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# RESPONSE OF SOME EGYPTIAN COTTON VARIETIES FOR BIO-FERTILIZER AND ITS EFFECT ON YIELD, YIELD COMPONENTS AND FIBER TRAITS

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## Abstract

Two field experiments were conducted at Sakha researchstations, Cotton Research Institute, Agricultural Research Center during the two summer growing seasons, 2018 and 2019. The aim of the present study was to study the effect of bio-fertilization on Egyptian cotton cultivars Giza 97, Giza 96, Giza 95, Giza 94 all these varieties belong to (*Gossypium barbadence* L.) was used in this study and the seeds of this cotton were given by Cotton research institute, Egypt. Microorganisms belong to *Azotobactr, Azospirillum, Pseudomonas fluorescens* (Ps.F), *Seratia, Bacillus bolymix;* Mix (*Azotobactr, Azospirillum + Pseudomonas fluorescens + Seratia + Bacillus bolymix*) and *Rhizobia* were provided by *Department* of *Microbiology*, *Institute* of *Soil* and *Water* Research, Agricultural Research Centre, *Giza*, *Egypt*. Among its untreated one (control) on growth, seed yield, lint yield and fiber properties of Egyptian cotton Giza 97, Giza 96, Giza 95 and Giza 94 cultivar. The most important results can be summarized as follows: the combined treatment which contains half dose of both the bio-fertilizer and some bio-fertilizers gave. The results for mean squares cleared that the mean squares for yield, yield components and fiber traits cleared that highly significant for all the genotypes for all the studied traits with except seed index and for interactions the results also showed that highly significant for bio-fertilization and the interactions between varieties $^x$ bio-fertilization and too highly significant mean squares for the interaction among years $^x$ varieties $^x$ bio- fertilization. For the effect of bio- fertilization on cotton varieties for yield and yield components traits the results cleared that highly significant mean performances for all yield and yield components traits if we compared it by control treatment and used Bio-fertilizer *Seratia, Bacillus bolymix* and /mix of all Bio-fertilizer gave the highest and desirable means for yield and yield components traits. For the effect on Egyptian cotton varieties as effected by using Bio-fertilizer the results cleared that highly significant mean performances for all the fiber traits by compared by control treatment and the highest mean was recorded by used *Azotobacter, Azospirillum, Bacillus bolymix* and Mix of all bio- fertilizer. From the all results in conclusion we possible use bio- fertilization for Egyptian cotton varieties to using clean fertilizer and decrease the mineral fertilizer and decrease the pollution for soil and atmosphere.

***Key words:*** Cotton plants, bio- fertilizers, plant growth promoting rhizobacteria (PGPR), growth and yield and yield components, fiber traits.

## Introduction

The use of microbial inoculants is of strategic interest for their potential to replace chemical fertilizers and pesticides in agricultural systems and improve environmental sustainability. Plant-aiding microorganisms, often referred to as plant growth-promoting *rhizobacteria* (PGPR) (Gupta *et al.,* 2015) and arbuscular *mycorrhizal fungi* (AMF) (Igiehon and Babalola, 2017), interact with plants roots (Hayat *et al.,* 2010) by enhancing growth, mineral nutrition, drought tolerance and disease resistance (Nadeem *et al*., 2013). Bacteria can beneficially contribute to plant growth via N2- fixation and solubilization of low mobile nutrients. Biological N2-fixation is carried out by various symbiotic and nonsymbiotic bacteria (Shridhar, 2012). Nonsymbiotic N2 fixation is carried out by free-living diastrophic bacteria, such as *Azospirillum*, *Azoarcus, Azotobacter*, *Burkholderia, Gluconacetobacter, Clostridium* and *Pseudomonas* (Bhattacharyya and Jha, 2012; Singh, 2018). The absence of symbiosis with plants supports their common use in bio fertilizers formulation. These bacteria can improve the uptake efficiency of nitrogen in many crops, thanks to the nitrogenase activity and soil N mineralization (Chauhan *et al.,* 2015). In addition, *Azotobacter* and *Azospirillum* stimulate root hair formation and lateral and adventitious root initiation through hormonal (auxins) exchange (Vejan *et al*., 2016; Zeffa *et al.,* 2019). Some PGPR are also known as phosphate- and potassium solubilizing bacteria through rhizosphere acidification (Afzal and Bano, 2008; Meena *et al.,* 2014). Among these, *Bacillus megaterium* and *Frateuriaa-urantia* were reported as efficient P- and K-mobilizing bacteria, respectively, thus being potentially exploitable in crop cultivation (Subhashini, 2014; Ghaffari *et al.,* 2018).

Ramadan *et al.,* (2018) The bio-fertilizer PGPR used in the study was a commercial multi-strains of (*Pseudomonas putida, Bacillus megatherium, Azospirillum brasilense*) produced by culture collection of Agricultural Microbiology Department, Agricultural Research centerat Giza, Egypt. PGPR concentration was adjusted to 1×10 8(cfu/gr) for all treatments and sprayed in the recommended times of cotton fertilization with 20 L /Fadden.

Ahmed *et al.,* (2020) Study the effect of bacterial strains treatments of *Bacillus circulance var.* (BC), *Bacillus megatherium* var. Phosphaticum (BM) and co-inoculation of BC and BM in combination with 50 and 100% of recommended dose fertilization (RDF) on growth, yield and fiber properties of Egyptian cotton Giza-94. Results showed that inoculation of cotton seeds with bacterial strains (*i.e.*, BC, BM) in combination with 50% of RDF significantly increased all important physiological traits of cotton such as plant growth, number of fruit sympodial branches, number of bolls per plant, boll weight, lint cotton yield and fiber properties. The highest increase of cotton yield was observed at the combined use of bacterial strains BC+BM with 50% mineral fertilizers followed by BC+BM with 100% mineral fertilizers which attributed the yield increase by 33 and 15% compared to the respective control. The aim from this investigation is evaluation the effect of bio-fertilization on yield, yield components and fiber traits of Egyptian cotton genotypes and study the using Bio-fertilizer to decrease the miner fertilization and decrease the pollution to the soil and atmosphere.

## Materials and Methods

### Experimental site

The experiment was conducted at the Sakha Agriculture research station, Cotton research institute, Agriculture research center Egypt during 2018 and 2019 seasons. The average yearly rainfall is 72 mm and the main part of the rainfall is observed for last three years is between December–January and February intervals. Climate is fine for (*Gossypium barbadense* L.) of cotton which requires 160-180 days to ripen. Soil type is clay in this area which is severely degraded after many years of continuous cotton monoculture. Details physicochemical characteristics of the soil in the experimental field were characterized at the beginning of the experiment table 1.

### Planting and Microorganisms inoculum preparation

Egyptian cotton cultivars of Giza 97, Giza96, Giza 95 and Giza 94 all of these varieties are belong to (*Gossypium barbadence* L.) was used in this study and the seeds of this cotton were given by Cotton research institute, Egypt. Microorganisms belong *Azotobactr*, *Azospirillum, Pseudomonas fluorescens* (Ps.F), *Seratia, Basillusbolymix;* Mix (*Azotobactr*, *Azospirillum* + *Pseudomonas fluorescens* + *Seratia* + *Basillusbolymix*) and *Rhizobia*were provided by Departm*ent* of *Microbiology*, *Institute* of *Soil*and *Water* Research, Agricultural Research Centre, *Giza*, *Egypt*.

Bio-fertilizersinoculum (*Bacillus megateriumvar Phosphaticum* and *Bacillus circulanus*) was prepared as carrier-based inoculants containing effective microorganisms (Accinelli *et al*., 2009).

However, the local development of commercial bio-fertilizers (Department of Microbiology, Institute of Soil and Water Research) is often restricted by technological limitations or the scarcity of local sources of peat, the

**Table 1:** Mechanical and chemical soil analysis of the experimental at Sakha Agriculture Research Station.

| Contents | 0.0 : 20 cm | 20 : 40 cm | 40 : 60 cm |
|---|---|---|---|
| Sand | 24.3 | 24.0 | 23.9 |
| Silt | 26.3 | 26.4 | 26.45 |
| Clay | 49.4 | 49.6 | 49.65 |
| Textural class | clay | Clay | Clay |
| Organic matter | 1.77 | 1.55 | 1.50 |
| PH | 7.91 | 7.95 | 7.98 |
| EC ds / m | 1.88 | 1.88 | 1.56 |
| Soluble cations | | | |
| Ca ++ meq / L | 2.88 | 2.63 | 2.17 |
| Mg ++ meq / L | 2.01 | 1.90 | 1.80 |
| Na + meq / L | 13.5 | 14 | 11.34 |
| K+ meq / L | 0.41 | 0.35 | 0.29 |
| Soluble anions | | | |
| $HCO_3^-$ | 1.75 | 1.75 | 1.75 |
| $CL^-$ | 10.67 | 10.84 | 10.48 |
| $SO_4^{--}$ | 6.38 | 6.65 | 3.37 |
| N | 18 | 16 | 14 |
| P | 17 | 10 | 8 |
| K | 500 | 475 | 450 |

most commonly used bio-fertilizer carrier in many countries (Khavazi *et al*., 2007).

The liquid inoculum of *Azotobactr*, *Azospirillum, Pseudomonas fluorescens* (Ps.F), *Seratia, Basillusbolymix,* Mix (*Azotobactr*, *Azospirillum* + *Pseudomonas fluorescens* + *Seratia* + *Basillusbolymix*) and *Rhizobia* were mixed 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 2×107 cells/ml in which 2-kg cotton seeds of promising Giza 97, Giza 96, Giza 95 and Giza 94 were dipped and stirred for 15 min. Thereafter, treated seeds were removed, spread in a thin layer on paper, air dried and sown, these treatments were repeated with the irrigation water at 65, 85 and 105 days after sowing (Ouédraogo *et al.,* (2008) and Khan, *et al*., (2009).

**Treatments layout**

The experiment was laid out in randomized complete blocks design with four replicates. Main plot size was 7.2 × 3.6m with control, *Azotobactr*, *Azospirillum, Pseudomonas fluorescens* (Ps.F), *Seratia, Basillusbolymix,* Mix (*Azotobactr*, *Azospirillum* + *Pseudomonas fluorescens* + *Seratia* + *Basillusbolymix*) and *Rhizobia*. The sub-plots contain: control (100%) and without fertilization, of recommended dose of fertilization (RDF). The inoculation was repeated in inoculated plotsthree times at 65, 85 and 105 days after sowing (DAS) with the Irrigation water. Inoculum of *Azotobactr*, *Azospirillum, Pseudomonas fluorescens* (Ps.F), *Seratia, Basillusbolymix,* Mix (*Azotobactr*, *Azospirillum* + *Pseudomonas fluorescens* + *Seratia* + *Basillusbolymix*) and *Rhizobia*were mixed with sterilized peat and seeds of promising Giza 97, Giza 96, Giza 95 and Giza 94 were pelleted with this mixture containing peat and inoculum ($10^9$cfu/g). The inoculated seeds (25 kg $ha^{-1}$) were sown using a hand drill. The fertilization was applied on the bases of treatment. All agriculture managements were applied as recommended practices for this area. Cotton bolls started to ripen at 110-120 DAS, yield was hand-picked.

**Growth and yield characteristics**

At 170days we token the samples of ten plants from each plot were randomly taken to determine during both 2018 and 2019 seasons-Plant height (cm), No. of fruiting branches /plant -No. of bills/plant -boll weight (g./plant) –Lint cotton yield (g.), Lint percentage was measured by the following equation: (lint cotton yield/seed cotton yield) *100, Seed index was measured by the following equation: Seed index = 100 seeds weight (g) – and Seed cotton yield was detected by dividing harvested cotton yield of each plot to a planted area: Seed cotton yield = total seed yield.

**Fiber properties**

**Fiber mechanical characters**

(a) Strength in gram/Tex (St. (g/tex) in gauge/length.

(b) Elongation % (Elon.) the percentage of Elongation, which occurs before a fiber bundle breaks. Was determined by Stelometer instrument, according to (A.S.T.M) American Society for Testing and Materials (1986).

**Micronaire reading**

Micronaire reading (Mic.) that is a measurement for the combination of fiber fineness and maturity was measured by Uster Micronaire (675). In this method the fiber sample is weighted on an electronic balance. This mass is accepted if its weight is between 9.5 and 10.5 grams from the measured values of mass and pressure, the microprocessor calculates specific surface from which the fineness and maturity value were derived. The tests were done according to Uster Instruction Manual.

**High volume instrument (HVI)**

- Upper half mean length (UHM mm - Uniformity index (UI)- short fiber index) (SFC %)- Micronaire value (MR)- Maturity ratio (Mat. %) - Strength in gram / Tex (St. (g/tex) - Elongation % (Elon. %)- Spinning constancy index (SCI). Were determined by using the high volume instrument (HVI) system according to the standard (ASTM: D4605-1986). All properties were measured under standard conditions of (65±5%) relative humidity and (20±2°C) room temp. Fiber tests were conducted at a relative humidity of 65 ± 2% and temperature of 21 ± 2°C. Also, the HVI was employed to determine the following fiber properties: Fiber length parameters, fiber bundle tensile, fineness characters, color attributes values and KEISOKKI, fiber length parameters (A.S.T.M: D 46050 - 1998).

All fiber tests were performed at the laboratories of Cotton Research Institute, Agricultural Research Center.

**Statistical analysis**

Statistical analysis was performed for each year. Combined analysis between the two years was done whenever homogeneity of error mean squares was detected for the studied traits according to Snedecor and Cocharn (1989).

## Results and discussion

Mean squares for bio-fertilization on yield and yield component of some Egyptian cotton genotypes during 2018 and 2019 summer seasons calculated and the results are presented in table 2 the results cleared that mean square for years was significant for plant height and seed index and insignificant for the other studied traits. Also the results indicated that highly significant for factor A (varieties) for all the studied traits with except seed index. But for mean square of interaction between years and Factor A was insignificant for all the studied traits and these results cleared that no interaction about varieties from year to year.

For the factor B (bio-fertilization) the results illustrated that the mean square was highly significant for all the studied traits. Also for the interaction between Y x B, A x B and Y x A x B the results also cleared that for the first interactionbetween years x bio-fertilization the results showed that insignificant for all the studied traits and these results meaning no interaction for bio-fertilization from year one their year. Also for the second interaction between varieties x bio-fertilization the results also illustrated that highly significant for all the yield and yield component traits. These results showed that the bio-fertilization types affected on the cotton varieties and this effect appeared in the yield and yield component traits. These results are agreement with many authors *i.e.*: Chen *et al.,* 2006, Ali *et al.,* 2010, Gupta *et al.,* 2015, Ahamed *et al.,* 2019 and Ahamed *et al.,* 2020.

The analysis of variances for the effect of bio-fertilization on fiber traits *i.e.* upper half mean length, uniformity index, short fiber index, micronaire value, maturity ratio, fiber strength, elongation and spinning constancy index (SCI) werecalculated and the results are presented in table 3 the results cleared that the years mean square were highly significant for upper half mean length, short fiber index, micronaire value, spinning constancy index and insignificant variances for the other traits. Also, the results cleared that highly significant differences for factor A for the all studied traits and the interaction between years x factor A was insignificant for all the studied traits with except short fiber and micronaire reading. Although for factor B the results showed that highly significant differences for all the studied traits and these results cleared that found highly differences for the bio-fertilizer type on cotton

**Table 3:** Mean Analysis of variances of the effect of Bio-fertilizer on Upper half mean, Uniformity index, short fiber, Micronaire reading, fiber strength, Elongation and Spinning constancy index of some Egyptian cotton genotypes for the combined data over the 2018 and 2019 growing seasons.

| S.O.V | Df. | Upper half mean | Unifo-rmity index | Short fiber per-centages | Mic-ron-aire | Stre-ngh | Elong-ation | Spinning constancy index |
|---|---|---|---|---|---|---|---|---|
| Years | 1 | 4.054** | 0.281 | 8.205** | 0.773** | 6.833 | 1.477 | 4800* |
| R(Y) | 4 | 0.441 | 0.05 | 0.544 | 0.101 | 4.128 | 1.182 | 905.4 |
| factor A | 3 | 352.248** | 51.697** | 304.216** | 1.029** | 56.876** | 44.111** | 1429815** |
| YA | 3 | 0.835 | 0.195 | 2.793* | 0.421* | 2.431 | 1.844 | 2599 |
| Error | 12 | 0.329 | 0.562 | 0.489 | 0.072 | 2.482 | 1.513 | 831.79 |
| factor B | 7 | 2.222** | 7.549** | 82.106** | 0.148** | 7.840** | 1.180** | 87196.1** |
| YB | 7 | 0.246** | 0.232 | 2.749** | 0.007 | 0.519 | 0.241* | 651.68* |
| AB | 21 | 1.988** | 5.968** | 29.515** | 0.165** | 11.561** | 2.124** | 32573.78** |
| YAB | 21 | 0.334** | 0.347* | 11.401** | 0.026** | 1.345* | 0.264** | 575.82** |
| Error | 112 | 0.115 | 0.188 | 0.929 | 0.013 | 0.858 | 0.115 | 255.19 |

*And **: significant at 5% and 1% levels of probability, respectively.

**Table 2:** Analysis of variances for Bio-fertilizer on yield and yield component traits of some Egyptian cotton genotypes for the combined data over the 2018 and 2019 seasons.

| S.O.V | Df. | Plant height | No. of fruiting.-branches | boll weight | seed cotton yield | lint cotton yield | lint perc-entage | seed index | No. of bolls/ plant |
|---|---|---|---|---|---|---|---|---|---|
| Years (Y) | 1 | 112.547* | 1.505 | 0.008 | 906.54 | 111.52 | 0.034 | 0.622* | 4.38 |
| R(Y) | 4 | 136.526** | 3.974* | 0.013 | 799.04 | 111.523* | 0.015 | 0.576** | 1.651 |
| factor A | 3 | 1877.24** | 12.339** | 0.065** | 1471238** | 274202** | 26.518** | 0.184 | 64.894** |
| YA | 3 | 9.755 | 0.38 | 0.002 | 381.46 | 24.306 | 0.065 | 0.059 | 1.491 |
| Error | 12 | 18.373 | 0.953 | 0.006 | 397.79 | 24.306 | 0.06 | 0.077 | 1.047 |
| factor B | 7 | 3363.898** | 11.237** | 0.150** | 55509** | 11780.2** | 35.794** | 0.978** | 28.327** |
| YB | 7 | 10.559 | 0.255 | 0.013 | 140.69 | 17.202 | 0.129 | 0.033 | 0.594 |
| AB | 21 | 459.293** | 12.811** | 0.006 | 64028** | 24788** | 88.484** | 0.125** | 11.180** |
| YAB | 21 | 10.481 | 0.479 | 0.008 | 358.344 | 14.976 | 0.168 | 0.014 | 1.341 |
| Error | 112 | 26.406 | 0.851 | 0.01 | 301.173 | 15.532 | 0.157 | 0.038 | 1.513 |

*And **: significant at 5% and 1% levels of probability, respectively.

varieties. Also, the results for the interaction between years x factor B were highly significant mean squares for all the studied traits with except uniformity index, micronaire value and fiber strength in The other hand, for the interaction between factor A x factor B the results illustrated that found highly significant mean squares values for all the studied traits in addition the interaction among years x factor A x factor B were highly significant for all the studied traits. The results are agreement with many Authors as Kevin 2003, Ali *et al.,* 2010, Chauhan *et al.,* 2015, Dhale *et al.,* 2011, Ahmed *et al.,* 2019 and Zewail and Ahamed 2015.

The mean performances for the effect of bio-fertilization on yield and yield component traits for some Egyptian cotton genotypes for the combined data over the 2018, 2019 season are presented in table 4 and the results cleared thatfor Giza 97 the results cleared that the highly significant mean variances for plant high was by *Seratias.p* (bio-fertilization) with the mean values 156.0 cm. but the lowest mean values 132.7 and 130.3 cm respectively. Also, number of fruiting bpranched and boll weight the highest mean values were Ps. F and mix fertilizer with the mean values 17.0 and 2.92 respectively but the lowest values for the same traits was by *Azotobactr* and control for no of fruiting bpranched and Rhizobia for bool weight the mean values 12.67, 12.5

**Table 4:** Mean performances for the effect of Bio-fertilizer on yield and yield component traits of some Egyptian cotton genotypes for the combined data over the 2018 and 2019 seasons.

| varieties | Bio-fertilizer type | Plant height | No. of fruiting.- | boll weight branches | seed cotton | lint cotton yield | lint percent yield | seed index age | No. of bolls/ plant |
|---|---|---|---|---|---|---|---|---|---|
| Giza 97 | control | 141.5 | 12.50 | 2.74 | 1386.3 | 561.0 | 40.51 | 9.67 | 17.67 |
| | Azotobacter | 127.5 | 12.67 | 2.76 | 1646.8 | 680.9 | 41.35 | 9.82 | 21.17 |
| | Azospirillum | 140.0 | 15.17 | 2.79 | 1618.6 | 656.4 | 40.55 | 9.32 | 21.17 |
| | Pseud. fluorescens | 140.0 | 17.00 | 2.78 | 1485.8 | 611.7 | 41.17 | 9.90 | 20.83 |
| | Seratia | 156.0 | 16.00 | 2.73 | 1646.3 | 499.2 | 30.32 | 9.28 | 20.50 |
| | Basillusbolymix | 145.5 | 15.67 | 2.74 | 1612.5 | 672.6 | 41.71 | 9.81 | 20.67 |
| | Mix | 132.7 | 15.00 | 2.92 | 1547.5 | 639.9 | 41.35 | 9.94 | 17.83 |
| | Rhizobia | 130.3 | 15.50 | 2.72 | 1471.4 | 613.0 | 41.66 | 9.54 | 20.50 |
| Giza 96 | control | 140.3 | 15.50 | 2.60 | 1664.7 | 638.4 | 38.35 | 9.28 | 17.67 |
| | Azotobacter | 156.3 | 12.33 | 2.73 | 1752.7 | 723.1 | 41.26 | 9.53 | 17.33 |
| | Azospirillum | 150.7 | 13.00 | 2.72 | 1631.3 | 674.6 | 41.37 | 9.50 | 17.00 |
| | Pseud. fluorescens | 152.5 | 13.83 | 2.75 | 1796.3 | 726.0 | 40.41 | 9.27 | 17.50 |
| | Seratia | 152.8 | 14.00 | 2.62 | 1585.8 | 827.7 | 52.23 | 9.37 | 16.50 |
| | Basillusbolymix | 157.3 | 16.50 | 2.74 | 1578.9 | 595.0 | 37.69 | 9.72 | 19.50 |
| | Mix | 157.5 | 13.67 | 2.90 | 1636.0 | 647.5 | 39.58 | 9.89 | 18.50 |
| | Rhizobia | 156.3 | 14.33 | 2.71 | 1592.9 | 656.9 | 41.24 | 9.55 | 17.00 |
| Giza 95 | control | 134.5 | 15.00 | 2.63 | 1244.8 | 486.0 | 39.04 | 9.27 | 15.83 |
| | Azotobacter | 154.8 | 17.00 | 2.69 | 1391.5 | 577.2 | 41.48 | 9.81 | 21.50 |
| | Azospirillum | 136.7 | 14.17 | 2.70 | 1207.7 | 421.7 | 34.92 | 9.16 | 19.83 |
| | Pseud. fluorescens | 152.5 | 14.67 | 2.75 | 1114.3 | 499.0 | 44.78 | 9.58 | 20.17 |
| | Seratia | 143.2 | 16.17 | 2.64 | 1136.7 | 471.9 | 41.51 | 9.54 | 20.67 |
| | Basillusbolymix | 144.8 | 14.33 | 2.66 | 1335.3 | 552.1 | 41.35 | 9.86 | 18.00 |
| | Mix | 157.0 | 13.00 | 2.91 | 1359.9 | 555.6 | 40.85 | 9.88 | 16.00 |
| | Rhizobia | 165.8 | 14.67 | 2.72 | 1268.4 | 488.5 | 38.51 | 9.63 | 19.17 |
| Giza 94 | control | 161.0 | 12.00 | 2.62 | 1780.8 | 695.4 | 39.06 | 9.47 | 16.00 |
| | Azotobacter | 151.7 | 12.67 | 2.67 | 1523.1 | 578.6 | 37.99 | 9.68 | 20.83 |
| | Azospirillum | 136.7 | 16.00 | 2.67 | 1644.8 | 593.2 | 36.07 | 9.30 | 18.50 |
| | Pseud. fluorescens | 145.2 | 15.50 | 2.63 | 1547.7 | 643.5 | 41.58 | 9.77 | 18.00 |
| | Seratia | 154.8 | 13.33 | 2.68 | 1510.3 | 606.9 | 40.18 | 9.26 | 18.33 |
| | Basillusbolymix | 152.3 | 13.33 | 2.64 | 1710.2 | 688.4 | 40.26 | 9.74 | 16.50 |
| | Mix | 157.3 | 12.83 | 2.90 | 1561.3 | 693.5 | 44.42 | 9.77 | 17.33 |
| | Rhizobia | 155.5 | 15.83 | 2.66 | 1389.3 | 573.7 | 41.30 | 9.50 | 15.50 |
| LSD | 2.1 | 0.38 | 0.04 | 7.1 | 1.6 | 0.16 | 0.08 | 050 | |

and 2.72 On the other hand, the *Azotobactr* fertilizer gave highest mean values for seed cotton yield and lint yield with the mean values 1646.8 and 680.9g. respectively. In addition, the results cleared that the *Basillusbolymix* in bio-fertilization *Pseudomonas fluorescens* (Ps. F) gave highest mean values for lint percentage, seed index and number of No. Of bolls per plant with the mean values 41.71, 9.94 and 20.83 respectively.

For Giza 96 the results cleared thatthe Mix (*Azotobacter+Azospirillum+Pseudomonas fluorescens + Seratia+Basillusbolymix*) bio-fertilization was the best and gave the highly means performances for Plant height, boll weight and seed index with the mean values 157.3, 2.9 and 9.89 respectively and the lowest values the same traits recorded by control for Plant height and boll weight and by *Pseudomonas fluorescens* for seed index with the mean values 140.3, 2.6 and 9.27 respectively. Also for number of fruiting pranched per plant and number of bolls/plant the *Basillusbolymix* (bio-fertilization) recorded that, highest mean values for the above traits with the mean values 16.5 and 19.5 respectively. But the lowest mean values recorded by *Azotobacter* and *Seratia* with the mean values 12.33 and 16.5 for the same traits respectively. Also, the results cleared that the *Seratia* (bio-fertilization) recorded the highest mean values for lint weight and lint percentage with the mean values 827 and 42.23% respectively and for the seed cotton yield highest mean values recorded by *Pseudomonas fluorescens* with the mean values 1796.3gm. For Giza 95 the results showed that the highest mean values for number of fruiting pranched per plant, seed cotton yield, lint cotton yield and number of bolls/ plant recorded by *Azotobacter* (bio-fertilization) with the mean values 17.0, 1391.5, 577.2 and 21.5 respectively. On the other hand, the highest mean performance for boll weight and seed index recorded by Mix (*Azotobacter + Azospirillum + Pseudomonas fluorescens + Seratia + Basillusbolymix*) (bio-fertilization) with the mean values 2.91 and 9.88 respectively. But, the highest mean values for plant height was with *Rhizobia* (fertilizer) with the mean value 165.8. On the other hand, the lowest mean values lint weight, lint percentage and seed index gave by *Azospirillum* (fertilizer) with the mean value 421.7, 34.92 and 9.16 respectively. Also, the lowest mean value for plant height, boll weight and number of bolls/ plant recorded by 6.95 controls. In addition, Mix (fertilizer) and *Pseudomonas fluorescens* gave the lowest Mean values for number of fruiting pranched per plant and seed cotton yield with mean value 13.0 and 1114.3 respectively. For Giza 94 the results cleared that, the highest mean values for boll weight, lint percentage and seed index were recorded by Mix (fertilizer) with the mean value 2.9, 42.42 and 9.77 respectively. On the other hand, the control treatment gave the highest mean value for plant height, seed cotton yield and lint cotton yield with the mean values 161.0, 1780 and 695.4 respectively. Also, the Rhizobia and Pseudomonas fluorescens (bio-fertilization) gave the highest mean values number of fruiting pranched per plant and seed index with mean value 16.0 and 9.77. But, the lowest mean values for number of fruiting pranched per plant and boll weight recorded by control treatment with the mean value 12.0 and 2.62 respectively.

The results also cleared that the Seratia (bio-fertilization) gave the lowest mean value for seed cotton yield and seed index with the mean value 1510.3 and 9.26 respectively. Also, for lint weight and number of bolls/plant the lowest mean value recorded by Rhizobia (bio-fertilization) with the mean value 573 and 15.5 respectively. These results are agreement with Ahamed *et al.,* 2019, Ali *et al.,* 2010, Ahamed *et al.,* 2020, Afzal and Bano 2008, Zewil and Ahmed 2015, Chen *et al.,* 2006, Subhashini 2014 and Gupta *et al.,* 2015.

Mean performances of the effect of Bio-fertilizer on Upper half mean, Uniformity index, short fiber, Micronaire reading, fiber strength, Elongation and Spinning constancy index of some Egyptian cotton genotypes for the combined data over the 2018 and 2019 growing seasons are calculated and the results are presented in table 5. For Giza 97 the results cleared that highest mean value for upper half mean (UHM) by Mix (*Azotobacter + Azospirillum + Pseudomonas fluorescens + Seratia + Basillusbolymix*) (bio-fertilization) with the mean value 35.30 mm and the lowest recorded by *Seratia* (bio-fertilization) with the mean value 32.78 mm On the other hand, Maturity, fiber strength and Spinning constancy index the highest mean performance were recorded by *Seratia* (fertilizer) with the mean value 0.94, 45.67 and 2991.7 for the three traits respectively. Also, for Uniformity index the desirable and highest mean recorded by *Pseudomonas fluorescens* (fertilizer) with the mean value 86.8 and the lowest value by *Seratia* (fertilizer) with the mean value 82.6. In addition to Micronaire reading the desirable mean was giving by the control treatments with the mean value 3.67. Although, for short fiber the highest was by control treatments with the mean value 13.15 and the lowest mean recorded by *Azotobacter* (fertilizer) with the mean value 2.10.

For Giza 96 variety the results cleared that the desirable mean performance for Uniformity index, Maturity, fiber strength and Spinning constancy index was recorded by used Mix (bio-fertilization) with the mean value 85.73, 10.94, 43.10 and 2365 respectively. Also, the highest mean value for upper half mean (UHM), short fiber and Elongationtraits were recorded by *Azospirillum, Seratia* and control treatment with the mean value were 30.65, 7.38 and 9.23 respectively.

For Giza 95 variety was studied and calculate and the results cleared that the highest mean performances value for upper half mean (UHM), uniformity index, short fiber, Elongation and Spinning constancy index recorded by *Rhizobia*, *Azotobacter, Azospirillum, Seratia* (bio-fertilization) and control treatment with the mean value are 35.05, 86.86, 5.43, 7.27 and 32.5 respectively. Also the Mix (*Azotobacter* + *Azospirillum* + *Pseudomonas fluorescens* + *Seratia* + *Basillusbolymix*) (bio-fertilization) was recorded the highest and desirable mean value for maturity ratio and fiber strength with the mean value 0.94 and 45.46. On the other hand, desirable mean value for Micronaire reading was recorded by *Seratia* (fertilizer) with the mean value 3.63 but the in desirable value was by *Pseudomonas fluorescens* (fertilizer) with the mean value are 4.04. Also, the lowest mean value upper half mean (UHM), uniformity index and maturity ratio was recorded by control treatment with the mean

**Table 5:** Mean performances of the effect of Bio-fertilizer on Upper half mean, Uniformity index, short fiber, Micronaire reading, fiber strength, Elongation and Spinning constancy index of some Egyptian cotton genotypes for the combined data over the 2018 and 2019 growing seasons.

| varieties | Bio-fertilizer type | Upper half mean | Unifo-rmity index | Short fiber per-centagre | Micr-onaire | Stre-ngth | Elon-gation | Spinning Constancy index |
|---|---|---|---|---|---|---|---|---|
| Giza 97 | control | 34.50 | 84.30 | 13.15 | 3.76 | 45.53 | 5.65 | 2582.5 |
| | Azotobacter | 33.88 | 85.23 | 2.10 | 4.07 | 40.57 | 7.70 | 2333.2 |
| | Azospirillum | 33.95 | 86.60 | 4.30 | 3.88 | 43.07 | 7.15 | 2421.0 |
| | Pseud. fluorescens | 33.43 | 86.80 | 3.95 | 4.16 | 44.23 | 6.90 | 2468.0 |
| | Seratia | 32.78 | 82.60 | 10.70 | 4.10 | 45.67 | 5.82 | 2691.7 |
| | Basillusbolymix | 34.35 | 85.75 | 7.48 | 4.08 | 43.23 | 6.55 | 2457.5 |
| | Mix | 35.30 | 86.55 | 4.64 | 3.89 | 43.20 | 6.90 | 2527.3 |
| | Rhizobia | 32.88 | 85.00 | 11.40 | 3.93 | 42.33 | 6.62 | 2428.0 |
| Giza 96 | control | 36.75 | 87.45 | 10.90 | 3.78 | 44.65 | 5.56 | 2572.5 |
| | Azotobacter | 37.10 | 87.23 | 5.65 | 3.73 | 44.50 | 5.51 | 2625.5 |
| | Azospirillum | 36.38 | 87.50 | 13.25 | 3.68 | 44.88 | 5.51 | 2661.0 |
| | Pseud. fluorescens | 36.18 | 86.60 | 11.45 | 3.37 | 43.90 | 6.69 | 2661.7 |
| | Seratia | 36.60 | 86.63 | 8.65 | 3.55 | 45.43 | 5.34 | 2710.5 |
| | Basillusbolymix | 37.15 | 87.18 | 5.40 | 3.60 | 44.87 | 5.88 | 2682.2 |
| | Mix | 36.63 | 86.88 | 6.65 | 3.75 | 41.40 | 6.52 | 2553.0 |
| | Rhizobia | 36.55 | 86.95 | 10.73 | 3.75 | 41.87 | 6.23 | 2564.3 |
| Giza 95 | control | 29.38 | 85.18 | 6.35 | 3.45 | 40.71 | 9.23 | 2260.3 |
| | Azotobacter | 30.38 | 84.78 | 3.45 | 3.87 | 40.40 | 7.22 | 2186.3 |
| | Azospirillum | 30.65 | 84.38 | 5.35 | 4.01 | 41.30 | 7.90 | 2194.5 |
| | Pseud. fluorescens | 30.60 | 84.45 | 5.00 | 4.05 | 41.78 | 8.36 | 2323.7 |
| | Seratia | 29.15 | 83.88 | 7.38 | 3.83 | 40.73 | 8.14 | 2236.7 |
| | Basillusbolymix | 30.05 | 84.23 | 5.18 | 4.10 | 40.93 | 7.81 | 2192.0 |
| | Mix | 30.58 | 85.73 | 3.03 | 4.07 | 43.10 | 8.17 | 2365.0 |
| | Rhizobia | 30.70 | 84.53 | 4.70 | 3.78 | 42.78 | 8.68 | 2264.5 |
| Giza 94 | control | 33.83 | 82.70 | 5.43 | 3.91 | 42.55 | 7.21 | 2543.5 |
| | Azotobacter | 34.48 | 84.03 | 2.38 | 3.95 | 43.25 | 6.73 | 2544.5 |
| | Azospirillum | 34.60 | 86.68 | 3.35 | 3.77 | 42.37 | 7.27 | 2618.2 |
| | Pseud. fluorescens | 34.60 | 84.65 | 3.38 | 4.04 | 43.35 | 6.24 | 2573.0 |
| | Seratia | 34.98 | 85.95 | 2.43 | 3.63 | 43.97 | 6.56 | 2832.5 |
| | Basillusbolymix | 34.70 | 86.35 | 2.43 | 4.03 | 43.02 | 6.15 | 2545.0 |
| | Mix | 35.03 | 85.75 | 2.95 | 4.03 | 45.46 | 6.32 | 2682.0 |
| | Rhizobia | 35.05 | 85.58 | 4.15 | 4.01 | 42.47 | 6.85 | 2526.0 |
| LSD | 0.14 | 0.18 | 0.39 | 0.05 | 0.38 | 0.14 | 6.5 | |

value were 33.83, 82.7 and 0.92. Althing, the lowest mean value for short fiber, fiber strength, Elongation and Spinning constancy index were recorded by *Azotobacter, Azospirillum*, *Basillusbolymix* and *Rhizobia* respectively with the mean value were 2.38, 42.37, 6.15 and 2526 for the above for traits.

The effect of bio-fertilization on the fiber traits for Giza 94 variety was studied and calculate and the results cleared that the highest mean performances value for upper half mean (UHM), uniformity index, short fiber, Elongation and Spinning constancy index recorded by *Rhizobia*, *Azotobacter, Azospirillum, Seratia* (bio-fertilization) and control treatment with the mean value are 35.05, 86.86, 5.43, 7.27 and 32.5 respectively. Also the Mix (*Azotobacter* + *Azospirillum* + *Pseudomonas fluorescens* + *Seratia* + *Basillusbolymix*) (bio-fertilization) was recorded the highest and desirable mean value for maturity ratio and fiber strength with the mean value 0.94 and 45.46. On the other hand, desirable mean value for Micronaire reading was recorded by *Seratia* (fertilizer) with the mean value 3.63 but the in desirable value was by *Pseudomonas fluorescens* (fertilizer) with the mean value are 4.04. Also, the lowest mean value upper half mean (UHM), uniformity index and maturity ratio was recorded by control treatment with the mean value were 33.83, 82.7 and 0.92 Althing, the lowest mean value for short fiber, fiber strength, Elongation and Spinning constancy index were recorded by *Azotobacter, Azospirillum*, *Basillusbolymix* and *Rhizobia* respectively with the mean value were 2.38, 42.37, 6.15 and 2526 for the above for traits. These results are agreement with many authors *i.e*: Zewil and Ahmed 2015, Dhale *et al.,* 2011, Chauhan *et al.,* 2015, Chen *et al.,* 2006, Ghaffari *et al.,* 2018, Ali *et al.,* 2010, Ahamed *et al.,* 2019 and Ahmed *et al.,* 2020.

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