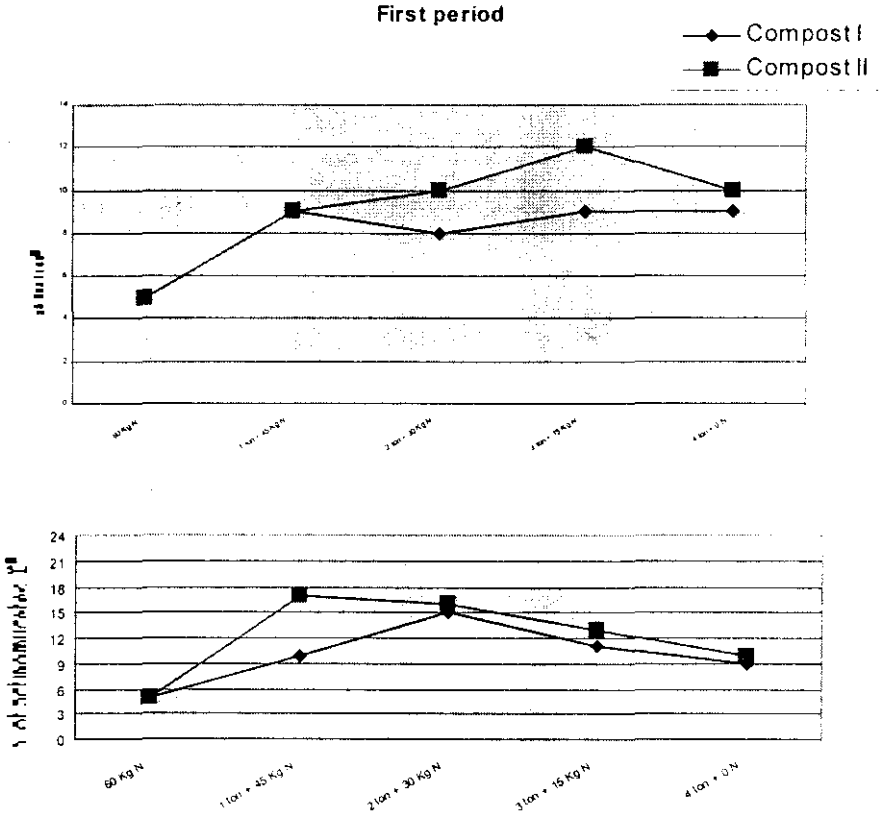
Generally, the number of bacteria, fungi and actinomycetes was increased by application of different levels of either compost I or poultry manure with and without N fertilizer at different rates compared with those in the rhizosphere of plants fertilized only with 60 Kg N/fed as a recommended dose. This was attributed to the fact that organic manure considered as sources of nutrients and energy for living microorganisms (Dalzell *et al.*, 1997). The majority of nitrogen in poultry manure is in the form uric acid that can be rapidly converted to ammonium nitrogen if temperature, moisture and pH are suitable for microbial activity (Sins and urelf 1994).

The lowest number of bacteria, Fungi and actinomycetes in both periods, was recorded in plants fertilized with 60 Kg / fed. It is clear from data in the first and second periods, that application of poultry manure gave higher count of bacteria compared with application of compost I. in the second period, application of poultry manure at a rate of 3 Ton + 15 Kg N or 4 Ton without mineral N-fertilizer gave high count of bacteria than their of compost I. It is obvious from these observations that poultry manure plays an important role in enhancing bacterial populations in the rhizosphere of cotton plants. Research with poultry manure as an organic amendment, has shown that application of poultry manure stimulate the development of microbial population (Main *et al.*, 1982 and Riegel *et al.*1996).

Poultry manure contains significant quantities of N, P, K, Ca, Mg and micronutrients and can be used for microbial population as a substitute for commercial fertilizer (Ndegwa al., 1991).

In the second period, plants fertilized with poultry manure at a rate of 2, 3, 4 Ton /fed in combination of different rates of N-fertilizer gave a higher number of Fungi compared with those fertilized with compost I combined with different rates of N-fertilizer. In the second season, soil amended with poultry manure at a rate of 3 and 4 Ton exhibit a high number of bacteria compared with those fertilized with compost I.. These findings have been partially due to microbes associated with poultry manure amendment. In this respect, Riegel and Noe (2000) identified bacterial genera from poultry manure amended soil. They found that *Arthrobacter*, *Bacillus*, *Cellulomonas* and *Micrococcus* have the ability to use ammonium salts or nitrates as there source of nitrogen (Krieg and Halt 1984). Poultry manure has levels of nitrogen in the organic and inorganic forms that would be really available to those organs other microbes such as *Bacillus macerance* and *Bacillus polymyxa* use ammonia to fix $N_2$ under anaerobic conditions (Edwads and Danial 1992).

Finally, these results demonstrated that application of organic manure increases soil microbial population and in the soil fertility, especially, soil amended with poultry manure.



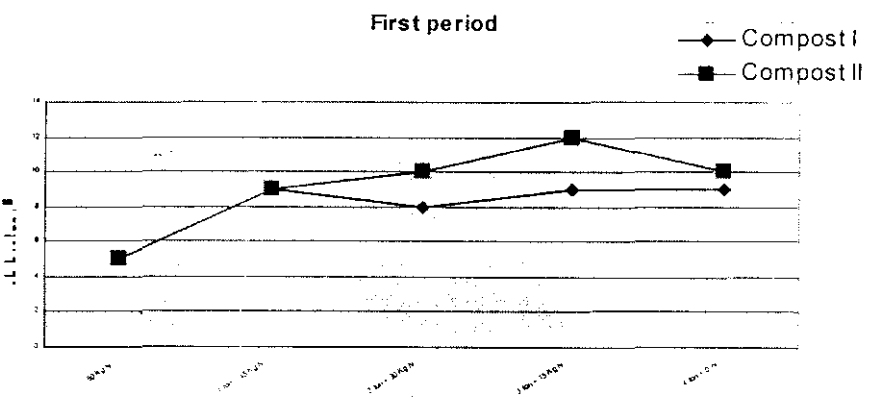




Fig (1): Effect of different rates and kindes of composted materials and nitrogen fertilizer on total microbial counts in the rhizospher of cotton plants in the first period.

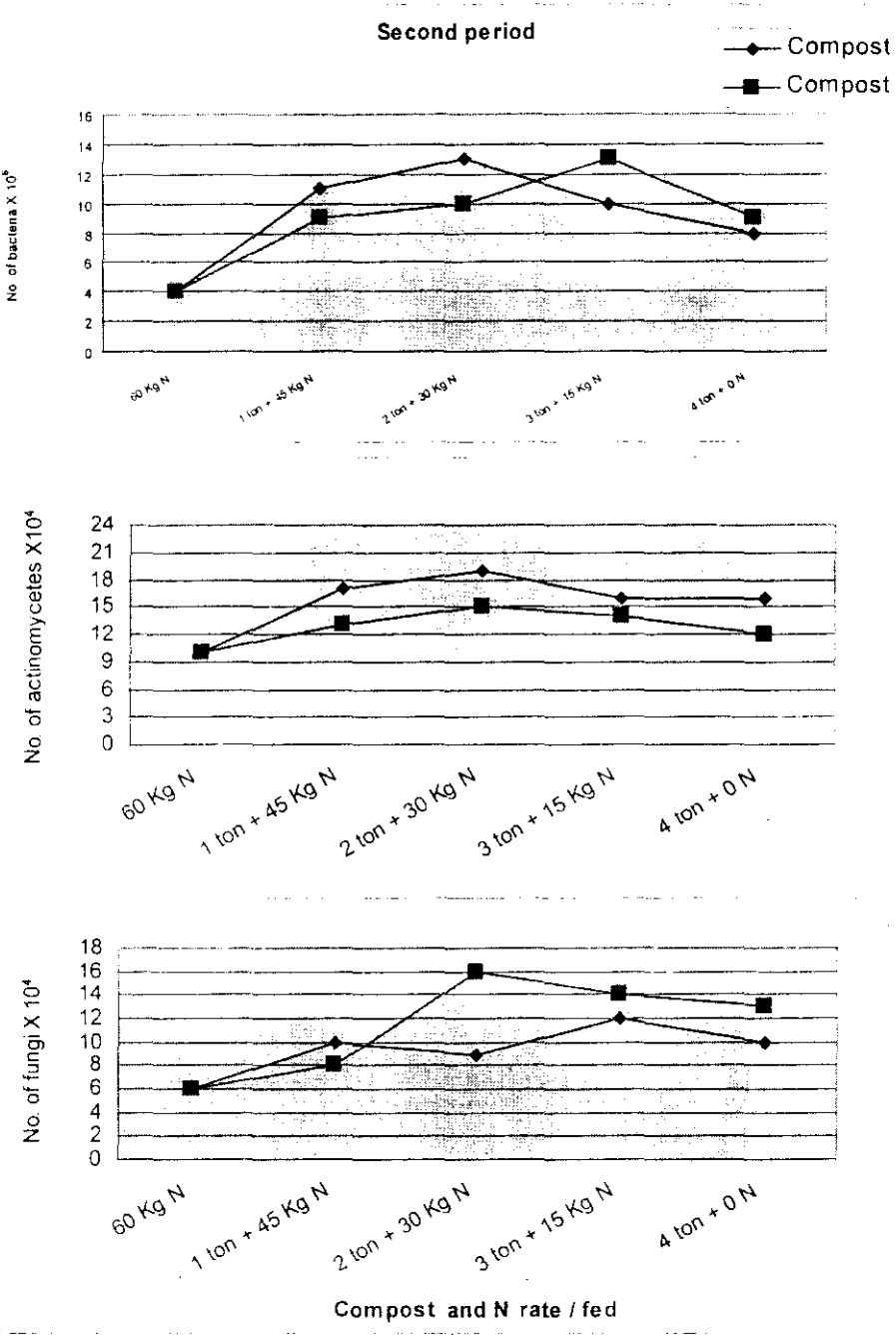



Fig (2): Effect of different rates and kinds of composted materials and nitrogen fertilizer on total microbial counts of the rhizosphere of cotton plants in the seconed period.

The application of these results aids in controlling soil borne disease, where Junli Huang *et al.*, 2006 show that organic amendment applied to soil reduced disease severity in both inoculated pots with Verticillium wilt and naturally infested cotton field plots.

Research with poultry manure for example, has shown that soil amended with poultry manure will lower population densities of plant parasitic nematodes that was attributed to the stimulation of microbial population which capable of producing substances toxic to nematodes (Oteifa *et al.*, 1979). Also, organic manure applied to soil has a positive residual effect of soil biological activity as stated by Mahmoud *et al.*, (2003).

More detailed studies of microbial population dynamics in poultry amended soil are needed to identify the specific roles that bacteria, Fungi and actinomycetes which were enhanced after application of organic manure in disease control. This area of research, are currently conducted.

## CONCLUSION

The results from this study indicate the feasibility of using organic manures in improving cotton plant characters, yield, yield components, leaf nutrients and stimulation of microbial populations in the rhizosphere of cotton plants. It could be concluded that a synergetic effect can be seen from combination of N-fertilizer as a starter and poultry manure .Thus the best treatment was 2 ton/ fed of poultry manure combined with 30kgN/fed.

From the practical point of view, the economic factor such as high transportation costs compared to prices of mineral fertilizers limit the application of organic manure to cotton soil. Compositing cotton wastes particularly cotton stalks may be a solution of high cost of purchase organic manure. Every year in Egypt millions Ton of cotton wastes are generated. Historically, these cotton wastes have been burnt as fuel. These methods of disposal cause environmental problems. These results together with other form wastes such as rice straw can effectively be utilized for preparing composts. Compost must be applied on cotton soils that are located near the region of cotton crop production.

Composting cotton wastes will beneficial not only cotton to cotton farmers, but will also offer an economic and environmentally acceptable means of waste disposal.

## REFERENCES

A.O.A.C. (1965). Official Methods of Analysis of Agricultural Chemists, ed. Washington, DC., USA.

A.O.A.C. (1975). Official and tentative Methods of American Oil Chemists Society, third Ed., Chicago, Illinois.

Allen, U. N. (1953). Experiments in soil Bacteriology. 1st Ed Burges pub. Co. USA.

Arnon, D. I. (1994). Copper enzymes in isolated chloroplasts. Plant Physiol., 24: 1-15.

Badawi, M. A. (2002). Organic farming of tomato in sandy soil. Minufia J. Agric. Res., 27 (1): 75-86.

Bednarz, C. W. and D. M. Oosterhuis. (1999). physiological changes associated with potassium deficiency in cotton. J. Plant Nutr., 22: 303-313.

Borowski, E. (2001). The effect of nitrogenous compounds on the growth, photosynthesis and phosphorus uptake of sunflowers. Annales Universitatis Mariae Curie- Sklodowsku. Section EEE, Horticultura 9 : 23-31.

Breitenbeck, G. A. and D. J. Boquet (1993). Effect of N fertilization on nutrient uptake by cotton. p. 1298-1300. In Proc. Betjmide Cotton Conf., New Orleans, IA. 10-14 Jan. 1993. NOTL. Cotton Counc. Am., Menphis, TN.

Cakmak, I., C. Hengeler and H. Marschner (1994). Partitioning of shoot and root dry weight and carbohydrates in bean plants suffering from phosphorus, potassium and magnesium deficiency. J. Exp. Bot. 45 : 1245-1250.

Cassman, K. G., B. A. Roberts and D. C. Bryant, (1992). Cotton response to residual fertilizer potassium on vermiculitic soil, organic matter and sodium effects. Soil Sci. Soc. Am. J., 56: 823-830.

Cerning, B. J. (1975). A note on sugar determination by enthrone method / Cereal Chem., 52: 857.

Chapman, H. D. and P. F. Pratt (1961). Methods of Analysis for soils, plants and waters, Univ. California, Divison Agric. Sci.

Cisneros, J. J. and L. D. Godfre (2001). Mid-season pest status of the cotton aphid ( Homoptera : Aphididae) in California cotton : Is nitrogen a key factor? Environ. Entomol. 30 : 501-510.

Edwards, D. R. and Danial, T. C. (1992). Environmental impact of on-farm poultry waste disposal- a review. Biores. Technol. 41: 9-33.

El-Fouly, M. M., A. F. A. Fawzi and A. A. El-Sayed (1997). Nutritional deficiencies in cotton in Egypt. Proc. FAO. IRCRNC., Joint Meeting of the working groups 4 & 3 (Cotton nutrition & Growth Regulators) 20-23 March, 1995, Cairo, Egypt, pp. 59-65.

El-Naggar, I. M., A. F. A. Darwish and A. M. Hanaa, (1996). Response of cotton plant to application of some soil amendments and phosphorus fertilization. Minufia J. Agric. Res., 21: 715-731.

El-Shazly, W. M. O. and M. F. El-Masri (2002). A comparative study on the effect of some organic manures and mineral nitrogen fertilizer on the leaf chemical composition, growth, earliness and yield of cotton (Giza 89 cultivar). Minufia J. Agric. Res. 27 (6) : 1325-1348.

Flymm. R. P. (1995). Comparative evaluations of composted broiler litter for crop production. pH. D. Diss. Auburn Univ. Aubur.

Greef, J. M. (1994). Productivity of maize (Zea mays L.) in relation to morphological and physiological characteristics under varying amounts of nitrogen supply. J. Agron. Crop Sci., 172:317-326.

Guinn, G. (1985). Fruiting of cotton. III Nutritional stress and count. Crop Sci. 25 : 981-985.

Howard, D. D., C. O. Gwathney, M. E. Essington, R. K. Roberts and M. D. Mullen (2001). Nitrogen fertilization of no-till cotton on loess derived soils. Agron. J. 93 : 157-163.

Junli Huang, Honglianli and Honxia Yuan (2006). Effect of organic amendment of *Verticillium* wilt of cotton. Crop protection 25,(11): 1167-1173.

Khalifa, M. R. (1993). Some soil properties yield and elemental composition of seeds and leaves of broad bean plants as influenced by some organic west products. J. Agric. Res. Tanta Univ., 19 (4): 1000-1011.

Kingery, W. L., C. W. Wood, G. L. Mullins and E. Van Santeen (1993). Implication of long term land application of poultry litter on tall fescue pastures. J. Prod. Agric. 6 : 390-395.

Kingery, W. L., C. W. Wood and J. C. Williams (1996). Tillage and amendment effect on soil carbon and nitrogen mineralization and phosphorus release. Soil Tillage Res. 37: 239-250.

Kler, D. S., D. Raj and G. S. Dhillon (1989). Modification of micro-environment with cotton canopy for reduced abscission and increased seed yield. Environ. Ecol. 7 : 800-802.

Koriem, M. A. (1993). Influence of sewage sludge and farmyard manure applications on some properties of clay soil and root yield of carrot. J. Agric. Res. Tanta Univ., 19 (4): 1012-1022 .

Krieg, N. R. and Holt, J. G. (1984). Bergey's Manual of Systemic Bacteriology. Vol. 1. Williams & Wilkins, Baltimore.

Mahmoud, M. H.; A. M. Eissa and Amal H. El-Guibali. (2003). Utilization of organic fertilizers for Egyptian cotton and subsequent broad bean in an alluvial soil. Egypt J. Appl. Sci; 18 (5).423-434.

Main, I. H., Godey, G., Shelby, R. Rodrigues-Kabana, R. and Morgan-Jones, G. (1982). Chitin amendment for control of *Mecloidogyne arenaris* infested soil. Nema-Tropica 12: 71-84.

Martin, J. P. (1950). Use of acid rose Bengal and streptomycin in the plate method for estimating soil fungi. Soil Sci., 69 (3): 215 – 233.

Mehana, T. A. (1988). Effect of N-serve nitrogen stabilizer and chicken manure on some soil properties and mineral composition of maize plants. 7th conf. Agric. Dev. Res., Fac. Agric., Ain Shams Univ., Cairo, December 15-17, Annals Agric. Sci., Sp. Issue I., 333-348.

Mostafa, M. H. (2002). Application of artificial municipal fertilizer (compost) in Egyptian cotton production. Egypt. J. Appl. Sci. 17 (12): 829-839.

Mullins, G. L. and C. H. Burmester (1990). Dry matter, nitrogen, phosphorus and potassium accumulation by four cotton cultivars. Agron. J. 82 : 729-736.

Ndegwa, P. M., Thomposon, S. A. and Merka, W. C. (1991). Fractionation of poultry litter for enhanced utilization. Trans. Am. Soc. Agric. Eng. 34. 992- 997.

Nofal, O. A. and K. A. Ziadah (2000). Response of cotton Giza 70 to application of two sources of organic manures and nitrogen fertilizer levels. J. Agric. Sci. Mansoura Univ., 25 (10) 5981-5991.

Oteifa, B. A., Badra, T. and Saleh, M. A. (1979). Nematocidal activity and composition of some organic fertilizers ans amendments. Rev. Nematol, 2 : 37-40.

Patil, B. N., K. C. Lakkireri and S. C. Bhangara (1996). Seed yield and yield contributing characters as influenced by N supply in rapeseed-mustard. J. Agron. Crop Sci., 177: 197-205.

Reedy, K. C., R. K. Malik, S. S. Reddy and E. Z. Nyakatawa (2007). Cotton growth and yield response to nitrogen applied through fresh and composted poultry litter. J. Cotton Science, 11: 26-34.

Riegel, C. and J. P. Noe. (2000). Chicken litter soil amendment effects on soil born microbes and meloidogyne incognita on cotton. Plant Dis. 84: 1275-1281.

Riegel, C., Fernandez, F. A. and Noe J. P. (1996). Meloidogyne incognita infested soil amended with chicken litter. J. Nematol. 28: 369-378.

Rogers, T. H. and J. E. Giddens (1957). Green manure and cover crops. 1-Soil. The Yearbook of Agriculture. The United States Department of Agriculture, Washington, D. C.

Rolbelen, G, (1957). Untersuchungen on strohleninduzieten blat arbumutonten Von arbidopoid. Thaliana (L.). Verbangsic.

Rosen, H. (1957). A modified ninhydrin Calorimeteric analysis for amino acid nitrogen. Arch. Biochem. Biophys. 76 : 10-15.

Sangakkara, U. R., M. Frehner and J. Nosberger (2000). Effect of soil moisture and potassium fertilizer on shoot, water potertial, photosynthesis and partitioning of carbon in mungbean and cowpea. J. Agron. Crop. Sci., 185:201-207.

Sims, J. J. and Woelf, D. C. (1994). Poultry waste management uses. Adv> Agron. 52 : 1-83.

Slosser, J., J. Leser, D. Rummel, T. Fuchs, E. Boring, M. Muegge, and C. Sansone. (1999). Suggestions for management of cotton applied in west Texas. Available on line at http:// entowww. Tanu. Edu / extensive Bulletins/aphweb99. htnl (Verified 6 Jan. 2006). Agricultural Communications, Texas A & M University System, College Station, TX.

Snedecor, G. W. and w. G. Cochran (1981). Statistical Methods, 6th Edition, Iowa Stat Univ. Press, Ames, Iowa, USA.

Stitt, M, (1999). Nitrate regulation of metabolism and growth. Curr. Opin. Plant Biol., 2: 178-186.

Taha, M. E. (1971). Foliar analysis as an index for cotton nitrogen fertilization. M. Sc. Thesis, Fac. Agric. Univ. of Cairo.

Towolde, H., and C. J. Fernandez (1997). Vegetative and reproductive dry weight inhibition in nitrogen and phosphorous deficient Pinra cotton. J. plant nutrition. 20 : 219-232.

University of Arizona (1999). Sticky cotton sources and Solutions. IPM serious No. 13, Publ# Az 1156-12 / 1999. univ. of Arizona Cooperative Extension, Tucson, Az.

Waksman, S. A. (1952). Soil Microbiology. John Wilys & Sons, Inc. New York, U. S. A.

Wood, C. W. (1992). Broiler litter as a fertilizer. Benefits and environmental concerns. P. 304-312. In Proc. Natl. Poultry waste Manage. Symp., Birmingham, Al. 6-8 Oct. 1992. Auburn Univ., Auburn.

Wood, B. H., C. W. Wood, K. H. Yoo, K. S. Yoon and D. P. Delaney (1999). Seasonal surface runoff losses of nutrients and metals fern soils fertilized with broiler litter and commercial fertilizer. J. Environ. Qual. 28: 1210-1218.

Zeng, Q. (1996). Experimental study on the efficiency of K fertilizer applied to cotton in areas with cinnamon soil or aquic soil. China cottons 23: 12.

## تأثير الإستخدام المتكامل للتسميد العضوي مع التسميد النتروجيني على نمو وانتاجية محصول القطن وعلى نشاط بعض المجموعات الرئيسية للكائنات الحية الدقيقة في ريزوسفير نبات القطن

**عبد الجواد أحمد ثروت الكحال[1] و عاليه عوض ناميش [2] و مدحت يمانى أبو زيد[1]**

١ – معهد بحوث الاراضى والمياه والبيئة – مركزالبحوث الزراعية– الجيزة

٢ –معهد بحوث القطن– مركزالبحوث الزراعية– الجيزة.

أجريت تجربتان حقليتان خلال الموسمين الزراعيين ٢٠٠٤ – ٢٠٠٥ وذلك لدراسة تأثير الاستخدام المتكامل لمصدرين من السماد العضوى وهم كمبوست ١ و زرق الدواجن بمعدلات ٠، ١، ٢، ٣، ٤ طن للفدان مع ثلاث مستويات من التسميد النيتروجينى ١٥ ، ٣٠، ٦٠ كجرام نيتروجين للفدان على بعض صفات النمو والمحصول لنبات القطن صنف جيزة ٨٠ وكذلك دراسة تاثير هذه المعاملات على نشاط بعض الكائنات الحية الدقيقة فى ريزوسفير القطن .

**ويمكن تلخيص النتائج كالتالى :-**

١.أدى استخدام السماد العضوى الصناعى أو زرق الدواجن بمستويات مختلفة الى زيادة طول النبات وعدد الافرع الثمرية وعدد اللوز المتفتح وكذلك وزن اللوز بالاضافة الى زيادة محصول البذرة والمحتوى الكيماوى للاوراق وصفات التيلة مقارنة بنباتات القطن التى سمدت بـ ٦٠ كجرام نيتروجين للفدان.

٢.فى معظم الحالات ادى استخدام ٣٠ كجرام نيتروجين للفدان مع ٢ طن سماد زرق الدواجن الى احسن النتائج بالنسبة للمحصول ومكوناته .

٣.لم يتاثر صفات التيلة بمعاملات التسميد العضوى .

٤.ادى استخدام التسميد العضوى مع التسميد المعدنى الى زيادة العدد الكلى للبكتريا والفطريات والأكتينوميسنات فى ريزوسفير نبات القطن.

وبصفة هامة هذه النتائج لكى تكون عملية لابد من تصنيع السماد العضوى الصناعى من مخلفات القطن وخاصة حطب القطن بواسطة مزارعى القطن أنفسهم وذلك للتغلب على مشاكل التكلفة العالية لنقل السماد العضوى الصناعى.