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THE USE OF COMPOST ENRICHED WITH SOME MICROORGANISMS AS A PARTIAL REPLACEMENT OF MINERAL N FERTILIZERS IN SUNFLOWER (HELIANTHUS ANNUUS)

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ABSTRACT

This study was carried out during ٢٠١٠ and ٢٠١١ seasons to examine the effect of using the recommended N (٤٥ kg N/ fed.) either completely via mineral N or ٢٥ to ٧٥ % mineral N form besides ٢٥ to ٧٥ % compost enriched with the four microrganism strains namely *B. polymyxa, Actinomyces, Spirulina plantensis* and EM on growth, seed yield and quality of sunflower cv. Giza- ١٠٢.

Results showed that using ٥٠ to ٧٥ % mineral, N plus ٢٥ to ٥٠ % compost enriched with any of the four microorganisms was very effective in enhancing growth, yield and its components compared with using N through mineral form at ٧٥ to ١٠٠ % without compost or when mineral N was applied at ٢٥ % even with the application of compost enriched with the investigated biofertilizers. The promotive effect of the four microorganisms with compost on the previous parameters could be arranged ascendly as follows, *actinomyces, B. polymyxa, Spirulina plantensis* and EM. A great decline on growth traits, yield and yield components was observed with using ٢٥ % mineral N regardless the organic biofertilization.

The best results in yield and its component of sunflower cv. Giza- ١٠٢ were obtained when using the recommended N (٤٥ kg N/ fed.) via ٥٠ % mineral form plus ٥٠ % compost enriched with EM.

INTRODUCTION

Sunflower (*Helianthus annuus*, L.) belonging to the family composite, is a major oil seed, used for the production of edible oil. It is considered as one of the four important annual crops in the world for edible oil. Seeds of sunflower contain ٢٤ – ٤٩ % oil. The cake contains ٢٥ – ٣٥ % protein which is mostly fed to livestock because of its high biological value. Sunflower seeds are eaten as salted whole seeds and as roasted nut meats. Oil is characterized by its high content of unsaturated fatty acids such as oleic and lenoleic which represent ٩٠ % of the total fatty acids that are responsible for reducing blood cholesterol levels (Saleh *et al*., ٢٠٠٨).

Organic agricultural practices aim to enhance biodiversity, biological cycle and soil biological activity so as to achieve optimal natural system that are socially, ecologically and economically sustainable (Karmakar et al., ٢٠٠٧). Excessive nitrogen fertilization of sunflower not only generates the environmental risk but it may also affect the grain quality, decreasing its oil content and reducing yield through an increase of plant lodging (Schemer et al., ٢٠٠٢). Soil microbes play an important role in many critical ecosystem processes, including nutrient cycling and homeostasis, decomposition of organic matter as well as promoting plant health and growth as biofertilization (Han et al., ٢٠٠٧). Certain strains are referred to act as plant growth promoting rhizobacteria, which can be used as inoculant biofertilizers (Kennedy et al., ٢٠٠٤). These bacteria include species of Azotobacter, Azospirillum and Bacillus polymyxa, they provide direct and indirect effects on plant growth and pest resistance (Nelson, ٢٠٠٤). Using actinomyces and algae is beneficial in this respect. In recent years, biofertilizers have emerged as a promising component of integrating nutrient supply system in agriculture. One whole system of agriculture depends in many important ways, on microbial activities and there appears to be a tremendous potential for making use of microorganisms in increasing crop production. Microbiological fertilizers are considered an important part of environment friendly sustainable agricultural practices (Bloemberg et al., ٢٠٠٠). The selection of compost management depends on environmental regulations for preventing pollution of land, water and air (Karmakar et al., ٢٠٠٧). In this field, many experiments were conducted to study the effect of biofertilizers alone or in combination with other chemical fertilizers (Ram Rao et al., ٢٠٠٧ and Seema et al., ٢٠٠٠). Sunflower gave a higher yield and better fruit quality from combination of organic compost along with chemical fertilizer (Dayal and Agarwal, ١٩٩٨).

$EM_{١}$ (effective microorganisms) contains more than ٦٠ strains of microorganisms specially photosynthetic bacteria, *Rhadopseudomonass plustris*, *Rhadobacterphaerods lactic acid bacteria, Lactobacillus planteru, Lactobacillus case, Streptococcus lactis,* yeast namely *Saccharomyces cerevisiae* and others like microhiza (Chela *et al*., ١٩٩٣)

Application of N through all sources was found by many authors to enhance yield quantitively and qualitatively of field crops (Chela *et al*., ١٩٩٣; Dayal and Agarwal, ١٩٩٨; Ramesh *et al*., ١٩٩٩; Ghani *et al*., ٢٠٠٠; Gorttappeh *et al*., ٢٠٠٠; Nanjundappa *et al*., ٢٠٠١; Saeed *et al*., ٢٠٠٢; Khaliq, ٢٠٠٤ Saleh *et al*., and Akbari *et al*., ٢٠١١).

The aim of the present studying was testing the effect of different proportions of mineral and compost enriched with some microorganisms on the growth seed yield and quality of sunflower cv. Giza- ١٠٢.

MATERIALS AND METHODS

This field experiment was conducted in a private field located at El-Kawamel village, near Souhag district, Souhag Governorate on Sunflower (Helianthus annuus, L.). Soil samples were taken at random from the experimental field area at depth of ٣٠ cm. before sowing for both mechanical and chemical analysis (Table ١). Analysis of the soil was done according to Cottenie et al., (١٩٨٢).

Table ١: Analysis of the tested soil:

Constituents	Values
Sand %	: ٤.٥
Silt %	: ٢٥.٥
Clay %	: ٧٠.٠
Texture	: Clay
pH (١:٢.٥ extract)	: ٧.٥٥
E.C (١: ٢.٥ extract as mmhos/ ١ cm ٢٥° C)	: ٠.٩٦
O.M. %	: ١.٨٠
$CaCO_{٣}$ %	: ٢.٢٠
Total N %	: ٠.٠٩
Available K (ammonium acetate, ppm)	: ٣٥٠
Available P (Olsen method, ppm)	: ٤.٢

Sunflower cv. Giza ١٠٢ seeds were sown in the first week of May during ٢٠١١ and ٢٠١٢ seasons. Each experimental unit included six ridges ٥٠ cm apart and ٧ m long, resulted an area of ٢١ m٢ (١/٢٠٠ fed.). seeds were sown on the ridges in hills ٢٠ cm apart. One plant per hill was maintained at ٢ – ٤ leaf stage of the plant (nearly ٢١ days after sowing). The normal procedures of organic practices were done as usually in sunflower fields.

The present investigation involved the following fourteen treatments from in randomized complete blocks with four replicates as following: -

١. Application of recommended N fertilizer (٤٥ kg/ fed), ١٠٠ % mineral N.
٢. Application of ٧٥ % of recommended mineral N.
٣. Application of ٧٥ % of recommended mineral N plus ٢٥ % compost enriched with *Bacillus polymyxa* at rate of ٠.٥ tons/ fed.
٤. Application of ٧٥ % of recommended mineral N plus ٢٥ % compost enriched with *actinomyces* at rate of ٠.٥٢٤ tons/ fed.
٥. Application of ٧٥ % of recommended mineral N plus ٢٥ % compost enriched with *Spirulina plantensis* at rate of ٠.٤٧ tons/ fed.
٦. Application of ٧٥ % of recommended mineral N plus ٢٥ % compost enriched with EM at rate of ٠.٤٣ tons/ fed.
٧. Application of ٥٠ % of recommended mineral N plus ٥٠ % compost enriched with *B. polymyxa* at rate of ١.٠ ton/ fed.
٨. Application of ٥٠ % of recommended mineral N plus ٥٠ % compost enriched with *actinomyces* at rate of ١.٠٥ tons/ fed.
٩. Application of ٥٠ % of recommended mineral N plus ٥٠ % compost enriched with *Spirulina plantensis* at rate of ٠.٩٤ ton/ fed.
١٠. Application of ٥٠ % of recommended mineral N plus ٥٠ % compost enriched with EM at rate of ٠.٨٦ ton/ fed.
١١. Application of ٢٥ % of recommended mineral N plus ٧٥ % compost enriched with *B. polymyxa* at rate of ١.٥ tons/ fed.
١٢. Application of ٢٥ % of recommended mineral N plus ٧٥ % compost enriched with *actinomyces* at rate of ١.٥٧ tons/ fed.
١٣. Application of ٢٥ % of recommended mineral N plus ٧٥ % compost enriched with *Spirulina plantensis* at rate of ١.٤١ tons/ fed.
١٤. Application of ٢٥ % of recommended mineral N plus ٧٥ % compost enriched with EM at rate of ١.٢٩ tons/ fed.

The use of compost enriched with some microorganisms

Mineral N source i.e. ammonium sulphate (٢٠.٦ % N) was divided into two equal doses the first applied at ٢١ days after sowing and the second at one month later. Compost enriched with the four microorganisms was added once at sowing time. Enriched composts were prepared (three weeks before use) by adding ٥٠ ml from *Bacillus polymyxa* containing ١٠×١٠^{٥} cells *actinomyces, S. plantensis* containing ١٠×١٠^{٦} cells and EM for ١٠٠ kg compost for preparing compost enriched with *B. polymyxa*, *actinomyces*, *S. plantensis* and EM, respectively. Data in Table (٢) show the chemical analysis of the different enriched composts.

Table ٢: Analysis of the different enriched composts:

Types of compost	Values			
	N %	OM %	P %	K %
Compost enriched with *Bacillus polymyxa*	٢.٦٠	٢٩.٥	٠.٩٩	١.٠٠
Compost enriched with *actinomyces*	٢.٤٠	٣٠.٠	٠.٥٠	٠.٩٥
Compost enriched with *Spirulina plantensis*	٢.٢٥	٣٠.٠	٠.٤٥	٠.٦٦
Compost enriched with EM	٢.١٥	٣٠.٠	٠.٣٩	٠.٥٠

At harvest a sample of five plants from every plot were chosen at random to measure the following characters:-

١. Plant height (cm.).
٢. Stem diameter (cm.).
٣. Head diameter (cm.).
٤. Head weight (gm.).
٥. Number of seeds/ head.
٦. Seed index (gm.).
٧. Seed weight/ plant.
٨. Seed yield/ fed.
٩. Straw yield/ fed.
١٠. Shelling percentage.
١١. Oil percentage, (according to A.O.A.C., ١٩٩٥).
١٢. Oil yield/ fed.
١٣. Protein percentage, (according to Hymowiz *et al*., ١٩٧٧).
١٤. Chlorophyll a (mg/ g. F.W).
١٥. Chlorophyll b (mg/ g. F.W).
١٦. Carortenoids (mg/ g. F.W).

Chlorophylls a and b and carotenoids were determined according to (Moran, ١٩٨٢).

Statistical analysis was carried out according to Mead *et al*., (١٩٩٣) using new L.S.D (revised) at ٠.٠٥ for comparing among the different treatment means.

RESULTS AND DISCUSSION

١- Growth characters:

It is clear from the data in Table (٣) that fertilized of sunflower plants with (٤٥ kg N/ fed) through ٥٠ to ٧٥ % mineral N form besides ٢٥ to ٥٠ % compost enriched with any of the four microorganisms significantly resulted in enhancing the two growth characters namely plant height and stem diameter in relative to using mineral N at ٧٥ to ١٠٠ % or when mineral N was added at ٢٥ % even with using enriched composts. The promotion was significantly associated with reducing mineral N from ١٠٠ to ٥٠ % and at the same time increasing percentages of enriched compost from ٠.٠ to ٥٠ %. A significant reduction on these growth characters was observed with using ٢٥ % mineral N besides different enriched composts. Significant differences on these growth characters were observed among most N management. Enriching compost with *actinomyces, B. polymyxa, S. plantensis* and EM, in ascending order was significantly very effective in enhancing these growth aspects. Treating the sunflower plants with N through ٥٠ % mineral N plus ٥٠ % compost enriched with EM gave the greatest values. The lowest values were recorded on the plants that received N through ٢٥ % mineral N plus ٥٠ % compost enriched with *actinomyces*. Similar results were announced during both seasons.

The beneficial effects of organic and biofertilization on controlling N uptake as well as enhancing biological, physical and chemical fertility of soil, fixation of N as well as secretion of antibiotics and natural hormones and vitamins B could explain the present results (Schemer *et al*., ٢٠٠٢ and Han *et al*., ٢٠٠٧).

These results are in harmony with those obtained by Ghani *et al*., (٢٠٠٠); Gorttappeh *et al*., (٢٠٠٠) and Nnjandappa *et al*., (٢٠٠١).

٢- Head Characters:

It is clear from the data in Table (٣) that using N as ٥٠ to ٧٥ % mineral N plus compost enriched with any one of the four microorganisms significantly enhanced head diameter and head weight per plant. This however, was responsible significantly for reducing number of seeds/ head rather than using N as ٧٥ to ١٠٠ % mineral N without organic and biofertilization or using mineral N at ٢٥ % + compost enriched with any one of the four biofertilizers. The effect either in promotion or reduction was mainly attributed to using *actinomyces, B. polymyxa, S. plantensis* and EM with compost, in ascending order. The maximum values of head diameter and head weight per plant were recorded on the plants that received N through ٥٠ % mineral N plus compost enriched with EM at ٥٠ %. The maximum values of number of seeds per head were recorded on the plants fertilized with N through ٢٥ % mineral N + ٧٥ % compost enriched with *actinomyces*. The best microorganisms applied with compost were, *actinomyces, B. polymyxa, S. plantensis* and EM, in ascending order with regard to head diameter and weight of heads/ plant and the vice versa was obtained regarding number of seeds per head. These results were true during both seasons.

The beneficial effects of organic and biofertilizations on enhancing growth and nutritional status of the plants in fvaour of producing larger heads. The opposite relation between diameter and weight of head from one side and number of seeds/ head from the other side could explain the present results.

These results are in accordance with those obtained by Khaliq (٢٠٠٤).

٣- Seed index and shelling %.

Data in Table (٤) obviously reveal that different mineral , organic and biofertilization treatments had no significant effect on shelling % during both seasons while they were significantly responsible for varying seed index. Application of N through ٥٠ to ٧٥ % mineral N plus compost enriched with any one of the four biofertilizers significantly was accompanied with increasing seed index in relative to application of N as ٧٥ to ١٠٠ % mineral N alone or when using mineral N at percentage lower than ٥٠ % with enriched composts. A significant reduction on such characters was observed with reducing mineral N % from ٥٠ to ٢٥ % even with the application of enriched composts at ٧٥ %. Using *actinomyces*, *B. polymyxa, S. plantensis* and EM, in ascending order was significantly followed by increasing seed index. The maximum seed index was recorded on the plants that were fertilized with N as ٥٠ % mineral plus compost enriched with EM at ٥٠ %. Supplying the plants with N via ٢٥ % mineral N + ٧٥ % compost enriched with *actinomyces* gave the lowest values. These results were true during both seasons.

The promotive effect of organic and biofertilization on plant nutritional status was surely reflected on enhancing seed index.

These results are in approval wit those obtained by Khaliq (٢٠٠٤).

٤- Seeds, straw and oil yields.

It is clear from the data in Tables (٤ & ٥) that straw and seed yields per plant and per feddan as well as oil yield/ feddan and biomass were significantly improved in response to application of the suitable N through ٥٠ to ٧٥ % mineral N plus compost enriched with any one of the four microorganisms strains at ٢٥ to ٥٠ % in relative to using N as ٧٥ to ١٠٠ % mineral N alone as well as when mineral N was added at ٢٥ % enriched composts at ٧٥ %. The efficiency of the four microorganisms applied with compost on improving yield could be arranged ascendly as follows *actinomyces*, *B. polymyxa*, *S. plantensis* and EM. A significant decline on the yield was noticed with reducing mineral N from ٥٠ to ٢٥ % even with the application of enriched composts. Treating the plants with N through ٥٠ % mineral N + compost enriched with EM at ٥٠ % gave the maximum values of seed yield (١.٩٥ and ١.٩٣ tons), straw yield (٧.٨٦ and ٧.٦٨ tons) and oil yield (٦٧٢.٦ and ٦٦٢ kg) per feddan during the two seasons, respectively. The lowest values of seed yield (١.٧٦ and ١.٧٤), straw yield (٦.٤٦ and ٦.٤٠ tons) and oil yield (٥٤٧.٥ and ٥٣٧.٧ kg) during both seasons, respectively were observed with using N via ٢٥ % mineral + ٧٥ % compost enriched with *actinomyces*. These results were true during both seasons.

The great profits of organic and biofertilization on yield might be attributed to their positive action on enhancing growth and nutritional status of the plants in favour of producing great number of heads and seeds.

These results are in agreement with those obtained by Saeed *et al* (٢٠٠٢); Khaliq (٢٠٠٤) and Akbari *et al*., (٢٠١١).

٥- Seed and leaf chemical composition.

As data shown in Table (٥), it is concluded that oil % and proteins % in the seeds as well as plant pigments namely chlorophylls a & b, total caroteniods and total chlorophylls in the leaves were significantly improved with using the suitable N through ٥٠ to ٧٥ % mineral N plus enriched composts at ٢٥ to ٧٥ % comparing with using N through ٧٥ to ١٠٠ % mineral N alone or when using mineral N at ٢٥ % plus enriched composts at ٧٥ %. The superiority of the four microorganisms strains applied with compost on these chemical parameters was arranged as follows in ascending order, *actinomyces, B. polymyxa*, *S. plantensis* and EM. Reducing percentages of mineral N from ٥٠ to ٢٥ % even with the application of enriched composts at ٧٥ % caused a significant reduction on these parameters. The highest values were recorded with using N via ٥٠ % mineral + ٥٠ % compost enriched with EM. Supplying the plants with N as ٢٥ % mineral plus ٧٥ % compost enriched with *actinomyces* recorded the minimum values.

The beneficial effect of organic and biofertilization on availability and uptake of various nutrients surely reflect on enhancing these chemical traits.

These results are in agreement with those obtained by Saeed *et al* (٢٠٠٢); Khaliq (٢٠٠٤) and Akbari *et al*., (٢٠١١).

As a conclusion, supplying sunflower Giza- ١٠٢ plants with N (٤٥ kg/ fed/ year) through ٥٠ % mineral N plus ٥٠ % compost enriched with EM was suggested to be beneficial for improving yield quantitively and qualitatively.

Table ٣: Effect of mineral N and plant compost enriched with different microorganisms on some growth and head characters of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.

Mineral , organic and bioforms of N treatments	Plant height (cm.)		Stem diameter (cm.)		Head diameter (cm.)		Head weight/ Plant (g.)		No. of seed/ head	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
١٠٠ % mineral	١٢٩.٩	١٣١.٠	١.٩٩	٢.٠١	١٧.٢٦	١٧.٢٠	٧٦.٠	٧٤.٥	٧٣٦.٠	٧٢٨.٣
٧٥ % mineral	١٢٨.٠	١٢٩.١	١.٩٦	١.٩٨	١٧.١٥	١٧.٠٩	٧٥.٠	٧٣.٤	٧٣١.٢	٧٢٥.٤
٧٥ % mineral + ٢٥ % compost + *B. polymyxa*	١٣٣.٣	١٣٤.٤	٢.٠٧	٢.٠٩	١٧.٥٠	١٧.٤٣	٧٧.٠	٧٥.٥	٧٢٣.١	٧١٤.١
٧٥ % mineral + ٢٥ % compost + *actinomyces*	١٣١.٠	١٣٢.١	٢.٠٣	٢.٠٥	١٧.٣٧	١٧.٣١	٧٦.٥	٧٥.٠	٧١٧.٤	٧٢٠.٨
٧٥ % mineral + ٢٥ % compost + *S. plantensis*	١٣٥.٠	١٣٦.١	٢.١٠	٢.١٢	١٧.٦٢	١٧.٥٥	٧٧.٥	٧٦.١	٧٢٠.١	٧١٤.٣
٧٥ % mineral + ٢٥ % compost + EM	١٣٨.٩	١٤٠.٠	٢.١٣	٢.١٥	١٧.٧٢	١٧.٦٧	٧٨.٠	٧٦.٥	٧٠٦.٠	٧٠٠.١
٥٠ % mineral + ٥٠ % compost + *B. polymyxa*	١٤٤.٠	١٤٥.٢	٢.٢٠	٢.٢٢	١٧.٨٧	١٧.٨٦	٧٨.٩	٧٧.٤	٦٩٩.٠	٦٩٣.٣
٥٠ % mineral + ٥٠ % compost + *actinomyces*	١٤١.٥	١٤٢.٦	٢.١٧	٢.١٩	١٧.٨٢	١٧.٧٥	٧٨.٣	٧٧.٠	٦٦١.٨	٦٥٥.٨
٥٠ % mineral + ٥٠ % compost + *S. plantensis*	١٤٧.٠	١٤٨.١	٢.٢٣	٢.٢٥	١٧.٩٠	١٧.٨٣	٧٩.٣	٧٨.٠	٦٩٩.٣	٦٩٣.٦
٥٠ % mineral + ٥٠ % compost + EM	١٤٩.١	١٥٠.٢	٢.٢٧	٢.٢٩	١٧.٩٥	١٧.٩١	٨٠.٥	٧٩.٠	٦٩٩.١	٦٩٣.٥
٢٥ % mineral + ٧٥ % compost + *B. polymyxa*	١٢٢.٩	١٢٤.٠	١.٨٧	١.٨٩	١٦.٨١	١٦.٧٤	٧٢.٦	٧١.٠	٧٥٤.٢	٧٤٧.٩
٢٥ % mineral + ٧٥ % compost + *actinomyces*	١٢١.٠	١٢٢.١	١.٨٢	١.٨٥	١٦.٧١	١٦.٦٥	٧٢.١	٧٠.٥	٧٦٠.٣	٧٥٢.٢
٢٥ % mineral + ٧٥ % compost + *S. plantensis*	١٢٥.٠	١٢٦.١	١.٩٠	١.٩٢	١٦.٩٢	١٦.٨٠	٧٣.٠	٧١.٥	٧٥٠.٠	٧٤٣.٧

٢٥ % mineral + ٧٥ % compost + EM	١٢٧.٠	١٢٨.٣	١.٩٢	١.٩٤	١٧.٠٢	١٦.٩١	٧٤.٠	٧١.٨	٧٤١.٤	٧٤٥.٠
New L.S.D at ٠.٠٥	١.٠	١.١	٠.٠٣	٠.٠٣	٠.٠٩	٠.٠٨	٠.٣	٠.٣	٥.١	٦.٠

Table ٤: Effect of mineral N and plant compost enriched with different microorganisms on seed index, straw and seed yield per plant, straw, seed and oil yield/ fed. and shelling % of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.

Mineral , organic and bioforms of N treatments	Seed index (g.)		Seed yield per plant (g.)		Straw yield per plant		Seed yield per fed. (ton.)		Straw yield per fed. (ton.)		Oil yield per fed. (kg.)		Shelling %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
١٠٠ % mineral	٦.٢٥	٦.٢٢	٤٦.٠	٤٥.٣	١٧٦.٠	١٧٤.٥	١.٨٤	١.٨١	٧.٠٤	٦.٩٨	٥٩٢.٥	٥٧٩.٢	٦٠.٥	٦٠.٨
٧٥ % mineral	٦.٢٢	٦.١٩	٤٥.٧	٤٤.٩	١٧٣.٠	١٧١.٥	١.٨٣	١.٨٠	٦.٩٢	٦.٨٦	٥٨٥.٦	٥٧٢.٦	٦٠.٩	٦١.٢
٧٥ % mineral + ٢٥ % compost + *B. polymyxa*	٦.٥٠	٦.٤٧	٤٧.٠	٤٦.٢	١٨٤.٠	١٨٢.٥	١.٨٨	١.٨٥	٧.٣٠	٧.٣٠	٦١٦.٨	٦٠٣.٣	٦١.٠	٦١.٢
٧٥ % mineral + ٢٥ % compost + *actinomyces*	٦.٣٧	٦.٣٤	٤٦.٥	٤٥.٧	١٨٠.٠	١٧٨.٥	١.٨٦	١.٨٣	٧.٢٠	٧.١٤	٦٠٤.٥	٥٩١.١	٦٠.٨	٦٠.٩
٧٥ % mineral + ٢٥ % compost + *S. plantensis*	٦.٦١	٦.٥٨	٤٧.٦	٤٧.٠	١٨٧.٠	١٨٥.٥	١.٩٠	١.٨٨	٧.٤٨	٧.٤٢	٦٢٩.١	٦١٨.٧	٦١.٤	٦١.٨
٧٥ % mineral + ٢٥ % compost + EM	٦.٧٠	٦.٦٧	٤٧.٣	٤٦.٧	١٩٠.٠	١٨٨.٥	١.٨٩	١.٨٧	٧.٦٠	٧.٥٤	٦٣٣.٢	٦٢٠.٨	٦٠.٦	٦١.٠
٥٠ % mineral + ٥٠ % compost + *B. polymyxa*	٦.٩١	٦.٨٨	٤٨.٣	٤٧.٧	١٩٣.٠	١٩١.٥	١.٩٣	١.٩٢	٧.٧٢	٧.٦٦	٦٥٦.٢	٦٤٩.٠	٦١.٧	٦٢.٧
٥٠ % mineral + ٥٠ % compost + *actinomyces*	٦.٨٠	٦.٧٧	٤٨.٠	٤٧.٤	١٩١.٠	١٨٩.٥	١.٩٠	١.٩٠	٧.٦٤	٧.٥٨	٦٤٠.٥	٦٣٦.٧	٦١.٣	٦١.٧
٥٠ % mineral + ٥٠ % compost + *S. plantensis*	٦.٩٥	٦.٩٢	٤٨.٦	٤٨.٠	١٩٤.٠	١٩٢.٥	١.٩٤	١.٩٢	٧.٧٦	٧.٧٠	٦٦٤.٥	٦٥١.١	٦١.٣	٦١.٥
٥٠ % mineral + ٥٠ % compost + EM	٦.٩٨	٦.٩٥	٤٨.٨	٤٨.٢	١٩٦.٥	١٩٥.٠	١.٩٥	١.٩٣	٧.٨٦	٧.٨٠	٦٧٢.٦	٦٦٦.٢	٦٠.٦	٦٠.٨
٢٥ % mineral + ٧٥ % compost + *B. polymyxa*	٥.٩٠	٥.٨٧	٤٤.٥	٤٣.٩	١٦٣.٩	١٦٢.٠	١.٧٨	١.٧٦	٦.٥٦	٦.٤٨	٥٥٧.١	٥٤٧.٤	٦١.٣	٦١.٨
٢٥ % mineral + ٧٥ % compost + *actinomyces*	٥.٨٠	٥.٧٧	٤٤.١	٤٣.٤	١٦١.٥	١٦٠.٠	١.٧٦	١.٧٤	٦.٤٦	٦.٤٠	٥٤٧.٥	٥٣٧.٧	٦١.٢	٦١.٦
٢٥ % mineral + ٧٥ % compost + *S. plantensis*	٦.٠٠	٥.٩٧	٤٥.٠	٤٤.٤	١٦٧.٠	١٦٥.٥	١.٨٠	١.٧٨	٦.٦٨	٦.٦٢	٥٦٧.٠	٥٥٥.٤	٦١.٦	٦٢.١
٢٥ % mineral + ٧٥ % compost + EM	٦.١١	٦.٠٠	٤٥.٣	٤٤.٧	١٧٠.٠	١٦٨.٥	١.٨١	١.٧٩	٦.٨٠	٦.٧٤	٥٧٣.٨	٥٦٣.٩	٦١.٧	٦٢.٣
New L.S.D at ٠.٠٥	٠.٠٩	٠.٠٩	٠.٣	٠.٤	٢.١	٢.٢	٠.٠٥	٠.٠٤	٠.٠٥	٠.٠٥	٥.١	٥.٢	NS	NS

Table ٥: Effect of mineral N and plant compost enriched with different microorganisms on oil %, biomass yield, protein % and some plant pigments of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.

Mineral , organic and bioforms of N treatments	Oil %		Proteins %		Chlorophyll a (mg/ ١ g. F.W)		Chlorophyll b (mg/ ١ g. F.W)		Total carotenoids (mg/ ١ g. F.W)	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
١٠٠ % mineral	٣٢.٢٠	٣٢.٠٠	١٦.٦	١٦.٠	٢.٦١	٢.٥٠	١.٣٦	١.٣٠	١.٥٧	١.٥٠
٧٥ % mineral	٣٢.٠٠	٣١.٨١	١٦.٣	١٥.٧	٢.٥٠	٢.٣٩	١.٣٠	١.٢٤	١.٥٠	١.٤٣
٧٥ % mineral + ٢٥ % compost + *B. polymyxa*	٣٢.٨١	٣٢.٦١	١٧.٣	١٦.٧	٢.٨٥	٢.٧٤	١.٥٠	١.٤٤	١.٧٠	١.٦٣
٧٥ % mineral + ٢٥ % compost + *actinomyces*	٢٣.٥٠	٣٢.٣٠	١٧.٠	١٦.٤	٢.٧٣	٢.٦٢	١.٤٢	١.٣٦	١.٦٢	١.٥٥
٧٥ % mineral + ٢٥ % compost + *S. plantensis*	٣٣.١١	٣٢.٩١	١٧.٥	١٦.٩	٢.٩٦	٢.٨٥	١.٥٦	١.٥٠	١.٨٠	١.٧٣
٧٥ % mineral + ٢٥ % compost + EM	٣٣.٥٠	٣٣.٢٠	١٧.٨	١٧.٢	٢.٩٩	٢.٨٨	١.٦٢	١.٥٦	١.٧٥	١.٦٨
٥٠ % mineral + ٥٠ % compost + *B. polymyxa*	٣٤.٠٠	٣٣.٨٠	١٨.٤	١٧.٨	٣.٢٥	٣.١٢	١.٧٢	١.٦٦	١.٩٨	١.٩١
٥٠ % mineral + ٥٠ % compost + *actinomyces*	٣٣.٧١	٣٣.٥١	١٨.١	١٧.٤	٣.١١	٣.٠٠	١.٦٧	١.٦١	١.٩٢	١.٨٥
٥٠ % mineral + ٥٠ % compost + *S. plantensis*	٣٤.٢٥	٣٣.٩١	١٨.٥	١٧.٩	٣.٥٠	٣.٣٩	١.٧٩	١.٧٢	٢.٠٥	٢.٠٠
٥٠ % mineral + ٥٠ % compost + EM	٣٤.٥٠	٣٤.٣٠	١٨.٨	١٨.١	٣.٦١	٣.٤٩	١.٨٤	١.٧٨	٢.١٦	٢.١٠
٢٥ % mineral + ٧٥ % compost + *B. polymyxa*	٣١.٣٠	٣١.١٠	١٥.٣	١٤.٧	٢.١١	٢.٠٠	١.١١	١.٠٥	١.٣٠	١.٢٣
٢٥ % mineral + ٧٥ % compost + *actinomyces*	٣١.١١	٣٠.٩٠	١٥.٠	١٤.٤	١.٩٩	١.٨٦	١.٠٥	١.٠٠	١.٢١	١.١٤
٢٥ % mineral + ٧٥ % compost + *S. plantensis*	٣١.٥٠	٣١.٢٠	١٥.٦	١٤.٩	٢.٢٥	٢.١٥	١.١٧	١.١١	١.٣٦	١.٢٦
٢٥ % mineral + ٧٥ % compost + EM	٣١.٧٠	٣١.٥٠	١٦.٠	١٥.٥	٢.٣٥	٢.٣٠	١.٢٣	١.١٧	١.٤٢	١.٣٦
New L.S.D at ٠.٠٥	٠.١٥	٠.١٤	٠.٣	٠.٣	٠.١١	٠.١٢	٠.٠٥	٠.٠٤	٠.٠٥	٠.٠٥

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The use of compost enriched with some microorganisms

"استخدام الكمبوست الملقح ببعض الكائنات الحية الدقيقة الفعالة كبديل جزئي للأسمدة النيتروجينية المعدنية في دوار الشمس"

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أجريت هذه الدراسة خلال موسمي ٢٠١٠ ، ٢٠١١ لاختبار تأثير استخدام المعدل المناسب من النيتروجين (٤٥ كجم للفدان) إما فى صورة أسمدة معدنية نيتروجينية كاملة أو من خلال إضافته فى صورة أسمدة نيتروجينية معدنية بنسبة ٢٥ الى ٧٥ % جنبا الى جنب مع استخدام الكمبوست الملقح بأربعة سلالات من الكائنات الحية الدقيقة وهى الباسيلس البوليميكسا ، الاكتينوميسيتات ، الاسبيريولينا بلانتسيس والكائنات الحية الدقيقة الفعالة (EM) على النمو وكمية محصول النبات وخصائص الجودة لبذور دوار الشمس صنف جيزة ١٠٢.

أشارت نتائج الدراسة إلى أن استخدام الجرعة الموصي بها من النيتروجين بنسبة ٥٠ الى ٧٥ % أسمدة نيتروجينية معدنية جنبا الى جنب مع استخدام الكمبوست الملقح بأى من سلالات الكائنات الحية الدقيقة بنسبة ٢٥ الى ٥٠ % كان فعالا جدا فى تحسين النمو والمحصول وخصائص الجودة وذلك بالمقارنة باستخدام الكمية المثلى من النيتروجين فى الصورة المعدنية بنسبة ٧٥ الى ١٠٠ % أو عند استخدام الصورة المعدنية من النيتروجين بنسبة ٢٥ % حتى مع استخدام الكمبوست الملقح بالأسمدة الحيوية تحت الدراسة.

وكان التحسن الناتج من استخدام السلالات الأربعة من الكائنات الدقيقة على صفات الدراسة ناتجا من استخدام الاكتينوميسيتات ، الباسيلس بوليميكسا – الاسبيريولينا بلانتسيس ، الكائنات الحية الدقيقة الفعالة (EM) مرتبة ترتيبا تصاعديا وكان هناك نقص ملحوظ فى صفات النمو وكمية المحصول ومكوناته عند استدام النيتروجين فى الصورة المعدنية بنسبة ٢٥ % بغض النظر عن استخدام التسميد العضوي والحيوي.

أمكن الحصول على أفضل النتائج بخصوص المحصول ومكوناته لدوار الشمس صنف جيزة ١٠٢ عند استخدام الجرعة الموصي بها من النيتروجين (٤٥ كجم نيتروجين للفدان) فى الصورة المعدنية بنسبة ٥٠ % جنبا الى جنب مع الكمبوست الملقح بالكائنات الحية الدقيقة الفعالة بنسبة ٥٠ %.