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Effect of Growing Area on Yield Traits, Fiber and Yarn Properties in Egyptian Cotton Genotypes by Using Biofertilizer Inoculation, Vermicompost and Algae Extract

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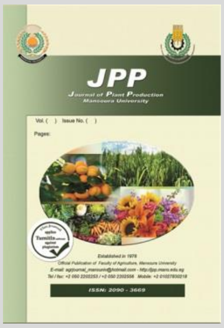

ABSTRACT

These experiments were conducted to study the response of some Egyptian cotton, Giza 96 (extra-long stable) and Giza Giza 96 (extra-long stable)varieties and its yield characteristic, lint percentage, fiber and yarn properties when using bio-fertilizers such as vermicompost, Bacteria bacteria inoculums (*Bacillus polymxa, Bacillus megaterium* and *Bacillus circulans*) and algae extract under different growing area, Sakha region (clay soil) and El-Nubaria region (calcareous soil).Concerning the effect of different treatments application on soil properties, this results showed a significantly increase of soil organic matter**,** pH it was relatively insignificantly decreased and the vermicompost treatments had positive effects on the levels of N, P and K. available. As soil biological count of Bacteria, Fungi, Actinomycetes and Carbon dioxide evolution rate it showed a significant increase. The content of cotton plant leaves of chlorophyll A, B, Carotenoids and Total phenols was significantly improved under different fertilizer treatments compared to the control.The treatment with (vermicompost fertilizer + bacterial inoculation + 50% of mineral fertilizer recommended dose + algae extract) proved its superiority over the rest of the treatments, especially in the seed cotton yield, and lint percentage, which increased at 1.41 kentar per feddan and 0.63(lint %) compared to the two control treatments. Data of cotton yield characteristics, fiber and yarn properties were recorded significantly different due to cultivated in different regions.The difference among studied varieties may be due to the growth habit and response of each one to environmental conditions, which controlled by genetic factors and efficient utilization of inputs and natural resources.

Keywords: Egyptian cotton, Fiber quality, Eco-friendly, Biofertilizers, *Bacteria* inoculants, Vermicompost algae extract.

INTRODUCTION

The environment and soil type (growing area), play an important role in the growth of plants and increasing the productivity of the unit area for the crops. Therefore, the state represented by research centers and some private companies and individuals has turned to the production of organic crops free from the impact of mineral fertilizers, which the farmer has over used since these were discovered, Nitrogenous fertilizers, thinking that the increase in addition of these mineral fertilizers will increase the productivity of the unit area, but with the passage of time, the pollution of groundwater, soil and the environment became a constant suffering for humans and exacerbated health problems and increased the incidence of cancerous diseases. Both compost tea and vermicompost tea one products derived from accelerated biological degradation of organic wastes by Aerobic fermentation by using microorganisms at case of compost and microorganisms plus earthworms at case of vermicompost, (Simon *et al*., 1999). In the modern cultivation, indiscriminate use of fertilizers, particularly the nitrogenous and phosphorus, has led to substantial pollution of soil, air and water the excessive use of these chemicals exerts deleterious effects on soil microorganism, affects the soil fertility and pollutes environment Youssef and Eissa (2014). While, Shivalingaiah (2007) indicated that organic cotton production is expected to expand in response to increased demand for organic fibers. Thus, there is a need to study the effect of these fertilizers on the Egyptian cotton quality and quantity because our cottons have a unique fiber property besides our soil is suffering of lack of minerals since building the high dam as clarified by Arafa and El-Gebaly (2007) and Arafa *et al.*, (2013). So, we should focus on method helps us to increase the soil fertility, like bio organic fertilization. Kevin (2003); Twewaadha and Alweendo (2007) and Shivalingaiah (2007) found that the organic cotton fertilizers like, vermicompost, humic acid solid manures and bio-fertilizers etc., provide necessary nutrients for plant, improve soil properties, and decrease the soil pH that reflected on the crop growth and production. The use of vermicompost along with inoculation of rhizospheric organisms shows beneficiary response on growth of plants, and as obtained from the results of this study, applying the organic and biological fertilizers led to significant increase in all studied cotton yield characters, fiber properties and yarn properties in addition to enhance its chemical composition like what reported by Javaid

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(2009) and Javaid and Mahmood (2010). Moreover, the crop resistant to damping-off and root-rot diseases were also encouraged. These truths may be due to certain features in each type of fertilizer that played a very important role in its mode of action. Mahmoud and Ibrahim (2012) found that observed a 46% reduction in the soil EC with addition of 10% vermicompost. Similarly, vermicompost contains a high proportion of humic substances (that is, humic acids, fulvic acids and hummin) which provide numerous sites for chemical reaction; microbial components known to enhance plant growth and disease suppression through the activities of bacteria, yeasts and fungi, as well as chemical antagonists such as phenols and amino acids Baker *et al.* (2011).

A good physical quality of soil is one that is strong enough to maintain good structure, resist erosion and compaction; but also weak enough to allow unrestricted root growth and proliferation of soil flora and fauna. It also has fluid transmission and storage characteristics that permit the correct proportion of water, dissolved nutrients and air for both maximum crop performance and minimum environmental degradation Iç *et al. (*2010).

Cultivation of calcareous soil present many challenges, such as low water holding capacity, high infiltration rate, poor structure, low organic matter and clay content, low CEC, loss of nutrients via leaching or deep percolation, surface crusting or cracking, high pH and loss of nitrogen fertilizer, low availability of nutrients particularly phosphorus and micronutrients and a nutritional imbalance between elements such as potassium, magnesium and calcium El-Hady and Abo-Sedra (2006) and FAO (2016).

Algae extract being organic and bio-degradable in nature is considered as an important source of nutrition for sustainable agriculture especially in the newly reclaimed soil. The appreciable influence of algae extract may be attributed to its effect in increasing cell membrane permeability and promoting plant efficiency in the absorption of nutrients such as nitrogen, which has a direct relation with leaf chlorophyll concentration. Moreover, algae extract may play a role through its content of cytokine's in delaying the aging of leaves by reducing the degradation of chlorophyll. In addition, alga extract as a bio-regulator affecting the balance between photosynthesis and respiration processes in plants Raupp and Oltmanns (2006) and Yassen *et al.* (2007).

Alga extract is considered a source of high protein which split into natural amino acids involved directly in the metabolism Marrez, *et al.* (2014). It also contains some essential macronutrients for growth and development of the plant as N, P and K. In addition, algae extract affects the nutrients uptake by plant roots Abd El-Mawgoud *et al.* (2010).

Khalil and Hassan (2015) found that, all the factors under the study led to an increase in soil biological activity in terms of increasing the total bacterial, total Fungi counts, CO_2 evolution. Generally, it could be concluded that the use of the treatment (PGPR) and compost in the presence of rice straw is useful for the colored cotton, and enhancement of soil chemical and biological properties. El-Maas *et al.* (2016) found that the effect of humic acid, compost tea and bio-fertilizer using two methods of application (foliar and soaking) on some chemical and physical soil properties under saline soil conditions. The soil pH and EC values decreased due to different treatments using soaking or foliar application. The lowest value of EC in soil reached (4.61 d s m) by applying humic acid as foliar application. The soil content of O.M increased in case of bio-fertilizer, humic acid and compost tea compared with control. While clay soil contains more organic matter and has fine particles that can hold water and nutrients very well because of its negative charge which form bonds with caution quickly and high surface area, thus, it can retain more water and nutrients needed by the plant Six *et al.* (2000).

El-Shazly *et al.* (2019) recommended that, the use of organic manure in the form of cattle manure interacted with humic acid application on cotton plants led to increase the productivity of cotton plants in terms of quantity. So, the high nitrogen fixing, phosphate isolates of *Azotobacter, Azospirillum, Acetobacter* and *Pseudomonas* were used as inoculants for cotton and its effect on Plant height and boll weight were determined at the time of harvesting whereas survival rate of inoculated bacteria was identified as significant both for American cotton varieties Mitkees *et al.,* 1996); Neeru *et al.* (2005) and ICOF (2010).

The main goal of the current study was investigating the effect of bio-fertilizes vermicompost and bacteria inoculation and algae extract separately or in combined on soil chemical and biological properties as well as cotton yield, yield components, leaf chemical analysis and cotton fiber properties.

MATERIALS AND METHODS

Two field Experiments were conducted at Sakha and El-Noubaria Research Stations belong to Agric. Res. Center in two summer seasons of 2019 and 2020 to examine the influence of bio-fertilizes vermicompost, bacteria inoculation and algae extract separately or in combination on yield characteristics, fiber and yarn properties of Egyptian cotton cultivars Giza 94 and Giza 96. The average yearly rainfall is 72 mm and the main part of the rainfall is observed for the last three years is between December, January and February intervals. Climate is fine for *(Gossypium barbadense* L.) of cotton which requires 160- to 180 days to ripen. Cotton plant was planting after removing alfalfa crop, (legumes crop), for both types of soil under study. Two surface soil samples (0 -30cm) having different physical and chemical properties were taken from locations. The first sample was taken from El-Noubaria Research Station and the second was collected from Sakha Research Station. Soil samples were air dried, sieved through 2 mm sieve and analyzed for some physical and chemical properties.

Inoculation:

The liquid inoculum of [*Bacillus polymxa* (B.p.), *Bacillus megaterium* (B.m.), *Bacillus circulans* (B.c.)] were Bacteria ed with sterilized peat to use separately or in combination for cotton seed dressing as follows: 20-ml product (bacterial concentration of about 10^9 cells per ml) was diluted with 10 L water to get a bacterial suspension with 2×10^7 CUF in which 2 kg cotton seeds of Giza 94 and Giza 96 were dipped and stirred for 15 min. So, recover cotton seeds at the thin layer from vermicompost powdered. Thereafter, treated seeds were removed, spread in a thin layer on paper and air dried sown, Jackson (1976); Khan *et al.* (2009) and Sayed Ahmed Hamed *et al.* (2019).

Soil sampling:

Soil texture of the experimental site was clay and pH of 8.0. Soil samples were taken at soil preparation to depth of 0-30 cm for chemical and physical properties analysis of the experimental soil were determined according to the standard procedures described by Rowell (1995) Main properties of the soils are given in table 1.

Table 1. Some chemical and physical properties of the soils cultivated in El-Nubaria and Sakha Agriculture Research Stations before planting.

Properties	Average of 2019 and 2020 before planting El-Nubaria Calcareous soil	Sakha Clay soil
Soil property		
Sand (%)	54.3	21.3
Silt (%)	25.1	33.0
Clay (%)	20.6	45.7
Texture grade	Sandy loam	Clay loam
$CaCO_3$ (%)	18.8	1.12
Saturation percentage (%)	26.2	40.4
pH	8.51	7.73
EC (dSm^{-1})	0.48	0.59
Soluble Cation (meq/L)		
Ca^{2+}	2.59	1.90
Mg^{2+}	1.55	1.37
Na^{+}	4.21	2.05
K^{+}	0.14	0.65
Soluble Anion (meq/L)		
CO_3^{--}	zero	zero
HCO_3^{-}	2.410	1.450
Cl^{-}	3.980	1.920
SO_4^{--}	2.100	2.600
Total N (%)	0.015	0.049
Total soluble N (mg/Kg)	16.40	64.82
Available P (mg/Kg)	3.40	8.820
Available K (mg/Kg)	127.0	356.2
Organic matter (%)	0.410	0.750
Extractable Fe (mg/Kg)	0.610	4.180
Extractable Mn (mg/Kg)	0.460	3.100
Extractable Cu (mg/Kg)	0.100	0.230
Extractable Zn (mg/Kg)	0.380	1.340

Note: pH of 1:2.5 soil: water suspension; EC of soil past extract.

Vermicompost:

Vermicompost recommended dose 400 kg-/feddan, it was prepared in Microbiology Department of Soils, Water and Environments Research Institute, Agricultural Research Centre, Giza, Egypt. The data of analyses are shown in table 2.

Table 2. Some chemical properties of vermicompost used.

properties	Value vermicompost
pH	8.600
E.C (d 5 m^{-1})	3.110
Available N-NH_4 ppm	9.310
Available N-NO_3 ppm	36.81
Total Nitrogen ppm	836.0
Total Phosphors ppm	13500
Total Potassium ppm	15400
Fe ppm	15.300
Zn ppm	9.700
Mn ppm	3.300
Cu ppm	1.700

Algae extract:

Algae extract contains several minerals as Fe, Zn, Cu, Mn and Mo, vitamins, enzymes, amino acids, sugars and plant hormones (auxins, cytokinins and gibberellins) were used. The recommended value of Algae extract was one L/feddan in each spraying. Chemical analyses of algae extract are shown in table 3.

Table 3. Chemical analysis of algae extract.

Components	Value (%)
Oligosaccharide	3.000
Algnic acid	5.000
Phytin	0.003
Menthol	0.001
Cytokinine	0.001
Indol acetic acid	0.0002
Pepsin	0.020
Potassium oxide	12.00
Phosphorus oxide	0.500
N	1.000
Mn	0.100
Fe	0.200

The experiments were laid out in a combined split block design with three replicates over all seasons and locations for one factor (bio-fertilizer). The locations were assigned for the main plot as a main factor with genotype while; the others bio-organic (fertilizers) treatments were distributed randomly in the sub plots. Net plot size was 3 x 3.5 m with proper irrigation channels. Vermicompost was applied and Bacteria ed inoculum [(B.p.), (B.m.), and (B.c.)] and foliar spray of algae extract thoroughly the main plots, the following fertilizer treatments were conducted in this study:

1) Control [1] (100 % (R.M.F)[a].
2) Control [2] (50 % (R.M.F).
3) Vermicompost + 50 % (R.M.F).
4) Vermicompost + 50 % (R.M.F) + Algae extract[b].
5) Vermicompost + Bacteria inoculation[c] + 50 % (R.M.F).
6) Vermicompost + Bacteria inoculation + 50 % (R.M.F) + Algae extract.
7) Vermicompost + Bacteria inoculation + 25 % (R.M.F) + Algae extract.

a- (R.M.F): Recommended mineral fertilizer dose 60 kg N /feddan + 30 kg K_2O /feddan + 15 kg P_2O_5 per feddan)

b- Algae extract: the plants were also sprayed with algae extract at the age of 65, 85 and 105 days after sowing by rates for one one L\feddan

c- Bacteria inoculation: [*Bacillus polymxa* (B.p.), *Bacillus megaterium* (B.m.), *Bacillus circulans* (B.c.)].

The studied characters on cotton plant:

(1) Chemical analysis:

Leaf chlorophyll (A, B) and Carotenoids contents were determined in leaves according to Arnon (1949) and Rolbelen (1957), respectively. While, total phenol was determined according to Simon and Ross (1971)

(2) Yield and yield components: At harvest, samples of ten plants from the inner ridges of each subplot were taken at random to determine the following yield attributes:

(a) Yield characters:-

- Plant height (P.h cm).
- Boll weight (B.W g.) = average for weight of 50 bolls

- Seed cotton yield (SCY kentar/fed.), which calculated by dividing the fed area of 4200 m^2 divided by the plot area (k. gram), 1 kentar seed cotton yield = 157.5 (k. gram).

(b) Ginning outturn:

- Lint percentage: Lint percentage = (Lint seed cotton weight /seed cotton weight)×100
- Seed index (100 seeds weight (g.).

(3) Fiber properties:

(a) Short fiber index (SFI %)

(b) Fiber length: upper half means (UHM mm).

(c) Uniformity index (UI %).

(d) Micronaire reading (Mic.).

(e) Fiber mechanical characters:-

- Strength in gram/Tex (St. (g/tex).
- Elongation % (Elon.) the percentage of Elongation,

Fiber properties: was determined using HVI instrument system, according to ASTM: D4605, (1986). All properties were measured under standard conditions of (65±5%) relative humidity and (20±2c°) lab temp.

(4) Yarn properties testing:

Lint cotton were spun at the ring spinning system to 60s carded yarns at 4 (T.M.) at the Spinning Research Department of Cotton Research Institute of Giza, Egypt for tests of yarn properties.

(a) Coefficient of variation: coefficient of variation or the mean yarn evenness (Cv. %).

(b) Number of neps (Neps) / 100 m, of the yarn was measured by Uster Telyster III as described by the designation of the ASTM: D. 1578, (1967).

(c) Yarn Strength (YS): (lea product) was determined by testing the skein strength on the Good Brand Lea Tester to estimate the lea strength (lea product) in pounds (ASTM: D-1578, 1967) from the following formula. Lea product = corrected breaking load in pounds × nominal count.

(5) Statistical analysis:

Statistical Procedures in this investigation was conducted in a combined split block with three replicates (over all season and location for randomized complied bloke design (RCBD) with one factor (bio-fertilizer). The data were statistically analyzed according to Snedecor and Cochran (1981). The data was computed using the M-Stat: 6.311, (1998-2005) as statistical program, to test differences among studied mean values of treatments, the least significant difference (LSD) at 0.05 level of probability was used. Data of each variety were analyzed separately.

RESULTS AND DISSCTION

Data in Table 4 showed some chemical properties of Sakha (clay soil) and El-Nubaria (calcareous soil) after cotton harvesting as affected by different applied treatments.

Soil chemical properties:

1-Soil organic matter (SOM):

Concerning the effect of different treatments application on soil organic matter after cotton harvesting, this result shows an increase of soil organic matter by addition of different treatments in comparison with untreated control [(1) (2)]. The increases in vermicompost treatments in combination with 50% of NPK mineral fertilizer, Bacteria ture bacteria inoculation and algae extract recording 0.90% and 0.88% in Sakha region during 2019 and 2020 seasons respectively. The corresponding percentage in El-Nubaria region during the same seasons was 0.45% and 0.43% in the same order. One of the important factors affecting fertility of soil is the presence of organic matter in the soil and microbial activities. Applying organic fertilizers elicit increasing OM which is considered as an indicator of soil quality; vermicompost applications enrich the soil with micro and macro nutrients, vitamins, enzymes and hormones and contribute to plant development by regulating the physics-chemical properties and promote biological activity of soil. These results are in conformity with those revealed by Sinha *et al.*, (2009), Hazra (2016), Pathma and Sakthivel (2012) and Lim *et al.* (2015).

2-Soil electric conductivity (EC):

Regarding the electrical conductivity EC of the soil with exception of one sampling point, EC relatively decreased even not significantly by application of different treatments as compared with untreated control during both seasons. The treatment (50% mineral fertilizer + vermicompost +algae extract + Bacteria inoculation) gave the least EC value which recorded (0.37dSm^{-1} and 0.39 Sm^{-1}) in Sakha region and (0.45dSm^{-1} and 0.43dSm^{-1}) in El-Nubaria region during 2019 and 2020 seasons respectively. The EC values of soil treated with organic fertilizers were lower than the EC value of untreated soil (to which chemical fertilizers were added). This is possibly due to the fact that organic fertilizers release nutrients gradually as a result of degradation process and their chelate effect so, the EC values obtained in the current study were not at a level that causes any salinity problems. Because the compost (vermicompost) reduces the EC of the soil without causing a salinity problem when used at moderate levels. This interpretation is consistent with the findings eachof Garg *et al.* (2009) and Atiyeh *et al.* (2002)

3. Soil reaction (pH):

Concerning soil pH, it was relatively decreased even if not significantly by application of different treatments as compared with untreated control. The treatment received (50% mineral fertilizer + vermicompost +algae extract + Bacteria inoculation) gave the least pH degree which recorded (7.25 and 7.01) in Sakha region and (7.02 and 7.00) in El-Nubaria region during 2019 and 2020 seasons respectively. Soil pH is one of the most critical factors affecting mineral solubility, plant growth, microbial activity and many other attributes and interactions. The pH is related to a higher number of hydrogen ions present in the organic matter in the vermicompost, and due to the production of organic acids, the compost mineralization or nitrification increases the carbon dioxide caused by the microbial activity, which leads to the formation of H_2CO_3. Similar results were in agreement with: Bolan and Hedley (2003), Garcia-Gil *et al.* (2004), and Rashad *et al.* (2011).

4. Soil Available N, P and K:

All vermicompost treatments that induced positive effects of available N, P and K levels compared to the untreated control were (vermicompost + 50% mineral fertilizer + algae extract + Bacteria ture inoculation) recording (69.85 mg/kg and 70.10 mg/kg), (9.45 mg/kg and 9.36 mg/kg), and (363.2 mg/kg and 364 mg/kg) for N, P and K contents respectively in Sakha region, while recorded (17.96 mg/kg and 17.85 mg/kg), (4.28 mg/kg and 4.50 mg/kg), and (134 mg/kg and 135 mg/kg) for N, P and K contents respectively in El-Nubaria region. The increase in the available N, P and K content is attributed to the decomposition of organic matter by microorganisms and the subsequent release of their nutrients. Adding different types of organic matter to the soil greatly increases the availability of phosphorous and potassium through the production of carbon dioxide and the formation of H_2CO_3 during the decomposition of organic matter, which contributes to the solubility of phosphates compared to inorganic fertilizers alone. These results are in agreement with those obtained by Badran *et al.* (2000), Renato *et al.* (2003) and Siddiqui *et al.* (2011).

Table 4. Some chemical properties of the soil after harvesting cotton as affected by vermicompost, bacteria inoculation and algae extract with recommended dose mineral fertilizer in 2019 and 2020 seasons under two locations.

properties	SOM %		E.C (dS m^{-1})		pH		Available N, P and K (mg/ Kg) N		P		K	
Seasons	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Treatments	**Sakha (Clay soil)**											
Control [1] 100% (R.M.F)	0.79	0.75	0.60	0.59	7.73	7.69	66.23	65.90	8.80	8.82	356.2	359
Control [2] 50% (R.M.F)	0.80	0.79	0.63	0.61	7.71	7.75	64.30	64.27	8.40	8.76	357.6	362
Vermicompost + 50 % (R.M.F)	0.84	0.81	0.57	0.49	7.66	7.67	66.45	66.90	8.84	7.99	361.7	360
Vermicompost + 50 % (R.M.F) + Algae extract	0.81	0.83	0.65	0.53	7.64	7.63	66.49	67.15	8.65	8.53	359	363
Vermicompost + Bacteria inoculation + 50 % (R.M.F)	0.82	0.82	0.47	0.44	7.43	7.34	67.00	68.20	8.94	9.15	362	361
Vermicompost + Bac. inoculation + 50 % (R.M.F) + Algae	0.90	0.88	0.37	0.39	7.25	7.01	69.85	70.10	9.45	9.36	363.2	364
Vermicompost + Bac. inoculation + 25 % R(.M.F) + Algae	0.86	0.83	0.45	0.42	7.30	7.16	68.70	69.31	9.00	8.34	359.9	360.5
El-Nubaria (Calcareous soil)												
Control [1] 100% (R.M.F)	0.39	0.37	0.50	0.48	8.55	8.52	16.43	16.46	3.4	3.60	127	128
Control [2] 50% (R.M.F)	0.40	0.38	0.49	0.49	8.44	8.43	16.20	15.99	3.3	3.70	128	127
Vermicompost + 50 % (R.M.F)	0.43	0.41	0.48	0.46	7.32	7.28	17.15	16.97	3.5	3.75	126	130
Vermicompost + 50 % (R.M.F) + Algae extract	0.41	0.40	0.48	0.47	7.30	7.29	16.95	17.10	3.8	3.92	129	134
Vermicompost + Bacteria inoculation + 50 % (R.M.F)	0.44	0.41	0.47	0.46	7.23	7.20	17.32	17.46	4.10	4.32	130	132
Vermicompost + Bac. inoculation + 50 % (R.M.F) + Algae	0.45	0.43	0.45	0.43	7.02	7.00	17.96	17.85	4.28	4.50	134	135
Vermicompost + Bac. inoculation + 25 % R(.M.F) + Algae	0.43	0.42	0.46	0.45	7.12	7.14	17.84	17.62	3.99	4.01	131	133

Soil organic matter (SOM %), Electric conductivity (E.C) and soil reaction (pH), recommended dose mineral fertilizer (R.M.F) 60 kg N /feddan + 30 kg K_2O /feddan +15 kg P_2O_5 /feddan.

Soil biological activity:

Count of Bacteria, Fungi, Actinomycetes and carbon dioxide (CO_2) evolution rate:

Soil biological count and CO_2 evolution rate under different fertilizer treatments are mentioned in Table 5: results revealed higher count of aerobic mesophilic microorganisms and showed that the CO_2 evolution rate in soil exerted high response to application of different treatments in comparison with (Vermicompost + Bacteria inoculation + 50 % (R.M.F) + Algae extract) followed by (Vermicompost + Bacteria inoculation + 25 % (R.M.F) + Alga extract) gives the highest values for soil biological count and CO_2 evolution rate in Sakha region, the total count of bacteria recorded (43×10^7 cfu/g dry soil and 44×10^7 cfu/g dry soil), total fungi count recorded (63×10^4 cfu/g dry soil and 67×10^4 cfu/g dry soil), total actinomycetes count recorded (70×10^3 cfu/g dry soil and 72×10^3 cfu/g dry soil), and CO_2 evolution rate recorded (35 mg/100g soil-1 and 35.7 mg/100g soil-1) during 2019 and 2020 seasons respectively. While; control (50% of recommended) without vermicompost, gave the lowest values which recorded (12×10^7 cfu/g dry soil and 14×10^7 cfu/g dry soil) for bacteria, (23.8×10^4 cfu/g dry soil and 27.1×10^4 cfu/g dry soil) for fungi, (20.6×10^3 cfu/g dry soil and 21×10^3 cfu/g dry soil) for actinomycetes and (17.2 mg/100g soil-1 and 17.6 mg/100g soil-1) for CO_2 evolution rate during 2019 and 2020 seasons respectively.

In El-Nubaria region, the total bacteria count recorded (30.5×10^7 cfu/g dry soil and 30.1×10^7 cfu/g dry soil), total fungi count recorded (43.9×10^4 cfu/g dry soil and 43×10^4 cfu/g dry soil), total actinomycetes count recorded (40.8×10^3 cfu/g dry soil and 41×10^3 cfu/g dry soil), and CO_2 evolution rate recorded (25.9 mg/100g soil-1 and 26 mg/100g soil-1) during 2019 and 2020 seasons respectively. While; control (50% of recommended) without vermicompost, gave the lowest values which recorded (9.4×10^7 cfu/g dry soil and 8.2×10^7 cfu/g dry soil) for bacteria, (13.2×10^4 cfu/g dry soil and 14×10^4 cfu/g dry soil) for fungi, (10.1×10^3 cfu/g dry soil and 10×10^3 cfu/g dry soil) for actinomycetes and (7.2 mg/100g soil-1 and 7.4 mg/100g soil-1) for CO_2 evolution rate during 2019 and 2020 seasons respectively.

Adding vermicompost to soil affects microorganisms as it supports a greater volume of microbes and biodiversity and thus increases the rate of carbon dioxide evolution in the soil directly by providing a source of nutrients and indirectly by changing the chemical and physical properties of the soil. There is also a positive correlation between the activities of enzymes and the development of carbon dioxide which plays an important role in the release of essential nutrients. Similar results were in agreement with: Chander *et al.* (1997), Aira *et al.* (2008), Doan *et al.* (2013) and Sayed Ahmed Hamed *et al.* (2019).

Leaf chemical analysis:

Chlorophyll content:

The data presented in Table 6 shows the effect of different fertilizer treatments compared to the control on the content of chlorophyll A, B, Carotenoids and Total phenols in the leaves of cotton plants. All the different fertilizer treatments showed an increase in the total chlorophyll content compared to the untreated plants, especially the treatment using (vermiform fertilizer + algae extract + Bacteria ture of biological factors + 50% mineral fertilizer), which gave the highest values significantly (5.30 and 5.10 mg / g), for chlorophyll a, (3.80 and 3.75 mg/g) for chlorophyll b, and (0.70 and 0.69 mg/g) for carotenoids in Sakha region for G94 and G 96 varieties, respectively. While (4.98 and 5.01 mg/g) were recorded for chlorophyll a, (4.09 and 4.12 mg/g) for chlorophyll b, and (0.60 and 0.69 mg/g) for carotenoids in El-Nubaria region for G94 and G 96 varieties, respectively. The organic matter that is converted into fertilizer contains large amounts of macronutrients such as nitrogen, phosphorous, potassium and micronutrients, such as iron, manganese, and magnesium which contribute to the synthesis of chlorophyll in the plant. Phytonutrients that are released in the available form during mineralization. Moreover, it improves soil properties, increases soil content of these essential elements, and enhances water use efficiency by plants, thus it is quite expected to enhance photosynthesis. These results are in agreement with Sayed Ahmed Hamed *et al.* (2019).

Table 5. Effect of vermicompost, bacteria inoculation and algae extract with recommended dose mineral fertilizer on soil biological characters after cotton harvesting in 2019 and 2020 seasons.

Character	Total Bact. Counts (10^7cfu g^{-1} soil)		Total Fungi (10^4 cfu g^{-1} soil)		Total actinon. (10^3cfu g^{-1} soil)		CO_2 evolution (mg100 g $soil^{-1}$)	
Seasons	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Treatments	**Sakha (Clay soil)**							
Control 1 100% (R.M.F)	17	19	33.1	35.1	24.9	26.0	18.4	18.8
Control 2 50% (R.M.F)	12	14	23.8	27.1	20.6	21.0	17.2	17.6
Vermicompost + 50 % (R.M.F)	26	30	38.1	39.9	26.1	29.0	21.6	22.8
Vermicompost + 50 % (R.M.F) + Algae extract	27	33	45.3	46.8	43.1	47.0	28.6	28.8
Vermicompost + Bacteria inoculation + 50 % (R.M.F)	42	43	62.1	61.9	69.1	70.0	34.0	34.3
Vermicompost + Bac. inoculation + 50 % (R.M.F) + Algae	43	44	63.9	67.1	70.0	72.0	35.0	35.7
Vermicompost + Bac. inoculation + 25 % R(.M.F) + Algae	40	39	60.0	61.0	65.0	67.0	33.0	34.0
El-Nubaria (Calcareous soil)								
Control 1 100% (R.M.F)	13.0	12.2	13.9	14.7	14.9	15.0	9.4	9.5
Control 2 50% (R.M.F)	9.4	8.2	13.2	14.0	10.1	10.0	7.2	7.4
Vermicompost + 50 % (R.M.F)	17.0	16.4	28.3	28.5	16.7	17.0	11.6	12.0
Vermicompost + 50 % (R.M.F) + Algae extract	17.1	17.3	35.3	35.0	23.2	23.0	18.6	19.0
Vermicompost + Bacteria inoculation + 50 % (R.M.F)	27.2	27.0	42.6	43.0	39.3	40.0	23.7	24.0
Vermicompost + Bac. inoculation + 50 % (R.M.F) + Algae	30.5	30.1	43.9	43.0	40.8	41.0	25.9	26.0
Vermicompost + Bac. inoculation + 25 % R(.M.F) + Algae	28.4	28.0	40.0	39.1	35.9	36.0	21.2	21.0

Bacteria inoculations: [*Bacillus polymxa* (B.p.), *Bacillus megaterium* (B.m.), recommended dose mineral fertilizer (R.M.F) 60 kg N /feddan + 30 kg K_2O /feddan +15 kg P_2O_5 /feddan.

Table 6. Chlorophyll (A, B), Carotenoids and Total phenols as affected by fertilization and vermicompost treatments in 2019 and 2020 seasons.

Character	Chlorophyll A (mg/g dry wt.)		Chlorophyll *B* (mg/g dry wt.)		Carotenoids (mg/g)		Total phenol (mg/g dry wt.)	
Varieties	**G 94**	**G 96**	**G 94**	**G 96**	**G 94**	**G 96**	**G 94**	**G 96**
Treatments	**Sakha (Clay soil)**							
Control 1 100% (R.M.F)	3.98	3.80	3.45	3.50	0.51	0.49	24.0	23.0
Control 2 50% (R.M.F)	2.35	2.98	2.90	2.92	0.22	0.21	20.0	19.7
Vermicompost + 50 % (R.M.F)	3.80	3.80	3.50	3.45	0.30	0.30	24.0	23.0
Vermicompost + 50 % (R.M.F) + Algae extract	3.90	3.90	3.60	3.70	0.60	0.50	27.0	25.0
Vermicompost + Bacteria inoculation + 50 % (R.M.F)	4.00	5.00	3.50	3.53	0.40	0.31	26.0	24.0
Vermicompost + Bac. inoculation + 50 % (R.M.F) + Algae	5.30	5.10	3.80	3.75	0.70	0.69	29.2	28.1
Vermicompost + Bac. inoculation + 25 % R(.M.F) + Algae	4.01	3.90	3.48	3.50	0.50	0.49	25.0	23.0
L S D	1.11	1.09	0.39	0.37	0.24	0.26	4.50	4.45
El-Nubaria (Calcareous soil)								
Control 1 100% (R.M.F)	4.0	3.99	3.35	3.51	0.59	0.56	25.0	24.9
Control 2 50% (R.M.F)	2.95	3.01	3.01	2.98	0.32	0.31	26.0	25.8
Vermicompost + 50 % (R.M.F)	3.89	3.88	3.70	3.75	0.39	0.38	24.0	23.7
Vermicompost + 50 % (R.M.F) + Algae extract	3.95	3.94	3.40	3.45	0.59	0.57	25.0	24.9
Vermicompost + Bacteria inoculation + 50 % (R.M.F)	4.09	4.11	3.54	3.53	0.44	0.46	27.0	26.9
Vermicompost + Bac. inoculation + 50 % (R.M.F) + Algae	4.98	5.01	4.09	4.12	0.60	0.69	30.0	29.1
Vermicompost + Bac. inoculation + 25 % R(.M.F) + Algae	3.81	3.90	3.58	3.59	0.51	0.53	27.0	26.8
L S D	1.00	1.03	0.56	0.59	0.17	0.19	2.85	2.82

Bacteria inoculations: [*Bacillus polymxa* (B.p.), *Bacillus megaterium* (B.m.), recommended dose mineral fertilizer (R.M.F) 60 kg N /feddan + 30 kg K_2O /feddan +15 kg P_2O_5 /feddan, Chlorophyll A, B (mg/g dry weight), Carotenoids (mg/g dry weight) and Total phenols (mg/g dry weight).

As for the effect of different fertilizer treatments on the total phenol content of leaves in the cotton plant, the data showed that all treatments gave an increase in the total phenol content compared to untreated plants, especially the treatment using (worm fertilizer + algae extract + Bacteria inoculation of biological factors + 50% mineral fertilizer).. Which had the highest significant values in Sakha region which recorded (29.2 mg/g dry weight and 28.1 mg/g dry weight) compared to the control (50% of the recommended) which recorded (20.0 mg/g dry weight and 19.7 mg/g dry weight) for G94 and G 96 varieties, respectively.While; The Nubaria region recorded (30.0 mg/g dry weight and 29.1 mg/g dry weight) compared to the control (50% of the recommended) which recorded (26.0 mg/g dry weight and 25.8 mg/g dry weight) during the two verities G94 and G 96 respectively. These results are in accordance with Sayed Ahmed Hamed *et al.* (2019).

These compounds have anti-inflammatory, antimicrobial, anti-allergic, and antioxidant properties that are part of the plant's natural defense system against infection and microbial invasion and their accumulation in plants has been shown to be influenced by interactions between plant genetics and environmental factors, including cultivation techniques, seasons, abiotic and biotic stress, and environmental conditions, nutrients. This is confirmed by Sayed Ahmed Hamed *et al.* (2019).

The data in Table 7: shows the effect of both growing season 2019 and 2020 on cotton yield characteristics, fiber and yarn properties for two cotton cultivars namely, Giza 94 and Giza 96, indicated that the response of cotton yield characteristics, fiber quality and yarn properties of two cotton cultivars in both seasons have the same trend and shows consistent expression for most traits studied gave all the traits under study insignificant result, except that the boll weight (BW g..), lint percentage (lint%), seed index (Si), short fiber index (SFI%) it which showed significant to these traits for Giza 94, as for as the Giza 96 variety, for the plant height (P.h cm), upper half mean (UHM) and yarn neps count (Neps). These results are in harmony with Ahmed *et al.* (2020) and Tolba *et al.* (2021)

In general, the results showed that the response of cotton yield characteristics, fiber properties and yarn properties of both cotton cultivars in both seasons have the same trend and show a consistent expression for most of the studied traits.

Table 7. The impact mean values of seasons for yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

V.	S.	Yield characteristics						Fiber properties					Yarn properties		
		P.h cm	BW g.	SCY	Lint%	S.i %	SFI%	UHM	UI %	Mic	St..	El.%	C.v %	Neps	YS
G94	2019	128.69	2.35	8.70	37.06	10.11	5.23	33.61	84.70	4.09	42.71	6.86	10.97	33.95	2826.07
	2020	130.19	2.39	8.72	37.40	10.93	4.52	33.69	84.73	4.09	43.19	6.88	10.64	36.83	2822.9
LSD		N.S.	0.03	N.S.	0.33	0.25	0.44	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
G96	2019	129.67	2.35	8.61	35.95	10.24	5.72	36.89	87.19	3.67	44.21	5.88	9.62	39.26	3326.48
	2020	132.79	2.35	8.64	36.04	10.15	5.38	36.30	87.04	3.68	44.11	5.93	9.51	33.17	3345.17
LSD		2.85	N.S.	N.S.	N.S.	N.S.	N.S.	0.22	N.S.	N.S.	N.S.	N.S.	N.S.	4.96	N.S.

V.: varieties, S.:Seasons P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant. UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability..

The results in Table 8: showed that the effect of two cultivation areas (Sakha area had clay soil and El-Nubaria area had calcareous soil) for all traits (yield characteristics, fiber and yarn properties) in two Egyptian cotton cultivars, Giza 94 and Giza 96. The cultivation area in clay soil showed superiority over the cultivation area on calcareous soil. Concerning the effect of the cultivated area on the cotton yield characteristics in Giza 94 cultivars showed a significant increase for all traits, except for SFI%, Mic, St, and neps, while the Giza 96 variety showed a non-significant increase for all traits fiber quality and yarn properties, except for SFI, UHM, on the other hand, all yield traits showed a significant increase except for Lint%. Soils of different textures significantly affected the cotton yield, and that the Sakha region with clay soil stimulated the appropriate growth of plants compared to those cultivated in the Nubaria region with calcareous soil. This difference between the studied varieties is due to the growth habit and the response of each species to environmental conditions, which are controlled by genetic factors and the efficient use of inputs and natural resources. Mahmoud and Ibrahim (2012), the good physical quality of soil is one that is strong enough to maintain good structure, with fluid transmission and storage characteristics that permit the correct proportion of water, dissolved nutrients and air for both maximum crop performance and minimum environmental degradation Iç *et al.* (2010).

Table 8. The impact of the location on yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

Characteristic		Yield characteristics						Fiber properties					Yarn properties		
V.	L.	P.h cm	BW g.	SCY	Lint%	S.i %	SFI%	UHM	UI %	Mic	St..	El.%	C.v %	Neps	YS
G94	Sakha	150.76	2.71	9.65	39.68	10.73	5.07	34.15	85.20	4.09	43.42	6.64	11.35	34.83	2818.95
	El-Nubaria	108.12	2.03	7.77	34.78	10.31	4.68	33.15	84.22	4.09	42.48	7.11	10.26	35.95	2830.02
L S D		3.27	0.03	0.13	0.33	0.25	N.S.	0.15	0.15	N.S.	N.S.	0.15	0.44	N.S.	9.92
G96	Sakha	154.69	2.72	9.84	36.18	10.59	6.10	36.72	87.11	3.64	44.23	5.86	9.48	35.67	3342.02
	El-Nubaria	107.76	1.98	7.40	35.81	9.81	5.00	36.48	87.12	3.70	44.08	5.95	9.65	36.76	3329.62
L S D at 0.05		2.85	0.02	0.19	N.S.	0.33	0.38	0.22	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

V.:Verities, L.:Locations . P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant.UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability..

The effect of the mean value of the first-order interaction between the season and cultivated area for cotton yield characteristics, fiber and yarn properties in Egyptian cotton cultivar Giza 94 and 96 are presented in Table 9: it had showed the cotton cultivar Giza 94 insignificant values except for BW, SI%, SFI, UHM, UI%, and Mic which gave a significant value, while the cotton cultivars Giza 96 showed insignificant values except for BW, UHM, and C.v% which recording significant values. Due to the fact that the interaction between clay and calcareous soil during the two growing seasons took almost the same direction in the growth plants, this was reflected in the improvement of traits under study.

Where agriculture in calcareous soil present many challenges, such as low water holding capacity, high infiltration rate, poor structure, low organic matter and clay content, low CEC, loss of nutrients via leaching or deep percolation, surface crusting or cracking, high pH and loss of nitrogen fertilizer, low availability of nutrients particularly phosphorus and micronutrients and a nutritional imbalance between elements such as potassium, magnesium and calcium El-Hady and Abo-Sedra, (2006) and FAO, 2016).

While clay soil contains more organic matter Six *et al.* (2000) and has fine particles that can hold water and nutrients very well because of its negative charge which form bonds with cation quickly and high surface area, thus, it can retain more water and nutrients needed by the plant e.g. NH_4^+, K^+, Ca^{2+}, Mg^{2+}, etc. These results are in conformity with those revealed by Arafa *et al.* (2013), Ahmed *et al.* (2020) and Ahmed (2021)

Table 9. The impact mean value of the first-order interaction between the seasons and location for yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

Characteristic			Yield characteristics						Fiber properties					Yarn properties		
V.	S.	L.	P.h cm	BWg.	SCY	Lint%	S.i %	SFI%	UHM	UI %	Mic	St..	El.%	C.v %	Neps	YS
G94	2019	Sakha	150.67	2.67	9.59	39.39	9.77	5.80	32.98	84.09	4.12	42.53	7.12	10.57	34.19	2831.38
		El-Nubaria	109.52	2.02	7.72	34.82	10.17	4.70	34.25	85.30	4.06	42.89	6.60	11.36	33.71	2820.76
	2020	Sakha	150.86	2.75	9.71	39.97	11.69	4.33	33.33	84.35	4.06	42.43	7.09	9.94	37.71	2828.67
		El-Nubaria	106.71	2.04	7.82	34.73	10.45	4.66	34.04	85.10	4.12	43.96	6.68	11.34	35.95	2817.14
L S D			N.S.	0.04	N.S.	N.S.	0.35	0.62	0.21	0.22	0.08	N.S.	N.S.	N.S.	N.S.	N.S.
G96	2019	Sakha	153.95	2.71	9.78	36.05	10.68	6.44	36.84	87.17	3.67	44.21	5.88	9.34	40.48	3338.43
		El-Nubaria	105.38	1.99	7.43	35.86	9.81	4.99	36.95	87.21	3.67	44.21	5.88	9.90	38.05	3314.52
	2020	Sakha	155.43	2.73	9.89	36.32	10.49	5.75	36.60	87.06	3.62	44.26	5.83	9.61	30.86	3345.62
		El-Nubaria	110.14	1.96	7.38	35.77	9.81	5.00	36.00	87.02	3.73	43.95	6.03	9.40	35.48	3344.71
L S D			N.S.	0.03	N.S.	N.S.	N.S.	N.S.	0.31	N.S.	N.S.	N.S.	N.S.	0.44	N.S.	N.S.

V.:Verities, S.:Season, L.: Locations.P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant. UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability.. N.S.: insignificant. V.:Verities, S.:Season, L.: Locations.

The data presented in Table 10: shows the effect of the treatments (vermicompost, bioagents Bacteria ture inoculation, mineral fertilizer and algal extract) on yield characteristic, fiber and yarn properties in Egyptian cotton verities Giza 94 and Giza 96. The results obtained from field experiment showed that all studied parameters significantly improved with the application of different treatments in comparison with control treatment. Giza 94 showed significant values for all traits except yarn string (Ys) value, while the cotton cultivars Giza 96 showed significant values for all traits except seed index (S.i%) value. All treatments showed suitable growth stimulation, and the best was treatment No. 6 (vermicompost, bioagents Bacteria ture inoculation, 50% mineral fertilizer and algal extract), followed by treatment No. 7 (vermicompost, bioagents Bacteria ture inoculation, 25% mineral fertilizer and algal extract) compared to the two control treatments, Where the cultivar G94 scored higher values compared to the control treatment 100%, where it reached plant high (Ph cm) 133.3, 131.92 compared to 131.17, boll weight (BW g) 2.52 , 2.41 compared to 2.38, (SCY k\f) 9.96 , 8.76 compared to 8.55, (Lint%) 37.68 , 37.15 compared to 37.05, (Si%) 10.29 , 10.28 compared to 10.25, (UHM) also recorded at 34.15, 33.39 compared to 33.15 and yarn strength (YS) recorded at 2838, 2832 compared to 2812.

Regarding to the G 96 variety, the results recorded higher values compared to the control treatment 100% (MF), where plant high (Ph cm) reached by 136.25 , 134.83 compared to 130.17, boll weight (Bw) 2.49 , 2.48 compared to 2.34, (SCY k\f) 9.95 , 8.63 compared to 8.42, (Lint%) 36.65 , 36.17 compared to 36.02 (Si%) 10.29 , 10.21 compared to 9.96 Also arrived (UHM cm) 37.07 , 36.31 compared to 36.22 and yarn strength (YS) recorded at 3375, 3347 compared to 3294.

These results are in harmony with Sayed Ahmed Hamed *et al.* (2019), Ahmed *et al.* (2020) and Tolba *et al.* (2021) and Such increase in these traits may be returned to the role of organic fertilizer to encourage the metabolic processes leading to accumulation of dry matter of cotton during flowering and boll formation. The pronounced favorable effect of utilizing vermicompost could be due to that Vermicompost is made up primarily of C, H and O, and contains nutrients such as NO_3, PO_4, Ca, K, Mg, S and micronutrients which exhibit similar effects on plant growth and yield as inorganic fertilizers applied to soil Sinha *et al.* (2009). Soils amended with these products have the ability to retain moisture, improve soil structure and cation exchange capacity, have a higher rate of plant growth hormones and humic acids, higher microbial population and activity Atiyeh *et al.* (2002), overall improvement in plant growth and productivity Arancon *et al.* (2003)

Table 10. Effect of treatments on yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

Characteristic		Yield characteristics						Fiber properties					Yarn properties		
V.	F.	P.h cm	BW g	SCY k\f	Lint%	S.i%	SFI%	UHM	UI%	Mic	St..	El.%	C.v	Neps	YS
G94	1	131.17	2.39	8.55	37.05	10.25	6.29	33.15	84.39	4.05	41.78	6.79	11.81	42.67	2812
	2	130.00	2.22	7.54	36.75	10.24	4.53	33.08	84.14	4.04	43.07	7.02	10.93	31.00	2814
	3	121.83	2.30	8.30	37.36	10.58	5.01	33.31	84.42	4.05	42.42	7.23	11.05	34.17	2826
	4	125.92	2.32	8.50	37.10	10.67	4.20	33.79	84.90	4.10	42.76	6.64	10.47	38.42	2826
	5	131.92	2.33	8.77	37.04	10.81	4.95	33.88	84.92	4.14	43.01	6.93	10.72	30.92	2830
	6	133.33	2.52	9.96	37.68	10.29	4.33	34.15	85.23	4.14	43.98	6.93	10.29	32.25	2838
	7	131.92	2.41	8.76	37.15	10.28	4.81	33.39	84.97	4.12	43.63	6.57	10.37	38.33	2832
L S D		4.44	0.04	0.32	0.55	0.36	0.83	0.28	0.29	0.07	0.56	0.27	0.79	5.40	N.S.
G96	1	130.17	2.34	8.42	36.02	9.96	6.66	36.22	87.69	3.67	41.96	5.62	10.69	45.58	3294
	2	128.25	2.16	7.32	35.68	10.43	5.61	36.72	87.33	3.66	44.29	5.71	9.67	36.42	3344
	3	128.00	2.30	7.88	35.83	10.09	5.49	36.23	87.22	3.72	44.71	5.59	9.41	35.83	3311
	4	130.58	2.33	8.15	35.78	10.24	5.55	36.12	86.57	3.47	43.72	6.54	9.39	34.67	3351
	5	130.50	2.34	8.81	35.99	10.15	5.68	36.70	86.98	3.63	45.25	5.54	9.10	32.58	3346
	6	136.25	2.49	9.95	36.65	10.29	4.57	37.07	86.70	3.85	44.54	6.51	9.30	32.58	3375
	7	134.83	2.48	8.63	36.17	10.21	5.27	36.31	87.30	3.72	44.64	5.83	9.37	35.83	3347
L S D		3.38	0.06	0.36	0.49	N.S.	0.58	0.29	0.28	0.09	0.75	0.30	0.43	5.16	45.16

V.:Verities, F.:Fertilizer. P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant. UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability..

Table 11: shows the effect of the average value of the interaction of the first degree between the years and the treatments for the characteristics of the cotton crop and the properties of fiber and yarn in the cotton varieties Giza 94, Giza 96, Which means that there are non-significant values between the first and second growing seasons, but the effect of the treatments was clear and controlling for all results, where the composite analysis of variance (ANOVA) averaged over two years showed non-significance differences ($p \leq 0.05$) between the fertilizer treatments for all the traits, while in the Giza 96 the the combined analysis showed significant ($p \leq 0.05$) among the fertilizer treatments for most traits except for the short fiber modulus (SFI%), the coefficient of variance (Cv.%) and the number of neps (neps). These results are in general agreement with those obtained by Dewdar and Rody (2013) and Sayed Ahmed Hamed et *al.* (2019).

Table 11. Effect of the first-order interaction between season and treatments for yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

Characteristic			Yield characteristics						Fiber properties					Yarn properties		
V.	S.	F.	P.h cm	BWg.	SCY	Lint%	S.i %	SFI%	UHM	UI %	Mic	St..	El.%	C.v %	Neps	YS
G94	2019	1	130.17	2.50	8.56	37.45	9.74	6.56	34.02	85.05	4.15	41.69	6.65	12.06	41.17	2809.83
		2	130.83	2.19	7.36	36.64	10.25	4.97	33.00	84.07	4.04	42.66	7.04	11.07	33.00	2813.83
		3	119.67	2.28	8.34	37.20	10.32	5.38	33.17	84.22	4.09	42.14	7.28	11.53	33.33	2838
		4	123.83	2.28	8.52	36.93	10.30	4.59	33.64	84.79	4.07	42.55	6.60	10.70	37.50	2811.5
		5	131.17	2.40	8.66	36.94	10.33	5.25	33.85	84.90	4.12	43.29	6.92	10.92	28.00	2836
		6	132.00	2.51	9.46	37.68	9.71	4.75	34.15	85.26	4.12	42.74	6.52	10.25	36.83	2831.5
		7	133.17	2.30	9.03	36.60	10.13	5.13	33.46	84.57	4.05	43.88	7.02	10.23	27.83	2841.83
	2020	1	133.67	2.50	9.54	37.65	10.82	6.03	33.87	84.89	4.12	41.87	6.94	11.55	44.17	2814.33
		2	129.17	2.25	7.72	36.85	11.23	4.08	33.17	84.22	4.04	43.48	7.01	10.80	29.00	2815.67
		3	124.00	2.33	8.25	37.52	10.85	4.63	33.45	84.62	4.00	42.70	7.17	10.58	35.00	2814.5
		4	128.00	2.35	8.49	37.27	11.04	3.81	33.94	85.01	4.13	42.98	6.68	10.23	39.33	2841.83
		5	132.67	2.38	8.87	37.13	11.29	4.66	33.91	84.93	4.15	43.97	6.93	10.52	33.83	2825.17
		6	130.33	2.53	9.65	37.68	10.84	3.91	34.15	85.20	4.11	43.29	6.62	10.48	39.83	2825.33
		7	133.50	2.35	8.49	37.68	10.44	4.48	33.32	84.22	4.05	44.08	6.83	10.34	36.67	2823.5
L S D			N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
G96	2019	1	131.50	2.51	9.85	36.10	10.42	6.48	37.50	87.75	4.01	45.20	5.60	11.25	49.67	3280.17
		2	127.50	2.19	6.97	35.82	10.29	5.95	37.10	87.50	3.69	44.33	5.50	9.86	46.17	3342.83
		3	127.83	2.32	7.79	35.89	10.04	6.85	36.45	87.50	3.69	44.67	5.57	9.30	40.50	3280.83
		4	126.67	2.33	8.31	35.71	10.34	4.80	36.37	86.60	3.36	43.87	6.70	9.58	41.50	3344.33
		5	129.83	2.29	8.90	36.10	10.00	5.22	37.00	86.85	3.55	45.13	5.43	9.07	27.00	3346.33
		6	136.17	2.48	9.71	36.40	10.19	5.03	37.40	87.40	3.61	44.87	5.87	9.02	37.50	3345.67
		7	128.17	2.33	8.70	35.66	10.41	5.69	36.43	86.71	3.77	41.40	6.50	9.27	32.50	3345.17
	2020	1	138.17	2.46	9.59	36.55	10.16	6.84	36.64	87.64	3.68	44.07	5.64	10.14	41.50	3309.33
		2	129.00	2.12	7.68	35.54	10.58	5.28	36.34	87.16	3.63	44.25	5.93	9.48	26.67	3345.17
		3	128.17	2.28	7.96	35.77	10.15	4.13	36.01	86.93	3.75	44.75	5.61	9.52	31.17	3341.17
		4	134.50	2.33	7.99	35.84	10.14	6.29	35.87	86.54	3.57	43.56	6.39	9.20	27.83	3358.67
		5	131.17	2.39	8.73	35.87	10.31	6.14	36.41	87.11	3.70	45.37	5.65	9.13	38.17	3347.33
		6	136.33	2.51	9.80	36.82	9.72	4.11	36.63	87.20	3.74	44.22	5.79	9.58	34.17	3344.83
		7	132.17	2.35	8.70	35.91	10.01	4.85	36.20	86.70	3.66	42.52	6.52	9.48	32.67	3369.67
L S D			N.S.	N.S.	N.S.	N.S.	N.S.	0.82	N.S.	N.S.	N.S.	N.S.	N.S.	0.62	8.02	N.S.

V.:Verities, S.:Seasons, F.:Fertilizer. P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant. UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability..

If we go to Table 12: shows the effect of the average value of the interaction of the first degree between the cultivation area and the fertilizer treatments and the effect of this on the characteristics of the cotton crop and the properties of fibers and yarns for the two Egyptian cotton varieties Giza 94 and 96. Where Giza 94 showed significant values except for boll weight (BW g), seed cotton yield (SCY k\f), seed index (S.i%), micronaire reading (Mic), variation yarn evenness (C.v%) and number of neps count (Neps.), where non-significant values were recorded. While the Giza 96 cotton cultivars showed a significant increase, except for Plant height (P.h cm), upper half mean (UHM mm), uniformity index (UI%), micronaire reading (Mic), strength (St.), elongation (El.%), number of neps count (Neps) and yarn string (YS), which recorded non-significant values.These results are in harmony with Atiyeh *et al.* (2002), Sayed Ahmed Hamed *et al.* (2019) and Ahmed *et al.* (2021).

In general, from the obtained results for the interaction shown in the previous table, it is clear that yield characteristics, fiber and yarn properties in both cotton cultivars; Giza 94 and 96 cultivated in Sakha area surpassed the Nobaria area. The soil properties in the Nubaria area negatively affect the nutrient content of plant growth and the efficiency of water and fertilizer use. Therefore, as part of a remedial strategy is the use of supplements rich in trace elements, which is the multiplication and amplification of biological processes in the soil, by adding organic matter in the form of vermicompost, and a Bacteria ture bio-factors and spraying with algae extract, we can enhance the biological activity, thus increasing the availability of prohibited elements resulting in the accumulation of organic matter in the soil. They increase soluble organic carbon, microbial biomass carbon Baker *et al.* (2011), soil respiration Iovieno *et al.* (2009) and the activity of various soil enzymes Bastida *et al.* (2008) by acting on the soil structure and its humus content, it also increases organic matter and fertility in the long run, which means better productivity.

Table 12. Effect of the interaction between the locations and treatments on yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

Characteristic			Yield characteristics						Fiber properties					Yarn properties		
V.	L.	F.	P.h cm	BW g.	SCY	Lint%	S.i %	SFI%	UHM	UI %	Mic	St..	El.%	C.v %	Neps	YS
G94	Sakha	1	159.67	2.83	9.69	39.77	10.76	6.77	34.25	85.28	4.14	42.55	7.21	12.49	41.83	2795.33
		2	150.33	2.56	8.37	38.76	10.95	4.11	33.64	84.68	4.03	43.25	6.73	11.35	30.17	2818.00
		3	136.67	2.66	9.26	40.25	10.67	5.54	34.18	85.18	4.07	42.37	7.27	11.45	37.50	2820.33
		4	145.17	2.66	9.32	39.59	10.82	5.00	34.22	85.25	4.13	43.35	6.24	10.82	37.67	2802.17
		5	154.83	2.73	9.48	39.88	10.80	5.16	34.42	85.47	4.09	43.97	6.56	11.23	30.17	2848.50
		6	157.00	2.83	10.65	39.94	10.60	4.05	34.49	85.61	4.11	43.02	6.15	10.82	35.33	2825.83
		7	151.67	2.68	9.78	39.59	10.51	4.84	33.82	84.92	4.05	45.46	6.32	11.31	31.17	2822.50
	El-Nubaria	1	104.17	2.17	7.41	35.34	9.80	5.81	33.64	84.66	4.13	41.01	6.38	11.13	43.50	2828.83
		2	109.67	1.88	6.71	34.73	10.52	4.94	32.52	83.61	4.05	42.89	7.32	10.52	31.83	2811.50
		3	107.00	1.95	7.33	34.47	10.50	4.48	32.44	83.66	4.02	42.47	7.19	10.65	30.83	2832.17
		4	106.67	1.98	7.68	34.61	10.52	3.40	33.36	84.55	4.07	42.18	7.03	10.12	39.17	2851.17
		5	109.00	2.05	8.05	34.19	10.82	4.75	33.35	84.36	4.18	43.29	7.29	10.20	31.67	2812.67
		6	105.33	2.21	8.46	35.41	9.96	4.62	33.80	84.85	4.12	43.01	6.99	9.92	41.33	2831.00
		7	115.00	1.97	7.74	34.68	10.06	4.78	32.97	83.87	4.05	42.50	7.53	9.27	33.33	2842.83
L S D			6.46	N.S.	N.S.	0.77	N.S.	1.15	0.39	0.40	N.S.	1.23	0.38	N.S.	N.S.	27.54
G56	Sakha	1	159.83	2.86	9.24	36.71	10.75	7.78	37.08	87.64	3.78	44.65	5.56	10.19	47.00	3329.67
		2	154.83	2.50	8.00	35.59	10.89	5.65	37.10	87.61	3.61	44.50	5.51	9.46	38.83	3340.00
		3	150.67	2.71	8.97	35.90	10.58	5.46	36.38	87.29	3.70	44.88	5.51	9.03	34.00	3336.00
		4	152.50	2.74	9.31	36.17	10.38	6.13	36.20	86.58	3.49	43.90	6.69	9.42	34.00	3349.33
		5	152.83	2.66	9.76	36.04	10.57	6.70	36.77	86.89	3.60	45.43	5.34	9.12	30.50	3337.00
		6	159.00	2.83	11.24	37.24	10.24	4.98	37.15	87.18	3.65	44.87	5.88	9.55	35.83	3341.17
		7	153.17	2.73	10.34	35.65	10.69	5.98	36.35	86.60	3.68	41.40	6.52	9.57	29.50	3361.00
	El-Nubaria	1	109.83	2.10	7.21	35.94	9.82	5.54	37.06	87.75	3.91	44.62	5.68	11.20	44.17	3259.83
		2	101.67	1.81	6.65	35.77	9.98	5.58	36.34	87.05	3.72	44.08	5.92	9.88	34.00	3348.00
		3	105.33	1.89	6.78	35.76	9.61	5.52	36.08	87.14	3.74	44.53	5.67	9.78	37.67	3286.00
		4	108.67	1.93	7.00	35.38	10.10	4.97	36.05	86.57	3.44	43.53	6.40	9.37	35.33	3353.67
		5	108.17	2.02	7.87	35.94	9.74	4.67	36.63	87.07	3.65	45.07	5.74	9.08	34.67	3356.67
		6	113.50	2.15	8.27	35.98	9.68	4.15	36.88	87.42	3.69	44.22	5.77	9.05	35.83	3349.33
		7	107.17	1.95	7.06	35.93	9.74	4.57	36.28	86.81	3.76	42.52	6.50	9.18	35.67	3353.83
L S D			N.S.	0.07	0.50	0.86	N.S.	0.82	N.S.	N.S.	N.S.	N.S.	N.S.	0.62	N.S.	N.S.

V.:Verities, L.:Locations, F.:Fertilizer P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant. UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability..

The effect of the mean value of the first-order interaction between the cultivated area, season and treatments for cotton yield characteristics, fiber and yarn properties in Egyptian cotton cultivar Giza 94 and 96 are presented in Table (13): concerning the effect of interaction between cultivated area, season and treatments on all yield characteristics in Giza 94 showed insignificant values except for boll weight (BW g) and seed cotton yield (SCY K/F) gave a significant value, while, in the Giza 96 showed that all yield traits recorded non-significant values except for plant height (P.h cm)) and cotton seed yield (SCY K/F) which recorded significant values.

Regarding the fiber and yarn properties; the cotton cultivars Giza 94 showed insignificant values in all traits except the number of neps count (Neps) gave significant values, while Giza96b showed non-significant values for all traits except for short fiber content (% SFC), upper half mean (UHM mm), coefficient of variation yarn evenness (CV%) and number of neps count (Neps) recorded significant values. The rest of the traits under study, namely uniformity index (UI%), micronaire reading (Mic.), strength (Str.), elongation (Elon. %), and the yarn string (YS) gave insignificant value. These results are in harmony with Neeru *et al.* (2005), Arafa and El-Gebaly (2007), El-Shazly *et al.* (2019) and Tolba *et al.* (2021)

Alga extract is considered a source of high protein which split into natural amino acids involved directly in the metabolism Marrez *et al.* (2014). It also contains some essential macronutrients for growth and development of the plant as N, P and K. In addition, algae extract affect the nutrients uptake by plant roots Abd El-Mawgoud *et al.* (2010).

So, the integrated use of vermicompost, bioagents Bacteria ture, algal extract with mineral fertilizer encourage the metabolic processes leading to accumulation of dry matter of cotton during flowering and boll formation. This could be attributed to the fact that increasing available soil mineral during vegetative and reproductive growth of cotton plants increase yield and its components

Table 13. Effect of the interaction between the years, locations and treatments on yield characteristics, fiber and yarn properties in Egyptian cotton Giza 94 and Giza 96 varieties.

Characteristic				Yield characteristics					Fiber properties						Yarn properties		
V.	**S.**	**L.**	**F.**	**P.h cm**	**BW g.**	**SCY**	**Lint%**	**S.i %**	**SFI%**	**UHM**	**UI %**	**Mic**	**St..**	**El.%**	**C.v %**	**Neps**	**YS**
G94	2019	Sakha	1	158.67	2.83	9.73	39.56	9.69	7.30	34.42	85.45	4.10	42.30	7.15	12.57	40.33	2793.67
			2	151.33	2.50	8.01	38.54	9.97	5.00	33.57	84.62	4.01	42.00	6.75	11.30	34.67	2822.33
			3	136.00	2.62	9.56	40.12	9.65	6.17	34.14	85.14	4.13	41.87	7.26	11.56	42.00	2826
			4	144.33	2.59	9.24	39.49	9.72	5.97	34.24	85.24	4.04	42.77	6.20	10.83	31.33	2805.33
			5	154.00	2.67	9.04	39.67	9.78	5.77	34.64	85.67	4.02	43.27	6.50	11.50	24.67	2850
			6	159.00	2.85	10.52	39.88	9.73	4.75	34.58	85.72	4.11	42.57	6.05	10.70	39.00	2826.33
			7	151.33	2.62	10.03	38.49	9.89	5.67	34.14	85.25	4.03	45.43	6.30	11.07	24.00	2821.67
		El-Nubaria i	1	101.67	2.17	8.30	35.34	9.80	5.81	33.63	84.65	4.20	41.08	6.14	11.56	42.00	2826
			2	110.33	1.88	6.71	34.73	10.52	4.94	32.43	83.52	4.07	43.33	7.32	10.83	31.33	2805.33
			3	103.33	1.93	7.11	34.27	10.99	4.60	32.20	83.30	4.05	42.41	7.30	11.50	24.67	2850
			4	103.33	1.98	7.80	34.37	10.88	3.20	33.04	84.34	4.10	42.33	6.99	10.57	43.67	2817.67
			5	108.33	2.12	8.28	34.21	10.89	4.73	33.06	84.14	4.23	43.31	7.35	10.33	31.33	2822
			6	105.00	2.18	8.40	35.48	9.70	4.76	33.71	84.81	4.13	42.92	7.00	9.80	34.67	2836.67
			7	115.00	1.99	8.03	34.70	10.37	4.59	32.77	83.88	4.07	42.33	7.74	9.40	31.67	2862
	2020	Sakha	1	160.67	2.83	9.52	39.97	11.83	6.25	34.09	85.11	4.17	42.80	7.26	12.41	43.33	2797
			2	149.33	2.62	8.74	38.98	11.93	3.22	33.72	84.74	4.04	44.50	6.70	11.40	25.67	2813.67
			3	137.33	2.69	8.96	40.37	11.70	4.90	34.21	85.22	4.00	42.87	7.27	11.35	33.00	2814.67
			4	146.00	2.74	9.41	39.69	11.93	4.02	34.20	85.26	4.22	43.93	6.28	10.80	44.00	2799
			5	155.67	2.78	9.92	40.10	11.83	4.55	34.19	85.27	4.17	44.67	6.62	10.97	35.67	2847
			6	155.00	2.82	10.79	40.01	11.47	3.35	34.40	85.51	4.12	43.47	6.24	10.93	31.67	2825.33
			7	152.00	2.75	9.53	40.69	11.13	4.00	33.49	84.59	4.08	45.49	6.35	11.54	38.33	2823.33
		El-Nubaria	1	106.67	2.17	7.43	35.34	9.80	5.81	33.66	84.67	4.07	40.94	6.63	10.70	45.00	2831.67
			2	109.00	1.88	6.71	34.73	10.52	4.94	32.62	83.69	4.03	42.45	7.32	10.20	32.33	2817.67
			3	110.67	1.97	7.55	34.66	10.00	4.36	32.68	84.02	4.00	42.53	7.07	9.80	37.00	2814.33
			4	110.00	1.97	7.57	34.85	10.15	3.60	33.68	84.75	4.04	42.02	7.07	9.67	34.67	2884.67
			5	109.67	1.98	7.82	34.17	10.74	4.77	33.63	84.59	4.13	43.27	7.23	10.07	32.00	2803.33
			6	105.67	2.24	8.52	35.35	10.21	4.47	33.89	84.90	4.10	43.11	6.99	10.03	48.00	2825.33
			7	115.00	1.96	7.46	34.66	9.75	4.96	33.16	83.85	4.03	42.67	7.32	9.13	35.00	2823.67
		L S D		N.S.	0.08	0.60	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	49.12	N.S.
G96	2019	Sakha	1	158.00	2.87	10.43	36.34	10.88	7.90	37.50	87.75	4.01	45.20	5.60	10.30	55.33	3336.33
			2	153.33	2.50	7.07	35.56	10.63	5.95	37.10	87.50	3.69	44.33	5.50	9.28	53.67	3341.33
			3	150.67	2.72	8.81	35.94	10.53	7.20	36.45	87.50	3.69	44.67	5.57	8.80	39.67	3334.33
			4	150.00	2.74	9.57	36.15	10.47	5.20	36.40	86.60	3.36	43.87	6.70	9.40	41.67	3344.00
			5	151.33	2.61	10.08	36.13	10.50	6.55	37.00	86.85	3.55	45.13	5.43	9.17	24.67	3330.00
			6	158.33	2.82	11.17	36.78	10.65	5.75	37.40	87.40	3.61	44.87	5.87	8.83	35.00	3340.67
			7	156.00	2.71	10.45	35.48	11.09	6.55	36.01	86.57	3.77	41.40	6.50	9.63	33.33	3342.33
		El-Nubaria	1	105.00	2.15	7.28	35.86	9.95	5.06	37.50	87.75	4.01	45.20	5.60	12.20	44.00	3224.00
			2	101.67	1.88	6.87	36.08	9.95	5.95	37.10	87.50	3.69	44.33	5.50	10.43	38.67	3344.33
			3	105.00	1.93	6.78	35.83	9.56	6.50	36.45	87.50	3.69	44.67	5.57	9.80	41.33	3227.33
			4	103.33	1.93	7.05	35.26	10.22	4.40	36.35	86.60	3.36	43.87	6.70	9.77	41.33	3344.67
			5	108.33	1.97	7.72	36.08	9.51	3.90	37.00	86.85	3.55	45.13	5.43	8.97	29.33	3362.67
			6	114.00	2.13	8.26	36.02	9.74	4.30	37.40	87.40	3.61	44.87	5.87	9.20	40.00	3350.67
			7	100.33	1.95	7.36	35.85	9.74	4.83	36.85	86.85	3.77	41.40	6.50	8.90	31.67	3348.00
	2020	Sakha	1	161.67	2.85	10.06	37.08	10.62	7.65	36.66	87.52	3.56	44.11	5.51	10.08	38.67	3323.00
			2	156.33	2.51	8.92	35.62	11.14	5.35	37.10	87.71	3.52	44.67	5.52	9.63	24.00	3338.67
			3	150.67	2.71	9.14	35.85	10.63	3.72	36.30	87.08	3.71	45.10	5.44	9.27	28.33	3337.67
			4	155.00	2.73	9.04	36.18	10.30	7.05	36.00	86.55	3.62	43.93	6.68	9.43	26.33	3354.67
			5	154.33	2.72	9.44	35.96	10.63	6.84	36.55	86.93	3.65	45.73	5.24	9.07	36.33	3344.00
			6	159.67	2.85	11.32	37.70	9.82	4.22	36.90	86.97	3.70	44.87	5.90	10.27	36.67	3341.67
			7	150.33	2.76	10.34	35.82	10.28	5.40	36.68	86.63	3.58	41.40	6.54	9.50	25.67	3379.67
		El-Nubaria	1	114.67	2.06	7.13	36.02	9.69	6.02	36.62	87.75	3.81	44.04	5.77	10.20	44.33	3295.67
			2	101.67	1.73	6.43	35.46	10.02	5.20	35.57	86.61	3.74	43.83	6.33	9.33	29.33	3351.67
			3	105.67	1.85	6.79	35.68	9.66	4.53	35.72	86.78	3.80	44.40	5.77	9.77	34.00	3344.67
			4	114.00	1.93	6.94	35.51	9.99	5.53	35.75	86.53	3.52	43.19	6.10	8.97	29.33	3362.67
			5	108.00	2.06	8.02	35.79	9.98	5.43	36.27	87.28	3.75	45.00	6.05	9.20	40.00	3350.67
			6	113.00	2.16	8.27	35.95	9.62	4.00	36.36	87.44	3.78	43.57	5.68	8.90	31.67	3348.00
			7	114.00	1.95	7.16	36.00	9.73	4.30	35.72	86.77	3.74	43.63	6.50	9.47	39.67	3359.67
		L S D		7.17	N.S.	0.70	N.S.	N.S.	1.16	0.60	N.S.	N.S.	N.S.	N.S.	0.88	11.35	N.S.

V.:Verities, S.:Seasons, L.:Locations, F.:Fertilizer. P.h cm: Plant height, BW g.: Boll weight, SCY: Seed cotton yield characteristics, lint%: lint percentage, S.i %: Seed index, SFI: Short fiber index, N.S.: insignificant. UHM: Upper half mean, UI %: Uniformity index, Mic: Micronaire reading, St.: Strength in gram/Tex, El.: the percentage of Elongation, C.v %: Coefficient of variation, Neps: neps count and YS: Yarn Strength,. Significant a t 0.01 level of probability *Significant at 0.05 level of probability..

CONCLUSION

Several researchers found that the utilization of microorganisms is also important to promote the circulation of plant nutrients and reduce the need for chemical fertilizer as much as possible and are considered alternatives to mineral fertilizers. So, the integrated use of vermicompost, bioagents Bacteria ture and algal extract with mineral fertilizer encourages the metabolic processes leading to accumulation of dry matter of cotton during flowering and boll formation. This could be attributed to the fact that increasing available soil mineral during vegetative and reproductive growth of cotton plants increase yield and its components. So, we can use this treatment safely to produce bio-organic cotton and a friend of the environment.

REFERENCES

Abd El-Mawgoud, A. M. R.; Tantawy, A. S.; El-Nemr, M.A. and Sassine, Y.N. (2010). Growth and yield responses of strawberry plants to chitosan application. *Europ. J. Scientific Res.39 (1), 161-168.*

Ahmed, H. S. A. (2021). Effect of vermicompost, (PGPR) and humic acid on Egyptian cotton yield in a Clayey soils. *Middle East Journal of Applied Sciences Volume: 11 | Issue: 03| Pages: 774-784*

Ahmed, H. S. A.; Mona H. A. and Deshish, EL-D. EL-D. (2021). Response of Egyptian cotton plants to the treatment with *Azotobactr, Azospirillum* and some *Bacillus Spp.* and their effect on yield and quality under calcareous soil. *Middle East J. Agric. Res., 10(2): 426-437.*

Ahmed, H. S. A.; Mona, H. A. H and Yehia, W. M. B (2020). Response of some Egyptian cotton verities for Bio-fertilizer and its effect on yield characteristics, yield components and fiber traits. *Plant Archives Volume (20) No. 2, pp. 9575-9583.*

Ahmed, H. S. A.; Mona, H. A. Hossein and Heba, S. A. El-Desoukey (2020). Effect of nano-fertilization and some bio-fertilizer on growth yield and fiber quality of Egyptian cotton. *Annals of Agric. Sci., Moshtohor. 57 (3) p. 661-668.*

Aira, M., Lazcano, C., and Dom´ınguez, J. (2008). Earthworms trigger enzymatic activities through the increase of microbial biomass and activity during vermicomposting of pig slurry. *Proceedings of the International Congress Compost and Digestate: Sustainability, Benefits, Impacts for the Environment and for Plant Production (CODIS '08), pp. 285–288, Solothurn, Switzerland, February 2008.*

Arafa, A. S. and S. G. Gebaly (2007). Cotton yield and fiber quality variation related to fertilization with poultry litter, microbien and mineral nitrogen. *The first Arab Conf. on Environ. St. and Res. "The contemporary and future environmental issues in the Arab region" Ain shams Univ.*

Arafa, S. Abeer; Heba, M. A. Khalil and Sana, G. Gebaly (2013). Impact of eco- friendly fertilizers and rice straw on cotton yield and fiber physical properties. *International Science and Investigation Journal Vol 8(2) PP. 2251-8576*

Arancon, N. Q.; Edwards, C. A.; Bierman, P.; Welch, C. and Metzger, J. D. (2004). The influence of vermicompost applications to strawberries: Part 1. Effects on growth and yield. *Biores. Technol., 93: 145-153.*

Arancon, N.; Lee, S.; Edwards, C. and Atiyeh, R. (2003). Effects of humic acids derived from cattle, food and paper-waste vermin-composts on the growth of greenhouse plants. *Pedobiologia, 47(5): 741-744.*

Arnon, D. I. (1949). Copper enzymes in isolated chloroplast. *Plant physiol., 24: PP.1-15*

ASTM: (1967). American Standard Testing and Materials. *Annual Book of ASTM Standard D. 1578 U.S.A.*

ASTM: D4605, (1986). American society for testing materials, *D-4605. U.S.A.*

Atiyeh, R. M.; Edwards, C. A.; Arancon, N. Q. and Metzger, J. D. (2002). The influence of humic acids derived from earthworm processed organic wastes on plant growth. *Bioresour. Technol., 84(1): 7-14.*

Baker, L. R.; White, P. M. and Pierzynski, G. M. (2011). Changes in microbial properties after manure, lime, and bentonite application to a heavy metal-contaminated mine waste. *Appl. Soil Ecol., 48, 1–10.*

Bastida, F.; Kandeler, E.; Moreno, J. L.; Ros, M.; Garcia, C. and Hernandez, T. (2008). Application of fresh and composted organic wastes modifies structure, size and activity of soil microbial community under semiarid climate. *Appl. Soil Ecol., 40, 318–329.*

Bolan,N.S. and Hedley, M.J.(2003). Role of Carbon, Nitrogen and Sulfur Cycles in Soil Acidification. *In: Renegel, Z., (Ed.) Handbooks of Soil Acidity. Marcel Dekker AG, New York, USA, PP. 29-56.*

Chander, K.; S. Goyal; M.C. Mundra and K.K. Kapoor (1997). Organic matter, microbial biomass and enzyme activity of soils under different crop rotations in the tropics. *Biol. Fertil. Soils, 24: 306-310.*

Dewdar, M.D. and Rady, M. M. (2013). Influence of soil and foliar applications of potassium fertilization on growth, yield and fiber quality traits in two *Gossypium barbadense* L. varieties. *African Journal of Agricultural Research, 8(19): 2211-2215.*

Doan, T.T.; Jusselme, D.M.; Lata, J.C.; Nguyen, B.V. and Jouquet, P. (2013). The earthworm species metaphire posthuma modulates the effect of organic amendments (compost vs. vermicompost from buffalomanure) on soilmicrobial properties. *A laboratory experiment, European Journal of Soil Biology, vol. 59, pp. 15–21.*

El-Hady, O.A. and Abo-Sedera, S.A. (2006). Conditioning Effect of Composts and Acrylamide Hydrogels on a Sandy Calcareous Soil. II: Physico-Biochemical Properties of the Soil. *Int. J. Agric. Biol.8(6), 876-884.*

El-Maas *et al.,* (2016)

El-Maas, I.M. Enshrah and Fatma, S.H. Ismail (2016). Impact of bio fertilizer ,Humic acid and compost tea application on soil properties and Egyptian clover productivity under slaime soil condition. *J. Soil and Agric. Eng, Mansura university, 7 (9) 611-622.*

El-Shazly, M. W. M.; Ata Allah Y. F. A and Abd El-All, A. M. (2019). Response of Cotton Plant to Fertilization Sources and Foliar Spraying with Humic Acid. *Agri Res& Tech: Open Access J. 20(2): 556120.*

FAO: (2016). FAO Soils Portal: Management of Calcareous Soils. *(accessed 01.04.16)*

Garcia-Gil, J.C.; Ceppi, S.B.; Velasco, M.I.; Polo,A., and Senesi, N. (2004). Long-term effects of amendment with municipal solid waste compost on the elemental and acidic functional group composition and pH-buffer capacity of soil humic acids. *Geoderma, 121, 135–142.*

Garg, V.K.; Gupta, R. and Kaushik, P. (2009). Vermicomposting of solid textile mill sludge spiked with cow dung and horse dung: A pilot-scale study. *International Journal of Environment and Pollution 38:385-396.*

Hazra, G. (2016). Different types of eco-friendly fertilizers: An overview. *Sustainability in Environment, 1(1): 54.*

Iç, S.; Gülser, C.; Candemir, F. and Demir, Z. (2010). Effects of Plant Growth on Some Physical Properties of Different Textured Soils. International soil science congress on "Management of Natural Resources to Sustain Soil Health and Quality. *Ondokuz Mayis University, Faculty of Agriculture, Soil Science Department, 55139, Samsun-Turkey.*

ICOF: (2010). International Conference on Organic Farming. *Friendship Hall, Khartoum, Sudan PP. 6 – 7*

Iovieno, P.; Morra, L.; Leone, A.; Pagano, L. and Alfani, A. (2009). Effect of organic and mineral fertilizers on soil respiration and enzyme activities of two Mediterranean horticultural soils. *Biol. Fertil. Soils, 45, 555–561.*

Jackson, M. L. (1976). Soil chemical analysis. *Prentice-Hall, Inc. Engle Wood Cliffs, N.J., PP. 498*

Javaid, A. (2009). Growth, nodulation and yield response of balck gram (*Vignamungo L.*) as influenced by biofertilizers and soil amandements. *Afr. J. Biotechnol. 8 (21), 5711- 5717.*

Javaid, A. and Mahmood, N. (2010). Growth, nodulation and yield response of soybean to bio fertilizers and organic manures. *P. J. Bot. 42 (2), 863-871.*

Kevin V. J. (2003). Plant growth promoting rhizobacteria as bio-fertilizers. *Plant and Soil. 255: PP. 571-585.*

Khalil, M. A. Heba and Hassan, M. Rokaya (2015). Raising the Productivity and Fiber Quality of Both White and Colored cotton Using Eco-Friendly Fertilizers and Rice Straw. *International Journal of Plant Research 5(5): 122-135*

Khan, A. A.; G. Jilani, M. S.; Akhtar, S. M. S. Naqvi and Rasheed M. (2009). Phosphorus solubilizing bacteria: occurrence, mechanisms and their role in crop production. *Journal of Agricultural and Biological Science 1: PP.48-58.*

Lim, S.L.; Wu, T.Y.; Lim, P.N. and Shak, K.P.Y. (2015). The use of vermicompost in organic farming: Overview, effects on soil and economics. *Journal of the Science of Food and Agriculture, 95(6): 1143–1156.*

Mahmoud, E. and Ibrahim, M. (2012). Effect of vermicompost and its Bacteria tures with water treatment residual on soil chemical properties and barley growth. *J. Soil Sci. Plant Nutr. 12(3),431-440.*

Marrez, D. A.; Naguib, M. M.; Sultan, Y. Y.; Daw, Z. Y. and Higazy, A. M. (2014). Evaluation of chemical composition for Spirulina platensis in different culture media. *Res. J. Pharmaceutical, Biol. and Chem. Sci. 5 (4), 1161-1171.*

Mitkees R. A.; Ajman M.; Sadek, A. M.; Eissa K. and Mahmoud S. k. (1996). Use of nitrogen bio-fertilizer requirements. *Nile valley and Red Sea Regional program, Eight, Ann. Coordination Meeting, Egypt, 15-19 Sep.,PP. 140-146.*

M-Stat: 6.311, C. C. W. (1998-2005). Cohort software798 light house Ave. *PMB320, Monterey, CA93940, and USA. http://www. cohort. com /Download M-Stat Part 2. html*

Neeru, N. B. S.; Saharan V. K.; Ranjana B. L. K.; Bishnoi B. P. L. and Lakshminarayana (2005). Impact of Biofertilizers on grain yield in spring wheat under varying fertility B.s.conditions and wheat-cotton rotation. *Archives of Agronomy and Soil Science 51(1):69-77*

Pathma, J. and Sakthivel, N. (2012). Microbial diversity of vermicompost bacteria that exhibit useful agricultural traits and waste management potential. *Springer Plus, 1(1): 26.*

Perner, H.; Schwarz, D. and George, E. (2006). Effect of mycorrhizal inoculation and compost supply on growth and nutrient uptake of young leek plants growth on peat-based substrates. *Horti. Sci., 41:628-632.*

Rashad, F.M., Kesba, H.H., Saleh, W.D. and Moselhy, M.A. (2011). Impact of rice straw composts on microbial population, plant growth, nutrient uptake and root-Knot nematode under greenhouse conditions. *African Journal of Agricultural research 6, 1188-1203.*

Raupp, J. and Oltmanns, M. (2006). Farmyard manure, plant based organic fertilizers, inorganic fertilizer-which sustains soil organic matter best. *Aspects of Applied Biology, 79, 273-276*.

Rolbelen, G. (1957). Mntersuchungen and strohlenin duzieten blatt arbumutantenvan arbidopois Thaliana *(l.) Verbungsie (Germany).*

Sayed Ahmed Hamed, Reda Zewail, Hala Abdalrahman, Ghazal El-Alal Fekry, Botir Khaitov and Kee Woong Park (2019). Promotion of growth and yield attributes of Egyptian cotton by *Bacillus strains* in combination with mineral fertilizers. *Journal of Plant Nutrition, Puplished on Line:Aug. 2019, PP. 1-13*

Shivalingaiah, M. (2007). Effect of nutrient management and plant protection practices in organic cotton production (*Gossypium spp.*). *M.Sc. Thesis, University of Agricultural Sciences, Dharwad*

Simon, S.; Corroyer, N.; Getti, F. X.; Girard, T.; Combe, F.; Fauriel, J. and Bussi, C. (1999). Organic forming optimization of techniques. *Arboriculure FrUI %ties, 533: 27-32.*

Simon, T. S. and Ross A. F. (1971). Changes in phenol metabolism associated with inclosed systemic resistance to tobacco mosic virus Sum sun NN tobacco. *phytopathology. 61: PP. 126-1265.*

Sinha, R.K., Heart, S., Valani, D., and Chauhan, K. (2009). Special Issue: Vermiculture and sustainable agriculture. *American-Eurasian Journal of Agriculture and Environmental Science, 5(s): 1–55.*

Six, J.; Paustian, K.; Elloitt, E.T. and Combrink, C. (2000). Soil structure and soil organic matter, I. distribution of aggregate size classes and aggregate associated carbon. *Soil Sci Soc Am J 64:681–689.*

Snedecor, G.W. and Cochran W.G. (1981). Statistical method, 6th ed. *Iowa State Univ. Press, Iowa, U.S.A. 593p.*

Tolba S. A. Fadia; Salah A. H. Allam; El-Sayed M. H. Shokr; Abd El-Baset A. Hassan and El-Saeed M. M. El-Gedwy (2021) Yield, Lint and Yarn Quality Properties of Some Egyptian Cotton Varieties as Affect By Some Natural Extracts and Mineral Fertilization Rates. *Annals of Agric. Sci., Moshtohor Vol. 59(3)*

Tolba S. A. Fadia; Salah A. H. Allam; El-Sayed M. H. Shokr; Abd El-Baset A. Hassan and El-Saeed M. M. El-Gedwy (2021) Effect of Some Natural Extracts and Mineral Fertilization Rates on Growth and Yield of Some Egyptian Cotton Varieties. *Annals of Agric. Sci., Moshtohor Vol. 59(3)*

Twewaadha, E. and Alweendo, S. R. (2007). The Effect of nitrogen, phosphorus and potassium fertilizers on cotton cultivar. (TETRA) *The World Cotton Research Conference-4 (September PP. 10-14, 2007)*

Yassen, A. A.; Badran, N. M. and Zaghloul, S. M. (2007). Role of some organic residues as tools for reducing metals hazard in plant. *World J. Agric. Sci. 3(2), 204-209.*

Youssef, M. M. A. and Eissa, M. F. M. (2014). Bio-fertilizers and their role in management of plant parasitic nematodes. *E. J. Biotechnol Pharm Res 5: 1-6.*

تأثير منطقة الزراعة على صفات المحْصول وصفات جوُدة التيلة والغزل لبعْض التراكيب الوراثية فى القُطن المصْرى بإستخدام التلقيح الحيوى والفيرم كُمبوست ومُستخْلص الطحالب

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أُجريت هذه التجارب لدراسة إستجابة بعض الطُرز الوراثية للقُطن المصري، أصناف جيزة 96 (فائق الطول) وجيزة 94 (طويل بحرى) وصفات المحصول ونسبة تصافى الحلج وخصائص التيله والغزل عند استخدام الأسمدة الحيوية، مثل سماد vermicompost، وخليط من اللقاح البكتيري *Bacillus polymxa, Bacillus megaterium, Bacillus circulans*) ومستخلص الطحالب، تحت منطقتى زراعة مختلفة، منطقة سخا (تربة طينية) ومنطقة النوبارية (تربة جيرية). فيما يتعلق بتأثير تطبيق المعالجات المختلفة على صفات التربة ، فقد أظهرت النتائج زيادة معنويه في المادة العضوية للتربة وانخفضت نسبيًا درجة الحموضة حتى وإن لم يكن بشكل كبير ، كما كان لجميع معاملات vermicompost تأثيرات إيجابية على مستويات N, P, K المتاحه. وفيما يخص العد البيولوجي للبكتيريا والفطريات ومعدل تطور ثاني أكسيد الكربون فى التربه فقد أظهرت زياده معنويه. كما تحسنت enhancement معنويا محتوى أوراق نبات القطن من الكلوروفيل أ ، ب ، الكاروتينات والفينولات الكلية بشكل ملحوظ تحت معاملات الأسمدة المختلفة مقارنة بالكنترول. أثبتت المعاملة بـ(سماد vermicompost + التلقيح البكتيري + 50٪ من السماد المعدنى الموصى به + مستخلص الطحالب) تفوقها على باقي المعاملات خاصة في محصول القطن الزهر وصافى الحلج والتي زادت بمقدار 1.41 قنطار لكل فدان ، 0.63٪ (نسبة تيله) مقارنة بمعاملتى الكنترول. سجلت بيانات خصائص محصول القطن وخصائص التيله والغزل اختلافات معنويه بسبب الزراعة في مناطق مختلفة ويرجع هذا الاختلاف بين الأصناف المدروسة إلى عادة النمو وإستجابة كل نوع للظروف البيئية، التي تتحكم فيها العوامل الوراثية والإستخدام الفعال للمُدخلات والموارد الطبيعية.