**INTRODUCTION**

Wheat (*Triticum aestivum* L.) which belongs to the grass family Poaceae (Gramineae) is considered the first important and strategic cereal crop for the majority of world’s populations. Wheat is both the most important grain and the single largest crop by area in Egypt (FAO 2022).

It is the most important staple food of about two billion people and provides nearly 55% of the carbohydrates and 20% of the food calories consumed globally (Briggle and Reitz, 1963 and Simmonds, 1976). Wheat exceeds in acreage and production every other grain crops, i.e., rice, maize, etc., and it is cultivated over a wide range of climatic conditions (Tomic et al., 2016).

In Egypt, wheat represents almost 10% of the total value of agricultural production and about 20% of all agricultural imports (GASC, 2020), and this is due to the majority of Egyptians are able to purchase a form of flat bread called Baladi at a heavily subsidized price. Wheat has managed to increase its share of the winter cropped area ranged from 41 to 47%, and the cultivated area is limited to the narrow strip along the Nile Valley (FAO, 2015). Therefore attempts have been made to expand the cultivated area in Egypt by reclaiming new lands using irrigation. The amount of wheat production in Egypt is about of 9 million metric tons in 2021 with an increase of 1.12% from the previous years (FAO, 2022), in a trial to increase wheat cultivation area to decrease dependency on wheat importing.

Organic manures applications were found to enhance plant growth or improve yield. A trial to evaluate the efficiency of four organic conditioners (composted town refuse, poultry manure, sewage sludge and biogas residues) for improvement the chemical and physical characters of four soils was carried out at El-Fayoum area known with their below production levels (El-Shakweer et al., 1998).
Effect of long-term manuring and fertilization on soil biological properties under the long-term fertilization experiment on wheat was evaluated on Vertisols using nine treatments (Katkar et al., 2011). They showed that the soil enzyme activity, viz. dehydrogenase (55.01 μg TPF/g/24 hr), urease (47.9 mg NH₄/kg/24 hr) and cellulase (52.23 μg glucose/g/24 hr) were significantly influenced with the application of 100% RDF + FYM at 10 tones/ha.

This study was designed to determine the effect of a combination of 50% nitrogen fertilization (mineral), organic fertilizer and SEWRI inoculum plus an identified strain of streptomycetes as a biofertilizer agent on improvement of wheat productivity under the conditions of new sandy soils.

### MATERIALS AND METHODS

#### Location and seasons:
During the 2019/2020 and 2020/2021 two experiments in successive winter seasons were conducted at Ismailia Agricultural Research Station, Ismailia Governorate, Egypt.

#### Source of wheat grains:
Wheat grains cultivar (Misr 01) was kindly obtained from Seed Management, Agricultural Research Center (ARC), Giza, Egypt.

#### Soil analyses and preparation:
Before planting and during plant bed preparation, soil sample was taken from the surface layer 0-30 cm and analyzed for the most proper mechanical and physicochemical properties according to method of Kilmer and Alexander (1949) and recorded in Table-1. The soil was prepared for cultivation as described by Helmy et al., (2014).

### Table -1: Mechanical and chemical analyses of cultivated soil among two seasons.

| Parameters                                                                 | 1st Season | 2nd Season |
|----------------------------------------------------------------------------|------------|------------|
| Mechanical analysis                                                        |            |            |
| Sand (%)                                                                   | 40.60      | 41.50      |
| Find sand (%)                                                              | 44.30      | 44.20      |
| Silt (%)                                                                   | 11.50      | 12.00      |
| Clay (%)                                                                   | 4.500      | 04.800     |
| Textures                                                                   | Sandy      | Sandy      |
| Chemical analysis                                                          |            |            |
| pH (1:2.5)                                                                 | 7.850      | 07.890     |
| E.C. (dSm⁻¹ at 25°C)                                                       | 3.060      | 03.070     |
| SP (%)                                                                     | 25.00      | 26.000     |
| Soluble cations (meq/L)                                                    |            |            |
| Ca²⁺                                                                      | 9.000      | 08.400     |
| Mg²⁺                                                                      | 8.000      | 08.400     |
| Na⁺                                                                       | 1.000      | 00.950     |
| K⁺                                                                        | 12.00      | 11.500     |
| Soluble anions (meq/L)                                                     |            |            |
| CO₃²⁻                                                                     | 00.00      | 00.000     |
| HCO₃⁻                                                                     | 01.20      | 01.250     |
| Cl⁻                                                                       | 22.30      | 23.300     |
| SO₄²⁻                                                                     | 06.50      | 05.400     |
| Total-N (%)                                                                | 0.018      | 00.020     |
| NPK content                                                               |            |            |
| Total soluble-N (mg Kg⁻¹)                                                  | 64.00      | 067.20     |
| Available-P (mg Kg⁻¹)                                                      | 5.560      | 05.950     |
| Available-K (mg Kg⁻¹)                                                      | 71.94      | 069.50     |
| DTPA-extract (mg Kg⁻¹)                                                     |            |            |
| Iron                                                                       | 0.880      | 00.920     |
| Manganese                                                                 | 0.120      | 00.136     |
| Zinc                                                                       | 0.110      | 00.120     |
| Copper                                                                     | 0.170      | 00.250     |

**DTPA:** Diethylene triamine pentacetic acid.

**Organic fertilizer:** The used organic fertilizer (farm yard manure-FYM) was obtained from Ismailia Research Station farm. The chemical analyses of farm yard manure are presented in Table-2.

### Table-2: Characteristics of farmyard manure conditioner used in the two experiment seasons at Ismailia station.

| Properties                          | 1st season | 2nd season |
|-------------------------------------|------------|------------|
| pH                                  | 7.25       | 7.46       |
| E.C. (dSm/m at 25°C)                | 4.89       | 4.19       |
| Organic-C (%)                       | 15.65      | 16.77      |
| Total N (%)                         | 1.16       | 1.31       |
| C/N ratio                           | 13.50      | 12.80      |
| Total-P (%)                         | 0.56       | 1.16       |
| Total-K (%)                         | 1.42       | 1.26       |
| Total soluble-N (ppm)               | 86.0       | 75.8       |
| Available-P (ppm)                   | 14.3       | 26.0       |
Bacterial strains inoculums: Microorganisms in SWERI inoculums biofertilizer were representing as nitrogen fixing bacteria (Azotobacter chroococcum), phosphate dissolving bacteria (Bacillus megatherium var. Phosphaticum) and potassium dissolving bacteria (Bacillus circulans) and kindly provided by Biofertlizers Production Unit, Soils, Water and Environmental Research Institute (SWERI), ARC, Giza, Egypt.

Actinomycete strain as a biofertilizer agent: An identified halotolerant streptomycete strain named as Streptomyces luteogriseus was obtained from Department of Agricultural Microbiology, ARC, Giza, Egypt. This isolate was previously isolated from soil, Taif, KSA and completely identified by Mohamed et al., (2013).

Preparation of actinomycetes inoculums: Inoculum of the Streptomyces strain was prepared by scraping the heavy spores from the surface of the bacterial growth of starch nitrate slant (Mohamed 1998) in the presence of 5 mL sterilized dH2O and used for preparing the inoculums described by Osman et al., (2007).

Grains inoculation: Wheat grains of each treatment were inoculated at the rate of 1.5 g inoculum per 150 g grains using 16% Arabic gum solution as a sticking agent followed by air drying for 15 minutes in the shade and sown direct.

NPK estimation: NPK in soil samples cultivated were estimated before and after planting according to the method of Attanandana et al., (1999).

Dehydrogenase activity: Dehydrogenase activity (DH) in soil was estimated before and after planting based on the method of Stevenson (1959).

Microbial total count: The total counts of microbes (bacteria, fungi and actinomycetes) in the soil samples before and after cultivated with wheat subjected to different fertilizers treatments were determined as described by the methods of Clark (1965).

Field experiment design: Two fields experiments were conducted at the Ismailia Research Station, Ismailia Governorate during two successive winter seasons (2019/2020 and 2020/2021). The soil was divided into plots each of 10.5 m² and a space of 1.2 m between adjacent plots were left empty. A Randomize Complete Block Design with three replicates was applied in each season. Sixteen treatments were distributed in each plot as follows:

| Codes | Soil Fertilizers                                      | Wheat grains inoculation                        |
|-------|------------------------------------------------------|-------------------------------------------------|
| T01   | Unfertilized                                         | Un-inoculated (Blank)                           |
| T02   | Recommended dose of mineral nitrogen*                | Un-inoculated (Control)                         |
| T03   | Unfertilized                                         | Inoculated with SWERI                           |
| T04   | Unfertilized                                         | Inoculated with Actinomycetes.                  |
| T05   | Unfertilized                                         | Inoculated with SEWRI + Actinomycetes.          |
| T06   | ½ recommended dose of mineral nitrogen               | Inoculated with Actinomycetes.                  |
| T07   | ½ recommended dose of mineral nitrogen               | Inoculated with SEWRI                          |
| T08   | ½ recommended dose of mineral nitrogen               | Inoculated with SEWRI + Actinomycetes.          |
| T09   | Organic fertilizer                                   | Un-inoculated                                   |
| T10   | Organic fertilizer + recommended dose of mineral nitrogen | Un-inoculated                                   |
| T11   | Organic fertilizer                                   | Inoculated with SEWRI                           |
| T12   | Organic fertilizer                                   | Inoculated with Actinomycetes.                  |
| T13   | Organic fertilizer                                   | Inoculated with SEWRI + Actinomycetes.          |
| T14   | Organic fertilizer and ½ recommended dose of mineral nitrogen | Inoculated with SEWRI                           |
| T15   | Organic fertilizer and ½ recommended dose of mineral nitrogen | Inoculated with Actinomycetes.                  |
| T16   | Organic fertilizer and ½ recommended dose of mineral nitrogen | Inoculated with SEWRI + Actinomycetes.          |

*: It was used due to the recommendation of Ministry of Agriculture and Land Reclamation.

Post harvesting measurements: In each experiment, plant height (Pepe and Heiner, 1975), weights of whole wheat sample, wheat straw, wheat ears, wheat grains and thousand wheat grains were determined, and three replicates were applied for each of the 16 treatments. From each replicates a number of wheat plants were collected to determine the previous measurements.

Nitrogen and protein contents: Nitrogen content and crude protein percentage in both of wheat grains and straw were estimated using the meth-
ods of Mosse (1990) and Hames et al., (2008) respectively.

### RESULTS AND DISCUSSION

Wheat as edible grains is considered the oldest and important cereal crops. It is grown under different climates and soil type, this is because it is adapted to temperature locations with rainfall (Shewry, 2009). He also reported that one of the most important breeding programs aims in wheat is improving productivity under drought conditions in arid and semi-arid regions. One of the major limiting factors for a wide range of crops in Egypt as well as worldwide is soil fertility (Yousef et al., 2017).

Among two winter seasons (2019/2020 and 2020/2021) this study was conducted at Ismailia Research Station, Ismailia Governorate in a trial to improve productivity of wheat under new sandy soils conditions by fertilization of the soil by mineral nitrogen (Ammonium nitrate) and organic fertilizer (Farm yard manure), followed by cultivation with wheat grains inoculated with SWERI soil biofertilizer (Azotobacter chroococcum, B. megatherium and B. circulans), and Streptomyces luteosporus as a biological fertilizer among sixteen treatments. In Egypt, similar trail was conducted by Badran (2009), who were evaluated the production and performance of two wheat cultivars (Sakha 69 and Giza 164) were in sandy soil among an experiment carried out in El-Bousstan region, Alexandria, by using three bio-nitrogen fertilization treatments (untreated, Microbin and Nitrobio) and five rates of chemical nitrogen fertilizer doses. In the same context, Abdelmageed et al., (2019) showed that to minimize the gap between production and consumption in Egypt, the Egyptian wheat productivity showed be improved through the use of promising wheat cultivars, expansion of new lands, modern agricultural practices, improved field irrigation efficiency and water-saving agricultural practices. Therefore, that study focused on use of a mixture of mineral, organic and biological fertilizers to improve wheat productivity under new sandy soil.

The Streptomyces strain under investigation was belonging to gray colour series with dark gray reverse side of substrate mycelium. Its spore chains belonged to section Rectus-Flexibilis or spiral with hairy surface. This strain was also found to have a good growth on Cazpek’s medium, produces melanoid, and did not produce soluble pigments. In the presence of all sugars as sole carbon source the strain was able to give a good growth. The strain was not inhibited with streptomycin appeared antimicrobial activities, and grew on NaCl concentrations up to 21% (Mohamed et al., 2013).

The importance of NPK fertilizers in wheat production was reported by Nisar et al., (1992) and Gill and Saleem (1994). In this study, results in Table-3 showed that level of NPK among the two seasons in the cultivated soil, before planting, were relatively low as the total soluble-N, available-P and available-K (mg Kg⁻¹) was ranged from 64.00 to 67.20; 5.56 to 5.95 and 69.50 to 71.94 respectively.

On planting and treating, the NPK was determined in soil samples collected from the fourteen fertilizer treatments (T03-T16) plus blank treatment (unfertilized and cultivated with wheat grains un-inoculated T01) and control (Soil fertilized with recommended dose of mineral nitrogen and cultivated with un-inoculated wheat grains).

Results in Table-3 showed that the NPK was raised up, as the percentage of total soil-nitrogen among the two seasons was ranged, from 0.019 to 0.033, available of P ranged from 07.20 to 11.81 mg Kg⁻¹, and available K ranged from 30.06 to 39.54 mg Kg⁻¹ compared to blank soil sample T01 (0.019%, 0.720 (mg Kg⁻¹) and 30.06 (mg Kg⁻¹), respectively, and control soil sample T02 (0.028%, 9.82 (mg Kg⁻¹) and 31.14 (mg Kg⁻¹), respectively). The result is in agreement with that reported by Malighani et al., (2010).

The presence of viable and physiologically active microorganisms could be indicated by rate of activity of DHs (Furtal and Gajda, 2017). The changes in soil microbial population could be controlled by DHs, therefore, it is considered as an important parameter of soil quality. In this study, rate of dehydrogenase enzyme activity among the two seasons reached to 3.90 or 3.95 µg
mineral nitrogen plus organic fertilizer and cultivated by each of 50% of recommended dose of fertilizer treatments and cultivated with wheat grains among the two seasons, the microbial total dehydrogenase activity (DHA) in soil cultivated with wheat subjected to different treatments among two seasons.

Table 3: Means of total nitrogen (N) (%), available phosphor (P) & potassium (K) and dehydrogenase activity (DHA) in soil cultivated with wheat subjected to different fertilizer treatments among two seasons.

| Treatments | Total nitrogen (%) | Available P (mg Kg⁻¹) | Available K (mg Kg⁻¹) | DHA (µg TPF/g soil/24 hr) |
|------------|--------------------|------------------------|-----------------------|---------------------------|
|            | 1st Seasons | 2nd Seasons | 1st Seasons | 2nd Seasons | 1st Seasons | 2nd Seasons | 1st Seasons | 2nd Seasons |
| T01       | 0.019     | 0.020     | 0.0720     | 0.0780     | 0.030      | 0.032      | 3.90        | 4.2         |
| T02       | 0.028     | 0.032     | 0.0982     | 0.1120     | 0.031      | 0.034      | 3.95        | 4.0         |
| T03       | 0.027     | 0.028     | 0.0724     | 0.0850     | 0.032      | 0.035      | 4.0         | 4.1         |
| T04       | 0.022     | 0.023     | 0.0723     | 0.0860     | 0.334      | 0.335      | 4.4         | 4.6         |
| T05       | 0.029     | 0.030     | 0.0720     | 0.0920     | 0.337      | 0.346      | 4.5         | 4.6         |
| T06       | 0.026     | 0.025     | 0.0928     | 0.0880     | 0.032      | 0.033      | 4.6         | 4.2         |
| T07       | 0.032     | 0.034     | 0.0832     | 0.1180     | 0.312      | 0.358      | 4.0         | 4.2         |
| T08       | 0.031     | 0.025     | 0.1045     | 0.0960     | 0.032      | 0.034      | 4.0         | 4.2         |
| T09       | 0.020     | 0.030     | 0.0766     | 0.0980     | 0.315      | 0.354      | 4.0         | 4.8         |
| T10       | 0.025     | 0.028     | 0.0832     | 0.0950     | 0.368      | 0.345      | 5.1         | 4.6         |
| T11       | 0.028     | 0.028     | 0.0945     | 0.1040     | 0.381      | 0.392      | 5.2         | 5.1         |
| T12       | 0.028     | 0.027     | 0.0928     | 0.1020     | 0.373      | 0.360      | 5.2         | 4.8         |
| T13       | 0.030     | 0.031     | 0.0984     | 0.1068     | 0.394      | 0.395      | 5.2         | 5.4         |
| T14       | 0.032     | 0.032     | 0.0985     | 0.1030     | 0.373      | 0.358      | 5.2         | 5.0         |
| T15       | 0.032     | 0.030     | 0.0991     | 0.1050     | 0.323      | 0.358      | 4.6         | 4.8         |
| T16       | 0.032     | 0.033     | 0.1141     | 0.1140     | 0.374      | 0.3620     | 5.2         | 5.8         |

The total microbial counts in the soil before planting (uncultivated) were fewer about (35X10⁴) of bacteria, (22X10⁵) fungi and (24X10⁵) actinomycetes compared to soil subjected to different fertilizer treatments and cultivated with wheat grains inoculated with SWERI or actinomycetes or both (SWERI+actinomycetes). On planting and treating among the two seasons, the microbial total counts were developed in the soil samples collected from the 14 fertilizer treatments compared to the blank-soil sample (T01) as well as control soil treatment (T02) (Table 4). This was obvious from the counts of bacteria (28.8-52X10⁴), fungi (0.6-1.3X10⁵) and actinomycetes (1.6-2.7X10⁵) while the bacterial count was the highest followed by total counts of actinomycetes and fungi.

Table 4: Means of microbial total counts in soil cultivated with wheat subjected to different fertilizers treatments among two seasons.

| Treatments | Microbial total counts |
|------------|------------------------|
|            | Bacteria (X10⁴) | Fungi (X10⁴) | Actinomycetes (X10⁴) |
|            | 1st Seasons | 2nd Seasons | 1st Seasons | 2nd Seasons | 1st Seasons | 2nd Seasons |
| T01       | 28.8       | 34.0       | 0.6      | 0.6      | 1.6        | 1.0        |
| T02       | 28.9       | 36.0       | 0.7      | 0.5      | 2.9        | 1.2        |
| T03       | 27.0       | 40.0       | 0.9      | 0.8      | 2.6        | 1.2        |
| T04       | 28.8       | 42.0       | 0.7      | 0.6      | 2.5        | 1.6        |
| T05       | 32.3       | 35.0       | 0.7      | 0.5      | 1.9        | 1.2        |
| T06       | 37.1       | 42.0       | 0.7      | 0.8      | 2.1        | 1.2        |
| T07       | 33.3       | 42.0       | 0.8      | 0.7      | 2.1        | 1.4        |
| T08       | 41.8       | 50.0       | 0.9      | 0.9      | 2.7        | 1.4        |
| T09       | 26.7       | 28.0       | 0.8      | 0.6      | 2.7        | 1.6        |
| T10       | 32.5       | 38.4       | 0.9      | 0.8      | 2.1        | 2.5        |
| T11       | 37.1       | 44.0       | 0.8      | 0.8      | 2.7        | 2.0        |
| T12       | 40.2       | 48.6       | 0.8      | 0.8      | 2.8        | 2.4        |
| T13       | 33.3       | 44.0       | 0.7      | 1.0      | 2.6        | 1.8        |
| T14       | 38.4       | 44.0       | 0.8      | 1.2      | 2.5        | 2.0        |
| T15       | 39.7       | 48.0       | 0.7      | 1.1      | 2.4        | 2.0        |
| T16       | 45.6       | 52.0       | 0.7      | 1.3      | 2.7        | 2.2        |

Results in Table 5 showed three postharvest measurements namely, height of plant, weight of ears per sample and weight of hundred grains among two seasons were determined.

As overall, treatment No. 16 includes soil fertilized by each of 50% of recommended dose of mineral nitrogen plus organic fertilizer and cultivated with wheat grains inoculated with mixture of SWERI and actinomycetes as biofertilizers was the most effective ones compared to blank-soil sample (T01) and control soil treatment (T02). The means of the three postharvest measurements gave higher values ranged from 40.15 to 52.55 (cm); 36.95 to 65.25 (g) and 62.25 to 70.85 (g), respectively, with a p-value of 0.01.
respectively, compared to T01 (33.70 (cm), 20.60 (g) and 55.55 (g)) and T02 (40.05 (cm), 37.95 (g) and 58.60 (g)). It was also noted that fertilization of soil with organic fertilizer and half recommended dose of mineral nitrogen increased the measurements of three postharvest parameters whatever grains inoculated with SWERI (T14), actinomycetes (T15) and both of them (T16) compared to the other eleven treatments and blank (T01) as well as control (T02). While, the absence of mineral nitrogen in spite of inoculation of wheat grains with SWERI and actinomycetes was the reason in reducing the effective, as T13 appeared measurements lower than that of contain mineral nitrogen (T14, T15 and T16). This could be explained by the ability of actinomycetes strain to utilize each of mineral nitrogen as well as organic fertilizer to be available by plant as a simple organic material. This was supported by the measurement of T10 contained soil fertilized by organic fertilizer and recommended dose of mineral nitrogen and cultivated with wheat grain did not treated with SWERI or actinomycetes. In other mean fertilization of soil with organic manure and cultivation with grains inoculated with SWERI (T11) or actinomycetes (T12).

Table-5: Wheat plant height (cm), ears weight (g/plant) and weight of thousand grains (g) of different treatments among two seasons.

| Treatments | Plant height (cm) | Ears weight (g/plant) | Weight of thousand grain (g) |
|------------|------------------|-----------------------|-----------------------------|
|            | 1st | 2nd | Means | 1st | 2nd | Means | 1st | 2nd | Means |
| T01        | 32.6 | 34.8 | 33.70 | 20.6 | 20.6 | 20.60 | 54.9 | 56.2 | 55.55 |
| T02        | 37.9 | 42.2 | 40.05 | 37.4 | 38.5 | 37.95 | 53.1 | 64.1 | 58.60 |
| T03        | 39.8 | 40.5 | 40.15 | 35.4 | 38.5 | 36.95 | 57.7 | 66.8 | 62.25 |
| T04        | 36.0 | 37.1 | 36.55 | 34.7 | 37.4 | 36.05 | 40.1 | 60.0 | 50.05 |
| T05        | 39.9 | 44.7 | 42.30 | 44.1 | 45.4 | 44.75 | 61.4 | 70.6 | 66.00 |
| T06        | 43.2 | 44.3 | 43.75 | 50.6 | 51.7 | 51.15 | 61.9 | 71.3 | 66.60 |
| T07        | 39.6 | 38.5 | 39.05 | 38.9 | 40.9 | 39.90 | 43.7 | 63.5 | 53.60 |
| T08        | 43.5 | 46.2 | 44.85 | 53.6 | 54.7 | 54.15 | 64.7 | 71.8 | 68.25 |
| T09        | 38.9 | 40.2 | 39.55 | 40.2 | 41.5 | 40.85 | 59.7 | 68.2 | 63.95 |
| T10        | 41.3 | 40.4 | 40.85 | 47.0 | 48.8 | 47.90 | 63.5 | 70.2 | 66.85 |
| T11        | 43.3 | 45.9 | 44.60 | 53.8 | 53.0 | 53.40 | 62.6 | 69.7 | 66.15 |
| T12        | 43.4 | 46.4 | 44.90 | 38.7 | 40.6 | 39.65 | 62.5 | 72.9 | 67.70 |
| T13        | 44.4 | 46.4 | 45.40 | 45.2 | 55.9 | 55.90 | 62.8 | 68.2 | 65.50 |
| T14        | 42.3 | 42.2 | 42.25 | 55.8 | 56.4 | 56.10 | 66.1 | 73.4 | 69.75 |
| T15        | 45.6 | 46.1 | 45.85 | 59.7 | 61.8 | 60.75 | 63.5 | 75.0 | 69.25 |
| T16        | 52.2 | 52.9 | 52.55 | 65.9 | 64.6 | 65.25 | 66.3 | 75.4 | 70.85 |

LSD 0.05 | 3.5 | 3.2 | 2.5 | 2.4 | 2.5 | 2.4

Results in Table-6 present determination of three postharvest measurements are grain weight (kg/m²), straw weight (g/m²) and weight of whole plants (g/m²). Results proved that the presence of mineral nitrogen fertilizer whatever in the recommended dose (RD) (T02 and T10) or half recommended dose (T06, T07, T08, T14, T15 and T16) was also effective whatever wheat grains were inoculated with SWERI (T06 and T14) or actinomycetes (T07 and T15) or both (T15 and T16) compared to blank (T01) or control (T02) or T10. Among the two seasons, the three measurements were highest when soil was fertilized with organic manure in the presence of half recommended dose of mineral nitrogen and cultivated with wheat grains inoculated with SWERI and actinomycetes as shown in T16 compared to the other 14 treatments including the blank (T01) and control (T02). The grain weight (kg/m²) rose from 275.25 (T01) to 719.85 (T16), while the weight of straw (g/m²) raised from 61.95 to 172.75, and weight of whole plants (g/m²) raised from 337.20 to 892.60 when compared to T01. The differences between measurements of T02 (control) and T16 were 282.45, 67.75 and 350.2 of grains weight, straw weight and weight of whole plants, respectively, and this is indicating the possibility of obtaining better a crop of wheat if it is cultivated in the sandy soils with the contents of the T16 treatment. The role of actinomycetes as a biofertilizer was obvious in increasing the weight of whole plants due to its ability to decompose the organic fertilizer into simple compounds easy to be used by plants. It was also confirmed the importance of reducing the use of mineral fertilizers and replacing it with organic fertilizers in the presence of a microorganisms that can breakdown it down into components that benefit plants without affecting the environment.
Table-6: Grain weight (kg/m²), Straw weight (g/m²) and weight of whole plants (g/m²) of different treatments among two seasons.

| Treatments | Grain weight (kg/m²) | Straw weight (Kg/m²) | Weight of whole plants (Kg/m²) |
|------------|----------------------|----------------------|--------------------------------|
|            | 1st | 2nd | Means | 1st | 2nd | Means | 1st | 2nd | Means |
| T01        | 263.0 | 287.5 | 275.25 | 54.9 | 069.0 | 61.95 | 317.9 | 356.5 | 337.20 |
| T02        | 410.3 | 464.5 | 437.40 | 98.5 | 111.5 | 105.00 | 508.8 | 576.0 | 542.40 |
| T03        | 378.6 | 499.5 | 439.05 | 90.9 | 119.9 | 105.40 | 469.5 | 619.4 | 544.45 |
| T04        | 361.4 | 562.0 | 461.70 | 106.7 | 124.9 | 115.80 | 448.1 | 696.9 | 572.50 |
| T05        | 482.8 | 594.0 | 538.40 | 115.9 | 142.6 | 129.25 | 598.7 | 736.6 | 667.65 |
| T06        | 547.5 | 626.0 | 626.00 | 131.4 | 150.2 | 140.80 | 678.8 | 776.2 | 727.50 |
| T07        | 522.7 | 558.0 | 540.35 | 121.4 | 137.9 | 129.65 | 624.1 | 715.9 | 670.00 |
| T08        | 585.2 | 654.5 | 619.85 | 140.4 | 167.8 | 154.10 | 725.6 | 867.2 | 796.40 |
| T09        | 280.0 | 364.3 | 322.15 | 103.3 | 124.0 | 113.65 | 383.3 | 488.3 | 435.80 |
| T10        | 430.9 | 540.4 | 485.65 | 103.4 | 129.7 | 116.55 | 534.3 | 670.1 | 602.20 |
| T11        | 548.5 | 658.2 | 603.35 | 169.2 | 158.0 | 163.60 | 717.7 | 816.2 | 766.95 |
| T12        | 520.9 | 541.0 | 530.95 | 111.0 | 143.8 | 127.40 | 621.9 | 694.8 | 658.35 |
| T13        | 590.5 | 708.6 | 649.55 | 141.6 | 160.1 | 150.85 | 722.1 | 887.8 | 800.40 |
| T14        | 617.3 | 716.7 | 667.00 | 148.1 | 172.0 | 160.05 | 765.4 | 888.7 | 827.05 |
| T15        | 648.4 | 717.5 | 682.95 | 155.6 | 172.2 | 163.90 | 804.0 | 889.7 | 846.85 |
| T16        | 705.0 | 734.7 | 719.85 | 169.2 | 176.3 | 172.75 | 874.1 | 911.1 | 892.60 |
| LSD 0.05   | 66.3 | 69.2 | 79.2 | 29.2 | 32.2 | 34.2 |

In Egypt, Kandilet al., (2016) carried out two field experiments at the experimental Station Farm of Kalabsho and Zayyan district during the two successive winter seasons of 2013/2014 and 2014/2015, to determine the effect of foliar application with humic acid, amino acid mixture of humic and amino acids under nitrogen fertilizer levels (166, 214 and 262 kg N/ha) on yield, yield attributes and grain quality characters of three cultivars of bread wheat (Shaka 93, Gemiza 9 and Giza 168) grown in newly reclaimed sandy saline soil conditions. In this study results of the nitrogen content and crude protein percentage in both grains and straw shown in Table 7 obtained from the sixteen treatments showed that the content of nitrogen or protein in grains was higher than in straw for the same treatments. Also, the least averages of protein percent of grain were for treatments T01 (9.1), T09 (9.5), T04 (10.2) and T10 (12), while the rest of the treatments were not higher than T16 which was keeping its superiority in both the nitrogen and protein content, whether in straw or grains. This may be explained by the fact that the formation of treatment 16 of each of half recommended dose of mineral fertilization in the presence of the SWERI inoculum and organic fertilizer in addition to actinomycetes has led to stimulating the growth of wheat plants in sandy lands, which promises the possibility of expanding the cultivation of such lands with wheat, which may contribute in a large and effective way to bridge the food gap, especially with the continuous increase in population numbers.

Table-7: Nitrogen and crude protein (%) in grains and straw of wheat subjected to different fertilizers treatments among two seasons.

| Treatments | % Nitrogen Grains | % Protein Grains | % Nitrogen Straw | % Protein Straw |
|------------|------------------|-----------------|-----------------|---------------|
|            | 1st | 2nd | Means | 1st | 2nd | Means | 1st | 2nd | Means |
| T01        | 1.5 | 1.6 | 09.1 | 10.0 | 0.8 | 1.0 | 5.1 | 5.9 |
| T02        | 2.2 | 2.4 | 13.5 | 14.7 | 1.1 | 1.2 | 6.9 | 7.6 |
| T03        | 2.1 | 2.2 | 12.8 | 13.9 | 0.8 | 1.0 | 5.1 | 6.2 |
| T04        | 1.6 | 1.9 | 10.2 | 12.0 | 0.8 | 1.0 | 4.8 | 6.3 |
| T05        | 2.2 | 2.4 | 13.9 | 14.9 | 0.8 | 1.1 | 5.1 | 7.1 |
| T06        | 2.3 | 2.3 | 14.2 | 14.3 | 1.1 | 1.1 | 6.6 | 6.6 |
| T07        | 2.4 | 2.6 | 15.0 | 16.2 | 1.0 | 1.1 | 5.9 | 7.0 |
| T08        | 2.4 | 2.5 | 14.6 | 15.6 | 1.2 | 1.3 | 7.4 | 8.1 |
| T09        | 1.5 | 1.7 | 09.5 | 10.8 | 0.8 | 1.2 | 4.8 | 7.3 |
| T10        | 1.9 | 2.2 | 12.0 | 13.7 | 0.9 | 1.0 | 5.9 | 6.2 |
| T11        | 2.2 | 2.5 | 13.9 | 15.5 | 1.2 | 1.4 | 7.3 | 9.0 |
| T12        | 2.1 | 2.3 | 13.2 | 14.3 | 1.1 | 1.3 | 6.3 | 7.8 |
| T13        | 2.3 | 2.5 | 14.4 | 15.7 | 1.1 | 1.4 | 7.6 | 8.7 |
| T14        | 2.4 | 2.5 | 15.0 | 15.7 | 1.1 | 1.3 | 6.9 | 7.0 |
| T15        | 2.2 | 2.3 | 13.5 | 14.5 | 1.1 | 1.3 | 7.0 | 7.4 |
| T16        | 2.4 | 2.8 | 15.0 | 17.2 | 1.2 | 1.3 | 7.5 | 8.3 |
The experimental results are in harmony with that reported by Arif et al., (2017), which showed that low and declining soil organic matter contents pose a significant threat to soil fertility, crop productivity and economic returns in arid and semiarid agroecosystems. Holistic approaches are required to build and sustain soil organic matter in such soils to enhance nutrients use efficiencies and meet food security.

Results in Tables 8 and 9 refer to the calculation of the quantity of wheat yield resulting from the sixteen treatments of the study. The results indicate that the 16th treatment can be given 2.65 times the first treatment, known as the blank (7.17 ardb per feddan), where the mean yield amounted to approximately 19.00 ardb per feddan, while the control (T02) gave 11.76 ardb per Feddan, and it was the highest among the treatments. In the second classification, treatment numbers T15, T14, T13, T08, T06, T11, T12 and T04 were the best, with yields of about 17.50, 17.13, 16.54, 16.53, 15.36, 15.65, 14.52 and 14.36, respectively. The results in the same Tables 8 and 9 showed the variation in the rate of increase in the wheat yield obtained from the 14 samples under study compared to the Blank (T01: unfertilized soil cultivated with un-inoculated wheat grains) and the control (T02: soil fertilized by the recommended dose of mineral nitrogen and cultivated with un-inoculated wheat grains). It was proved that the 16th treatment containing half recommended dose of mineral nitrogen, SEWRI, organic fertilizer and actinomycetes was the best, as the rate of increase in yield was 164.99, and 62.80 % compared to T01 and T02, respectively. While the non-addition of the SEWRI inoculums as in the 15th treatment led to a decrease in the rate of increase to 25.5 and 15.68 % compared to T01 and T02 respectively, and it’s still reliable as well.

Table 8: Yield of wheat grains weight subjected to different fertilizers treatments among two seasons.

| Treatments | Grain weight (kg/Fed) | Grain weight (Ardb/Fed) |
|------------|-----------------------|-------------------------|
|            | 1st Season | 2nd Season | Means | 1st Season | 2nd Season | Means |
| T01        | 1052.0     | 1100.0     | 1076.0 | 07.01 | 07.33 | 07.17 |
| T02        | 1641.2     | 1858.0     | 1749.6 | 10.94 | 12.40 | 11.67 |
| T03        | 1514.4     | 1998.0     | 1756.2 | 10.10 | 13.32 | 11.71 |
| T04        | 1445.4     | 2248.0     | 1846.7 | 09.44 | 14.99 | 12.22 |
| T05        | 1931.2     | 2376.0     | 2153.6 | 12.87 | 15.84 | 14.36 |
| T06        | 2189.8     | 2503.8     | 2346.8 | 14.60 | 16.69 | 15.65 |
| T07        | 2060.6     | 2332.0     | 2196.3 | 13.73 | 15.55 | 14.64 |
| T08        | 2340.6     | 2618.0     | 2479.3 | 15.60 | 17.45 | 16.53 |
| T09        | 1120.0     | 1288.6     | 1204.3 | 07.50 | 08.59 | 08.04 |
| T10        | 1723.6     | 1942.6     | 1833.1 | 11.50 | 12.95 | 12.23 |
| T11        | 2194.0     | 2413.4     | 2303.7 | 14.63 | 16.09 | 15.36 |
| T12        | 2093.2     | 2263.2     | 2178.2 | 13.95 | 15.09 | 14.52 |
| T13        | 2362.0     | 2598.2     | 2480.1 | 15.75 | 17.32 | 16.54 |
| T14        | 2469.0     | 2667.8     | 2568.4 | 16.46 | 17.80 | 17.13 |
| T15        | 2593.6     | 2731.8     | 2662.7 | 17.29 | 18.21 | 17.75 |
| T16        | 2819.8     | 2879.4     | 2849.6 | 18.80 | 19.20 | 19.00 |
| LSD 0.05   | 265.0      | 276.8      | 1.76  | 1.85  |

Table 9: Yield increasing rates of wheat subjected to different fertilizers treatments among two seasons.

| Treatments | Yield increasing rates of wheat grains (Kg/Fed) | (Ardb/Fed) |
|------------|-----------------------------------------------|-----------|
|            | 1st Season | 2nd Season | 1st Season | 2nd Season |
| T01        | 0000.0     | 0000.0     | 0000.0     | 0000.0     |
| T02        | 0589.2     | 0000.0     | 0758.0     | 0000.0     |
| T03        | 0462.4     | -126.8     | 0898.0     | 0140.0     |
| T04        | 0393.4     | -195.8     | 1148.0     | 0390.0     |
| T05        | 0879.2     | 0290.0     | 1276.0     | 0518.0     |
| T06        | 1137.8     | 0548.6     | 1403.8     | 0645.8     |
| T07        | 1008.6     | 0419.4     | 1232.0     | 0474.0     |
| T08        | 1288.6     | 0699.4     | 1518.0     | 0760.0     |
| T09        | 0068.0     | -521.2     | 0188.6     | -569.4     |
| T10        | 0671.6     | 0082.4     | 0842.6     | 0084.6     |
| T11        | 1142.0     | 0552.8     | 1313.4     | 0555.4     |
| T12        | 1041.2     | 0452.0     | 1163.2     | 0405.2     |
| T13        | 1310.0     | 0720.8     | 1498.2     | 0740.2     |
| T14        | 1417.0     | 0827.8     | 1567.8     | 0809.8     |
| T15        | 1541.6     | 0952.4     | 1631.8     | 0873.8     |
| T16        | 1767.8     | 1178.6     | 1779.4     | 1021.4     |
**Conclusion:** One can recommend with use of treatment T16 (soil fertilized with half recommended dose of nitrogen and organic manure, cultivated with wheat grains inoculated with SWERI inoculums+Actinomycetes) to improve wheat yield, especially in sandy soils, and to reduce the use of mineral fertilizers, in soil, which could be affect human health when leaked with waste water. Use of actinomycetes in the presence of organic fertilizer has led to stimulating the growth of wheat plants in sandy soils, which promises the possibility of expanding the cultivation of such soils with wheat, which may contribute in a large and effective way to bridge the food gap, especially with the continuous increase in population numbers.

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