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EFFECT OF SOME BIO-FERTILIZERS ON THE YIELD AND QUALITY OF THREE BREAD WHEAT CULTIVARS UNDER DIFFERED NITROGEN LEVELS

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ABSTRACT: The present study has been undertaken objectively in Kafr El-Herrawy Village, Zagazig district, Sharkia Governorate, Egypt during two successive seasons of 2014/2015 and 2015/ 2016 to disclose the effect of single and dual inoculation with Cerealine and Phosphorein as microbial inoculants on the yield and quality of three bread wheat cultivars under different nitrogen levels. The two experiments were laid out in a split-split plot system with three bread wheat cultivars (Gemmeiza 11, Misr 1 and Giza 168) in the main plots, three nitrogen levels (40, 60 and 80 kg N/fad.) in sub-plots and bio-fertilizers (Check, Cerealine, Phosphorein each used at the rate of 500 grams/45 kg wheat grains/fad., and Cerealine + Phosphorein) in sub-sub plots. The number of replicates being three. The net sub-sub plot area was 3×4 m having fifteen rows of 20 cm apart and four meters long.The findings revealed that wheat cultivars, nitrogen levels and bio-fertilizer treatments gave marked changes in all the agronomic traits of wheat, since Gemmeiza 11 cultivar received 80 kg N/fad., and inoculated with the combined treatment of Cerealine + Phosphorein attaind greater mean averages in each of : plant height, flag leaf area efficiently, tillering index, spike length, number of fertile spikelets/spike, grain weight/spike, number of spikes/m^2, 1000-grain weight, harvest index, the final yields/fad., from grain, straw, biomass and both grain carbohydrate and protein contents and the last protein yield/fad., if compared with the other two cultivars and the rest treatments. However, Misr 1 cultivar was superior to the other tested cultivars regarding number of spikes /m^2. But, the reverse hold true as for relative photosynthetic potential of biological yield (RPP), since such character showed significant reduction due to the tested treatments and such trend was greatly true in both seasons and over them, too. The interaction effect of the three factors reflected significant changes on the final wheat yield/fad., and it's quality, where Gemmeiza 11cultivar was superlative as for grain, straw, biomass and protein due to treating it with 60 kg N level and inoculated with Cerealine + Phosphorein bio-fertilizers. Also, the bio-fertilizers treatment of both Cerealine + Phosphorein detected its efficiency in reduced the adverse effects of mineral N and reduced the N level about 20 kg/fad., and such cultivar proved to be the more producer for the final yields/fad., and grains quality and more suitable the environmental conditions of Kafr El-Herrawy Village, Zagazig district, Sharkia Governorate, Egypt.

Key words: Wheat cultivars, cerealine, phosphorein, N levels, grain yield and quality.

INTRODUCTION

Bread wheat (*Triticum aestivum,* L.) is considered the major winter cereal crops as well as the world's leading and strategic cereal one. In Egypt, it occupies a better position in the agricultural policies. Nowadays, wheat crop is cultivated on roughly 230 million hectars worldwide with a total yield of nearly 800 million tons (**FAOSTAT, 2017**). In Egypt, the cultivated area of bread wheat is approximately 3.40 million fad., yielding about 9.3 million tons

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(**Anonymous, 2017**). Egypt imports annually about 30% of its grain requirements. This clears the size of wheat grain problem and the efforts required in boosting the wheat production. In this regard, wheat crop provides food for human as well as for domesticated animals along with many industrial products. In the short term and in Egypt, raising wheat yield during nowadays and in the future is considered as one of the most important strategic purposes. The increased production of wheat to meet the over population growth can be achieved through using the high yielding cultivars grown under following the newly cultural techniques such as suitable nitrogen levels and bio-fertilizers which are considered as natural, beneficial and ecological friends. Grain wheat cultivars production is one of the most important factors, which play a greater role in meliorating wheat productivity and contribute markedly in food production solves. Also, wheat cultivars differed meaningly in their vegetative growth, grain, straw, biomass output and protein yields per unit land area as well as their attributes as reported by earlier workers, including: **El-Hag (2017)** in Egypt, made a comparison among three wheat cultivars, being Sids 12, Misr 1 and Sohag 93, as for most yield attributes and yield/fad.The obtained results detected that Misr 1 cultivar possessed the highest mean values regarding number of days to 50% heading, plant height, grain number/spike, both grain and straw yields/fad., compared with the two other cultivars used. Meantime, Sids 12 cultivar was extremely superior than the two other ones respecting number of total tillers/m^2 and 1000-grain weight. Similar cultivar differences were variant in their values according to the differed wheat cultivars examined in the trials of earlier workers, of them: **Abd El-Aziz *et al.* (2017)** and **Abd El-Hady (2018)**

Nitrogen as a major macronutrient, is constituent of protoplasm, enzymes and chlorophyll synthesis and likewise, plays an appreciable role of catalytic agent in different physiological processes. It, also accelerates cell division and speeds up photo assimilation process, that in turn maximize wheat growth with resultant high wheat yields per unit land area. In other meaning, N nutrient plays an favorable role in wheat growth and is concerned as an indispinsible nutrient for numerous vital functions leading to better wheat yields per unit land area. Several workers have reported an enhancement in wheat growth and consequently in grain yield per unit land area upon applying moderate levels of such element, among them: **Khalid *et al.* (2014)** in Pakistan, tried five different N levels (*i.e.* zero, 50, 100, 150 and 200 kg/ha) on wheat yield and its attributes. The findings appeared that number of spikelets and grains/spike, 1000-grain weight as well as grain and biological yields/ha responded positively to N level up to 100 kg N/ha, while number of tillers/m^2, plant height and harvest index responded up to 50, 150 and even to 200 kg N/ha, successively. Also, other workers documented the importance of N fertilization on the majority of agronomic traits of wheat, among them **Abd-Allah *et al*. (2016)** and **Seyed *et al.* (2017)**.

In the development and implementation of sustainable agriculture techniques, the biofertilizers are of a great importance due to: N_2-fixing potential, rhizosphare intensification, inhabiting the growth of pathogens, stimulating seed germination, raising the endogenous levels of phytohormones, increasing the formation of soil organic matter and the uptake of N,P and K nutrients, reducing the amount of N fertilization and at last minimizing the environmental pollution to the lowest level that could induce a harmful effect for both human and animal health. All such previous benefits of bio-fertilizers could fairly contribute in maximizing the final wheat yields per unit land area. In this concern, the interest of many workers focused on the possibility of using suitable bio-fertilizers as an alternative or a complementary application for raising the majority of agronomic characters, yield, its attributes and grain quality of wheat crop. **Singh *et al.* (2016)** used four bio-fertilizer treatments; *viz:* control, *Azotobacter*, phosphate solubilizing bacteria and co-inoculation of *Azotobacter* + phosphate solubilizing bacteria in wheat fields. The findings detected marked increments as for the following characters: plant height, number of tillers/plant, number of spikelets/spike, number of grains/spike and both straw and grain yields/ha when compared with the check treatment. They, also added that the dual inoculation with both the previous bio-fertilizers reflected greater yields of wheat over

each of individual inoculation and the control treatment. Similar views were reported by earlier workers, such as: **Ahmed *et al*. (2011)** on *Azotobacter,* **Badran (2011)** on Cerealine, **Malik *et al.* (2012)** on Phosphorein and **Namvar and Khandan (2013)** on other bio-fertilizers.

Furthermore, the integrated nutrient management strategies including both mineral N and bio-fertilizers is a virtual challenges to limit using the higher rates of agrochemicals and to enhance the sustainability of wheat crop production. In this respect, earlier investigators examined the pronounced effect of integrated fertilizers on wheat yield and its attributes beside grain quality, including **Agamy *et al.* (2012)** in Egypt who pointed out that the application of 50% from the recommended N dose along with using certain bio-inoculants increased significantly both protein and carbohydrate contents inside wheat grains. Likewise, **Abd El-Lattief (2016)** cited that, the integrated plant nutrient supply system (different N levels and *Azotobacter* sp) could help in meeting the tasks of balanced fertilization and increased yields/fad., and their attributes of wheat crop. Identical findings were given by other investigators, such as: **Seyed *et al.* (2013)**; **AAzudi *et al.* (2014)**, **Badwan *et al.* (2014)** and **Khattab *et al.* (2016)**.

Ultimately and in this work, to emphasis increased wheat yields per unit land area and its quality, there is a need to intensify efforts on judicious use of the available land area through application of proper fertilizers including wise application of N fertilizer combined with the more effective bio-fertilizers and their interactions in wheat fields of high yielding cultivars suitable for each district and conditions under the sustainable agriculture cultivation of the Egyptian country.

Therefore, the present trials embodied in this paper was designed to evaluate the indepental of the combined effects of nitrogen and bio-fertilization and their interactions on the final yields/fad., and their attributes as well as the grain quality of three wheat cultivars, being Gemmeiza 11, Misr 1 and Giza 168 under the conditions of Zagazig locality.

MATERIALS AND METHODS

Two field experiments were implemented at Kafr El-Herrawy Village, Zagazig District, Sharkia Governorate, Egypt during the winter seasons of 2014/2015 and 2015/2016 to elucidate the impact of some nitrogen fertilizer levels, microbial fertilization and their interactions on yield attributes, grain yield and quality of three wheat cultivars. The soil sample was taken from the upper 40 cm soil surface before sowing and the physical and chemical analyses of the tested soil was clay in texture and uniform up to 40 cm depth, having sand of 20.50 %, silt of 32.00%, clay of 47.50%, organic matter of 1.45%, with electrical conductivity of 0.95 mmhos/cm and calcium carbonate ($Ca\ Co_3$) of 2.40% respectively. Such experimental soil was appeared to be low in available N (12.4 ppm), medium in available P (18.80 ppm) and fairly rich in available K (135.50 ppm), successively. Likewise, the soil of each trial was slightly alkaline in reaction (pH 7.65). All the previous values of the tested soils were documented from the averages of both trials.

The Tested Factors

Three chosen factors (36 treatments) of each experiment were as below:

Wheat cultivrs, V

The three wheat cultivars evaluated in this study were as below:

a- Gemmeiza 11
b- Misr 1
c- Giza 168

The above-named wheat cultivars were released by wheat Res. Sta., field Crops Res. Institute, Agric. Res. Center, Giza, Egypt.

The pedigree and origin of the examined bread wheat cultivars are listed in Table 1.

Nitrogen fertilizer levels (N)

Three nitrogen fertilizer levels tested were as follows:

a- 40 kg/fad., as N_1
b- 60 kg/fad., as N_2
c- 80 kg/fad., as N_3

Table 1. Pedigree of the studied wheat cultivars

Cultivar	Pedigree	Origin
Gemmeiza 11	BOW "S"/KZ "S" //7C/aeri 82/3/Giza 168/Sakha61. GM78922-GM-1GM-2GM-1GM-0GM	Egypt
Misr1	OASIS/KAUZ//4*BCN/3/2*PASTOP.GMssooY O1881T-050M-030Y-030M-030WGY-33M-OY-OS	Egypt
Giza 168	Mri/Buc/ Seri CM 9304% - 8M- Oy- OM- 2y – OB.	Egypt

Bio-fertilization (microbial, bacterial) treatments, (B)

Four bio-fertilizer (inoculant) treatments were as follows:

a- Check (without applications), B_1
b- Cerealine bio- fertilizer, B_2
c- Phosphorein bio- fertilizer, B_3
d- Cerealine+Phosphorein bio-fertilizer, B_4

Cerealine bio-fertilizer contains *Azotobacter* Strain as N_2-fixing bacteria, and Phosphorein bio-fertilizer contains *Bacillus megatherium* variety phosphaticum strain as P solving bacteria. Both Cerealine and Phosphorein bio-fertilizers were known as commercial products. The previous bio-fertilizers were obtained from the Agric. Res .Centers, Giza, Egypt, and the recommend rate of each bio-fertilizer was 500 grams/45 kg wheat grains/fad., for the three wheat cultivars.

Experimental Design

Each trial was laid out in a split-split plot system having three replicates. The main plots were occupied randomly by the three wheat cultivars, while the sub plots were alloted by the three nitrogen levels and the four bio-fertilizer treatments were consigned to the sub-sub plots, respectively. Each sub-sub plot consisted of fifteen rows of three m width and 4 m length occupying 12 m^2 (20 cm row distance). The outer two rows of each experimental plot were left as borders, whereas the other inner ones were employed to record yield attributes and the final yields examined in this work for the adopted wheat cultivars.

Cultural Practices

The preceding crop was sudan grass in both seasons. The soil of the experimental fields were irrigated and when become friable, they were ploughed twice, harrowed and compacted suitably to prepare a fine seed-bed, then the experimental plots were established.

To avoid the interference among the studied treatments, one meter bed was left between any two of the neighbored sub-sub plots to prevent the movement of irrigation water to the adjacent plots. The grains of the three wheat cultivars were hand planted on Nov. 21 in both the trials with a common seed rate of 45 kg grains/fad., (15 kg grains for each cultivar) and such seed rate was computed on grains index basis related to each cultivars. Also, calcium super- phosphate (15.5% P_2O_5) and potassium sulphate (48-52% K_2O) fertilizers were applied fully overall the entire experimental area during the seed-bed preparation at the rate of 31 and 25 kg/fad., P_2O_5 and K_2O/fad., consecutively. Each nitrogen fertilizer level (40, 60 and 80 kg N/fad.), as per –treatments, was top-dressed just before the first and second irrigations, being after 21 and 40 days age. The urea fertilizer (46.5% N) was the source of nitrogen fertilization. The wheat crop received five irrigations according to the case of temperature degree found in the surrounding media. The other cultural practices commonly used in wheat growing were done as it when necessary to keep the crop free from weeds and to protect it from the harmful diseases. At last, wheat crop was harvested manually on 21 May during the both seasons.

The Studied Characters

At the end of each season, ten wheat plants were randomly selected from the third row of sub-sub plot of the three replicates to estimate the yield attributes as well as the grain quality as coming:

1. Plant height in cm
2. Flag leaf area efficiency mg /cm^2

It was expressed as a ratio of grain yield (mg) per cm^2 of flag leaf area.

3. Tillering index
4. Spike length in cm (averaged from ten spikes).
5. Number of fertile spikelets/spike.
6. Grain weight /spike in grams.
7. Number of spikes/m^2 =spike population per unit area.
8. Thousand grain weight (1000- grain weight = grain index) in grams.

It was detrmerined by recording three samples of 1000-grains taken randomly from the grains of each experimental unit, weighed and then averaged.

Thereafter, a bulk sample included all inner wheat plants existed in an area of two square meters (ten rows width ×one meter length) of each sub-sub plot were also harvested to determine the following respects:

9. Grain yield/fad., (ton).

Adjusted to 15.5% moisture content.

10. Straw yield/fad., in tons.

Both grain and straw yields of wheat per fad., were firstly determined as kg per the net harvested area of two square meters, and converted to tons /fad, orderly.

11. Biological yield/fad., = biomass, output, above ground biomass yield/fad., in tons. = grain + sraw yield in terms of tons/fad.
12. Harvest index (HI = %).

It was determined as percentage of grain yield to biomass yield/fad.,

13. Relative photosynthetic potential (RPP) in biological yield/fad.

It was recorded for the biomass yield/fad., in both the seasons and across them as well as by using the following formula:

$$RPP = \frac{\text{Biomass output/fad. at harvest}}{\text{Leaf area index recorded at heading stage}}$$

14. Carbohydrate content (%), C.
15. Protein content (%), N.

The micro-Kjeldahl method was used to determine the total nitrogen in wheat grains and multiplying by 6.75 to obtain the percentage of crude protein according to the procedure out-lined by **AOAC (2002).**

16. Protein yield/fad., (ton).

It was calculated by multiplying the final grain yield/fad (ton) by grain protein content (%) and dividing by 100.

Statistical Analysis

The recorded data of both trials for all tested parameters and their integrated analysis were subjected to the analysis of variance according to the standard statistical procedure described by **Sokal and Rohif (1997).**

The statistical marked means were separated by means of Duncan multiple range test at 1.0 and 5% levels of probability (**Duncan, 1955**).

In this connection, the combined analysis of variance of both trials was computed after testing homogeneity of variance using Bartlett's homogeneity test, due to homogeneity of the combined analysis using MSTAT-C computer Software (**SAS, 2002**), since the error variance of the single seasons was homogeneous. In interaction Tables, capital and small letters were used to denote significant differences among rows and columns means, respectively.

RESULTS AND DISCUSSION

The findings of this paper delt with the impact of various treatments*, viz*: some nitrogen levels and four bio-fertilizers and their interactions on yield and quality of three bread wheat cultivars as coming:

Wheat Cultivar Effects

Significant cultivar distinctions were observed among the three wheat cultivars, being Gemmeiza 11, Misr 1 and Giza 168 ones in terms of the following characters: plant height, flag leaf area efficiency, tillering index, spike length, number of fertile spikelets per spike, grain weight/spike, number of spikes/m^2, 1000-grain weight, the final yields/fad., from grain, straw, biomass, harvest index, RPP and both grain carbohydrate and protein contents and at last protein yield/fad. The results recorded in Tables 2-7 clearly indicate that Gemmeiza 11 cultivar produced markedly greater mean values over both Misr 1 and Giza 168 ones as for the following parameters: plant height, flag leaf area efficiency, tillering index, spike length, grain weight/spike, number fertile spikelets/ spike, 1000-grain weight, the final yields/fad., from (grain, straw, biomass, HI, grain carbohydrate and protein contents as well as protein yield/fad.). The reverse hold true respecting number of spikes/m^2 and RPP where Misr1 and Giza 168 wheat cultivars ranked first in this regard. Such trend was clearly valid in both seasons and across them as well.

It is clear from the above-named results that the ranking of wheat cultivars on the final yields (grain, straw, biomass and protein)/fad., was similar to that of yield attributes owing to that the cultivar variations in such yields were not enough to change the ranking of yield attributes in all the studied cultivars . In this regard, the pervious results my be due to the variations among the three wheat cultivars in growth habit and the response of each cultivar to the environmental conditions existed in the surrounding media during their growth seasons, which are controlled by the genetical factors. Some workers denoted to the genetical construction among wheat cultivars that could be responsible much for such changes in yield attributes, yield and quality as reviewed by **Abd El-Aziz *et al.* (2017)**, **El-Hag (2017)** and **Abd El-Hady (2018)** as they documented significant cultivar diversities in the majority of yield attributes and grain yield per unit land area as well as grain quality , but such differences were prone on other wheat cultivars tested in their studies.

Nitrogen Fertilizer Level Effects

The results listed in Tables 2, 3, 4, 5, 6 and 7 clearly indicate substantial increases in all wheat characters tested in both seasons and over them as well. It is obvious that, the increase in N levels from 40 to 60 and even to 80 kg N/fad., could bring identical increasing in the following wheat parameters, being: plant height, flag leaf area efficiency, tillering index, spike length, number of fertile spikelets/spike, grain weight/ spike, number of spikes/m^2, 1000-grain weight, the final yield/fad., from (grain, straw, biomass and harvest index) and both carbohydrate, protein contents in wheat grains and at last protein yield/fad. At the same-time, the RPP (relative photosynthetic potential of biological yield) was adversely and significantly affected by raising N level over 40 kg N/fad. Such findings were fairly true in both the trials and over them too. In other meaning, increasing N levels up to 80 kg N/fad., could reflects positive and definite increases, in one way to another, in all the studied wheat characters mentioned previously, except RPP which decreased in its mean values with increasing N levels tested. It could be concluded that, the stimulating effect of N nutrient on raising the previous wheat traits might be due the role of N in synthesizing more metabolic compounds in plant organs and this in turn enhanced the metabolites translocated from the source to the sink. Earlier workers have recorded marked excess in grain yield per unit land area, its attributes as well as grain quality, of them **Khalid *et al.* (2014), Abd-Allah *et al.* (2016) and Seyed *et al.* (2017).**

Biofertilizer Effects

Significant diversities were distinguished among the three bio- fertilizer treatments and the check one as for all the studied respects of wheat in both seasons and when their data were integrated together as documental in Tables 2, 3, 4, 5, 6 and 7. It is obvious that the increases in the studied parameters were greater with Cerealine, Phosphorein and Cerealine + Phosphorein bio- fertilizers than without them and the highest mean values were in favour of the mixed inoculation with Cerealine + Phosphorein each at the rate of 500 grams/fad., followed in order with Cerealine, Phosphorein alon and the un-inoculated check. Here, it could

Table 2. Plant height, flag leaf area efficiency and tillering index of three wheat cultivars as impacted by N and bio-fertilization and their interactions during both seasons and across them

Main effects and interactions	Plant height(cm)			Flag leaf area efficiency (mg/cm^2)			Tillering index		
	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.
Cultivars (V)									
Gemmeiza 11	114.56 c	110.30 c	112.43 c	0.072 c	0.066 c	0.069c	0.86 c	0.82 c	0.84 c
Misr 1	111.50 b	105.52 b	108.51 b	0.061 b	0.055 b	0.058 b	0.84 b	0.80 b	0.82 b
Giza 168	102.80 a	98.10 a	100.45 a	0.056 a	0.050 a	0.053 a	0.82 a	0.78 a	0.80 a
F. test	**	**	**	**	**	**	**	**	**
N levels (kg/fad.)(N)									
40	98.92 a	93.48 a	96.20 a	0.049 a	0.037 a	0.043 a	0.78 a	0.76 a	0.77 a
60	113.20 b	105.46 b	110.83 b	0.064 b	0.060 b	0.062 b	0.86 b	0.80 b	0.83 b
80	116.74 c	111.98 c	114.36 c	0.076 c	0.074 c	0.075 c	0.88 c	0.84 c	0.86 c
F. test	**	**	**	**	**	**	**	**	**
Biofertilizers (B)									
Check	103.68 a	99.42 a	101.55 a	0.046 a	0.040 a	0.043 a	0.80 a	0.76 a	0.78 a
Cerealine	110.66 c	105.40 c	108.03 c	0.066 b	0.060 b	0.063 b	0.84 c	0.80 c	0.82 c
Phosphorein	108.90 b	102.86 b	105.88 b	0.064 b	0.058 b	0.061 b	0.84 b	0.78 b	0.81 b
Cer. × Pho.	115.24 d	110.88 d	113.06 d	0.076 c	0.070 c	0.073 c	0.88 d	0.86 d	0.87 d
F. test	**	**	**	**	**	**	**	**	**
Interactions									
V × N	*	NS	NS	NS	NS	**	NS	NS	NS
V × B	NS	NS	NS	**	*	*	*	*	*
N × B	**	*	**	**	**	**	*	NS	NS

Where *,** and NS refers to significancy at 0.05 , 0.01 and not significant, respectively.

Table 3. Spike length (cm), number of fertile spikelets/spike and grain weight/spike of three wheat cultivars as impacted by N and bio-fertilization and their interactions during both seasons and across them

Main effects and interactions	Spike length (cm)			No.of fertile spikelets/spike			Grain weight/spike (g)		
	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.
Cultivars (V)									
Gemmeiza 11	14.70 c	13.48 c	14.09 c	24.24c	24.32c	24.28c	2.93 b	2.71 c	2.82 c
Misr 1	12.65 b	11.45 b	12.05 b	21.28b	20.76b	21.02b	2.43 a	2.21 b	2.32 b
Giza 168	10.81 a	10.41 a	10.61 a	20.18 a	19.72 a	19.95 a	2.14 a	1.98 a	2.06 a
F. test	**	**	**	**	**	**	**	**	**
N levels kg/ fad.) (N)									
40	9.40 a	9.00 a	9.20 a	19.34 a	18.82 a	19.08 a	1.80 a	1.50 a	1.65 a
60	13.83 b	12.73 b	13.28 b	21.16 b	21.06 b	21.11 b	2.50 b	2.40 b	2.45 b
80	14.93 b	13.61 c	14.24 c	25.20 c	24.92 c	25.06 c	3.20 c	3.00 c	3.10 c
F. test	*	*	*	**	**	**	**	**	**
Biofertilizers (B)									
Check	9.00 a	8.80 a	8.90 a	18.66 a	18.34 a	18.50 a	1.76 a	1.56 a	1.66 a
Cerealine	14.66 c	12.80 c	13.73 c	22.08 c	21.96 c	22.02 c	2.60 c	2.52 c	2.56 c
Phosphorein	12.24 b	11.60 b	11.92 b	21.34 b	20.98 b	21.17 b	2.44 b	2.32 b	2.38 b
Cer. × Pho.	14.98 d	13.92 d	14.45 d	25.52 d	25.10 d	25.31 d	3.20 d	2.8 d	3.00 d
F. test	**	**	**	**	**	**	**	**	**
Interactions									
V × N	NS	NS	N.S	NS	NS	NS	*	NS	NS
V × B	*	NS	*	*	**	**	NS	*	*
N × B	NS	*	*	*	NS	NS	NS	*	*

Where *,** and NS refers to significancy at 0.05 , 0.01 and not significant, respectively.

Table 4. No. of spikes/m^2 and 1000-grain weight of three wheat cultivars as impacted by N and bio-fertilization and their interactions during both seasons and across them

Main effects and interactions	No. of spikes/m^2			1000-grain weight (g)		
	2014/2015	2015/2016	Comb.	2014/2015	2015/2016	Comb.
Cultivars (V)						
Gemmeiza 11	388.34 b	384.48 b	386.41 b	43.26 c	41.50 c	42.38 c
Misr 1	406.10 c	388.24 c	397.17 c	41.93 b	40.45 b	41.19 b
Giza 168	366.74 a	365.42 a	366.08 a	39.70 a	39.10 a	39.40 a
F. test	**	**	**	**	**	**
N levels (kg/fad.) (N)						
40	340.77 a	337.19 a	338.98 a	38.89 a	37.97 a	38.43 a
60	399.55 b	396.69 b	398.21 b	42.25 b	40.87 b	41.56 b
80	420.86 c	404.26 c	412.56 c	43.75 c	42.21 c	42.98 c
F. test	**	**	**	**	**	**
Biofertilizers (B)						
Check	354.94 a	351.14 a	353.04 a	39.63 a	38.91 a	39.27 a
Cerealine	400.66 c	385.68 b	393.17 c	42.08 c	40.78 c	41.43 c
Phosphorein	389.58 b	385.80 b	387.69 b	41.82 b	39.88 b	40.85 b
Cer. × Pho.	403.06 d	394.90 c	398.98 d	42.99 d	41.83 c	42.41 d
F. test	**	**	**	**	**	**
Interactions						
V × N	*	NS	NS	*	NS	NS
V × B	NS	*	*	*	*	*
N × B	NS	*	*	*	*	*

Where *,** and NS refers to significancy at 0.05 , 0.01 and not significant, respectively.

Table 5. Grain, straw yields/fad., and Biological yield/fad., (ton) of three wheat cultivars as impacted by N and bio-fertilization and their interactions during both seasons and across them

Main effects and interactions	Grain yield/ fad. (ton)			Straw yield/ fad. (ton)			Biological yield/fad. (ton)		
	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.	2014/2015	2015/ 2016	Comb.
Cultivars (V)									
Gemmeiza 11	3.310 c	3.000 c	3.155 c	3.700 c	3.604 c	3.652 c	7.010 c	6.604 c	6.807 c
Misr 1	2.620 b	2.420 b	2.520 b	3.600 b	3.560 b	3.580 b	6.220 b	5.980 b	6.100 b
Giza 168	2.440 a	2.260 a	2.350 a	3.500 a	3.240 a	3.370 a	5.940 a	5.500 a	5.720 a
F. test	**	**	**	**	**	**	**	**	**
N levels (kg/fad.) N									
40	2.120 a	2.070 a	2.095 a	2.766 a	2.698 a	2.732 a	4.886 a	4.768 a	4.827 a
60	3.020 b	2.616 b	2.818 b	3.796 b	3.790 b	3.793 b	6.816 b	6.406 b	6.611 b
80	3.230 c	2.994 c	3.112 c	4.238 c	3.916 c	4.077 c	7.468 c	6.910 c	7.189 c
F. test	**	**	**	**	**	**	*	**	**
Biofertilizers (B)									
Check	2.244 a	2.200 a	2.222 a	3.088 a	3.034 a	3.061 a	5.332 a	5.234 a	5.283 a
Cerealine	2.976 c	2.550 c	2.763 c	3.712 b	3.534 c	3.623 b	6.688 c	6.084 c	6.386 c
Phosphorein	2.838 b	2.480 b	2.659 b	3.604 c	3.372 b	3.488 b	6.442 b	5.852 b	6.147 b
Cer. × Pho.	3.102 d	3.010 d	3.056 d	3.996 d	3.932 d	3.964 c	7.098 d	6.942 d	7.020 d
F. test	**	**	**	**	**	**	**	**	**
Interactions									
V × N	**	*	**	*	**	**	*	NS	*
V × B	*	**	**	*	NS	*	*	NS	**
N × B	**	**	**	**	*	*	**	*	**

Where *,** and NS refers to significancy at 0.05 , 0.01 and not significant, respectively.

Table 6. Harvest index and RPP of biological yield/fad., of three wheat cultivars as impacted by N and bio-fertilization and their interactions during both the seasons and over them

Main effects and interactions	Harvest index			RPP		
	2014/2015	2015/2016	Comb.	2014/2015	2015/2016	Comb.
Cultivars (V)						
Gemmeiza 11	47.20 c	45.42 c	46.31 c	2.382 a	2.256 a	2.319 a
Misr 1	42.12 b	41.40 b	41.76 b	2.486 b	2.598 b	2.542 b
Giza 168	41.00 a	40.08 a	40.54 a	2.800 c	2.694 c	2.747 c
F. test	**	**	**	**	**	**
N. levels (kg/fad.)(N)						
40	42.12 a	40.26 a	41.19 a	3.016 c	3.216 c	3.116 c
60	43.20 b	41.72 b	42.46 b	2.334 b	2.220 b	2.277 b
80	45.00 c	44.92 c	44.96 c	2.318 a	2.112 a	2.215 a
F. test	*	*	*	**	**	**
Biofertilizers (B)						
Check	42.10 a	41.02 a	41.56 a	3.420 d	3.648 d	3.534 d
Cerealine	44.40 c	42.70 c	43.55 c	2.400 c	2.142 b	2.271 c
Phosphorein	43.06 b	42.12 b	42.59 b	2.240 b	2.106 a	2.173 b
Cer. × Pho.	44.20 d	43.36 d	43.78 d	2.164 a	2.168 c	2.166 a
F. test	**	**	**	*	*	*
Interactions						
V × N	NS	*	NS	*	NS	NS
V × B	*	NS	NS	*	*	**
N × B	*	*	**	NS	*	NS

Where *,** and NS refers to significancy at 0.05 , 0.01 and not significant, respectively.

Table 7. Carbohydrate, protein content (%) and protein yield/fad., (ton) of three wheat cultivars as influenced by N and bio-fertilization and their interactions during both seasons and over them

Main effects and interaction	Carbohydrate content (%)			Protein content (%)			Protein yield/fad. (ton)		
	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.	2014/ 2015	2015/ 2016	Comb.
Cultivars (V)									
Gemmeiza 11	72.02 c	71.14 c	71.58 c	13.12 c	12.32 c	12.72 c	0.436 c	0.386 c	0.404 c
Misr 1	70.92 b	68.86 b	69.89 b	11.20 b	11.86 a	11.53 b	0.296 b	0.276 b	0.293 b
Giza 168	67.18 a	66.28 a	66.73 a	10.06 a	10.08 b	10.07 a	0.246 a	0.226 a	0.236 a
F. test	**	**	**	**	**	**	**	**	**
N levels (kg/fad.)(N)									
40	66.60 a	65.38 a	65.99 a	10.32 a	9.66 a	9.99 a	0.218 a	0.200 a	0.209 a
60	70.72 b	69.64 b	70.18 b	11.86 b	10.86 b	11.36 b	0.362 b	0.284 b	0.323 b
80	72.80 c	71.26 c	72.03 c	12.20 c	13.74 c	12.97 c	0.398 c	0.404 c	0.401 c
F. test	*	**	**	**	**	**	**	**	**
Biofertilizers (B)									
Check	67.66 a	66.64 a	66.15 a	8.66 a	9.28 a	8.97a	0.196 a	0.204 a	0.200 a
Cerealine	70.56 c	69.46 c	70.01 c	12.20 c	11.76 c	11.98 c	0.362 c	0.298 c	0.330 c
Phosphorein	69.28 b	68.70 b	68.99 b	11.46 b	11.04 b	11.25 b	0.324 b	0.272 b	0.298 b
Cer. × Pho.	72.66 d	70.24 d	71.45 d	13.52 d	13.60 d	13.56 d	0.422 d	0.410 d	0.416 d
F. test	**	**	**	**	**	**	**	**	**
Interactions									
V × N	NS	*	NS	NS	*	NS	*	NS	*
V × B	*	NS	NS	**	*	**	**	*	**
N × B	*	*	**	NS	NS	NS	NS	**	**

Where *,** and NS refers to significancy at 0.05 , 0.01 and not significant, respectively.

be noticed that the pronounced effect of the combined treatments (Cerealine + Phosphorein) were drastically prone on the coming wheat characters, being: plant height, flag leaf area efficiency, tillering index, spike length, number of fertile spikelets/spike, grain weight/spike, number of spikes /m^2, 1000-grain weight, harvest index, the final yields/fad., from (grain, straw and biomass), both carbohydrate and protein contents and at last protein yield/fad. Meanwhile, the RPP of biological yield/fad., was inversely behaved as all the studied pervious traits did, being increased in case of the un-inoculated check compared to the three bio-fertilizer treatment. This inclination was fairly intrinsical in both the seasons and over them too (Tables 2-7, orderly). At the other extreme, when the dual treatments consisted of Cerealine + Phosphorein bio-fertilizers was used in inoculating wheat grains, the increases in all yield attributes, yields/fad., and grain quality were considered worthwhile in this regard (except RPP) if compared with each of Cerealine and Phosphorein bio-inoculants when were tested separately as well as the check treatment. In this context, wheat yield attributes, yields/fad., and grain quality showed marked increases due to Cerealine + Phosphorein bio-fertilizers application and such ameliorates may be ascribed to the favorable impact of such bio-fertilizers on N_2-fixation and raising the endogenous phytohormones (IAA, GA3 and cytokinis) , as they play an important role in the activity of root system to absorb more necessary nutrients for increasing photosynthesis rate and producing more assimilates inside plant organs that are responsible much for boosting all the above-mentioned wheat parameters. The preferable effects of bio-fertilizers on raising most of agronomic characters of wheat plants were documented by earlier works, including: **Ahmed *et al*. (2011), Badran (2011), Malik *et al*. (2012), Namvar and Khandan (2013) and Singh *et al*. (2016).**

Interaction Effects

The interaction effect between any two of the studied factors belonged to the tested wheat yield attributes, yield and grain quality (on pooled data basis) detected similar inclinations as found in the final yields/fad., so the following discussion are confined only to the significant interaction effects related to the final wheat yields per unit land area from grain, straw, biomass and protein as documented in Tables 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19.

The interaction between the three wheat cultivars and nitrogen fertilizer levels detected substantial effects on the final yields/fad., from grain, straw, biomass and protein where the highest mean values were appeared on the Gemmeiza 11 cultivar when fertilized with 80 kg N/fad., at the same- time, the least wheat yields/fad., were shown due to the 40 kg N level when the Giza 168 cultivar was in the picture. However, the other tested interactions between Misr 1 cultivar and 60 kg N/fad., came in between.

In addition, the tested cultivars interacted strongly with bio-fertilizers under study on the final wheat yields/fad., being grain, straw, biomass and protein (Tables 12, 13, 14and 15). It is clear that, the wheat cultivar Gemmeiza 11 inoculated with Cerealine + Phosphorein beared significant increases as for grain, straw, biomass and protein yields/fad. Mean-while, the Giza 168 cultivar when interacted with the un-inoculated check produced the lowest records of such wheat yields. Like –wise, the cultivar Misr 1 had intermediate values as for such yields when inoculated with either Cerealine or Phosphorein alone.

Furthermore, the nitrogen fertilizer levels interacted positively with the tested bio-fertilizers regarding: grain, straw, biomass and protein yields per unit land area (Tables 16, 17, 18 and 19). The findings demonstrated that the 60 kg N level conjucated with Cerealine + Phosphorein treatment gave greater mean records of such yields/fad. Besides, the 40 kg N rate acted with un- inoculated check and gave the lowest values in this respect.

The examned results revealed that each of the V× N, V × B and N × B interaction effects on wheat yields are considered dependent and consistent. Also, the findings could be indicated that the Gemmeiza 11 wheat cultivar proved to be more producer of yields due to 60 kg N level with Cerealine + Phosphorein bio-fertilizer treatment. Likewise such bio-fertilizer treatment saved about 20 kg N / fad., under the conditions of this study, referring to its benefit in reducing

Table 8. Grain yield/fad. (ton) of wheat in case of the V× N interaction, consolidated data

Nitrogen levels (kg N/fad.),(N) Cultivars (V)	40	60	80
	A	B	C
Gemmeiza 11	2.314 c	3.391 c	3.760 c
	A	B	C
Misr 1	2.002 b	2.623 b	2.935 b
	A	B	C
Giza 168	1.969 a	2.240 a	2.641 a

Tale 9. Straw yield/fad. (ton) of wheat as affected by the V×N interaction, integrated data

Nitrogen levels (kg N/fad.) (N) Cultivars (V)	40	60	80
	A	B	C
Gemmeiza 11	2.713 b	3.399 a	4.844 c
	A	C	B
Misr 1	3.222 c	4.046 c	3.472 a
	A	B	B
Giza 168	2.261 a	3.934 b	3.915 b

Table 10. Biological yield/fad. (ton) of wheat according to the V×N interaction, pooled data

Nitrogen levels (kg N/fad.) (N) Cultivars (V)	40	60	80
	A	B	C
Gemmeiza 11	5.027 b	6.790 b	8.604 c
	A	C	B
Misr 1	5.224 c	6.669 b	6.407 a
	A	B	C
Giza 168	4.230 a	6.374 a	6.556 b

Table 11. Protein yield/fad. (ton) as influenced by the V×N interaction, pooled data

Nitrogen levels (kg N/fad.) (N) Cultivars (V)	40	60	80
	A	B	C
Gemmeiza 11	0.237 b	0.395 c	0.580 c
	A	B	B
Misr 1	0.220 b	0.310 b	0.349 b
	A	B	B
Giza 168	0.170 a	0.264 a	0.274 a

Table 12. Grain yield/fad. (ton) of wheat in response to the V×B interaction, combined data

Biofertilizer (B) Cultivars (V)	Check	Cerealine	Phosphorein	Cerealine + Phosphorein
	B	C	A	D
Gemmeiza 11	2.743 c	3.502 c	2.474 a	3.901 c
	A	B	C	D
Misr 1	2.012 b	2.454 b	2.762 b	2.852 b
	A	B	D	C
Giza 168	1.911 a	2.333 a	3.741 c	2.415 a

Table 13. Straw yield/fad. (ton) of wheat in response to the V×B interaction, as listed from the integrated data

Biofertilizer (B) Cultivars (V)	Check	Cerealine	Phosphorein	Cerealine+ Phosphorein
	A	B	A	C
Gemmeiza 11	3.400 c	3.600 b	3.406 a	4.202 b
	A	C	B	C
Misr 1	3.002 b	3.804 c	3.701 b	3.813 a
	A	C	B	D
Giza 168	2.781 a	3.465 a	3.357 a	3.877 a

Table 14. Biological yield/fad. (ton) of wheat in proportion to the V×B interaction, combined data

Biofertilizer (B) / Cultivars (V)	Check	Cerealine	Phosphorein	Cerealine+ Phosphorein
	B	C	A	D
Gemmeiza 11	6.143 c	7.102 c	5.880 a	8.103 c
	A	B	C	D
Misr 1	5.014 b	6.258 a	6.463 c	6.665 b
	A	D	B	C
Giza 168	4.692 a	7.798 b	6.098 b	6.292 a

Table 15. Protein yield/fad. (ton) as influenced by the V×B interaction, pooled data

Biofertilizer (B) / Cultivars (V)	Check	Cerealine	Phosphorein	Cerealine+ Phosphorein
	A	B	C	D
Gemmeiza 11	0.190 c	0.367 c	0.404 b	0.655 c
	A	B	A	B
Misr 1	0.259 b	0.338 b	0.240 a	0.335 b
	A	B	B	B
Giza 168	0.151 a	0.285 a	o.250 a	0.258 a

Table 16. Grain yield/fad. (ton) of wheat due to the N×B interaction, integrated data

Biofertilizer (B) / Nitrogen levels (kg/N fad.) (N)	Check	Cerealine	Phosphorein	Cerealine + Phosphorein
	A	C	D	B
40	1.621 a	2.354 a	2.462 b	1.943 a
	B	C	A	D
60	2.441 b	3.002 b	2.141 a	3.688 c
	A	B	C	D
80	2.604 c	2.933 b	3.374 c	3.537 b

Table 17. Straw yield/fad. (ton) of wheat in response to the N×B interaction, integrated data

Biofertilizer (B) / Nitrogen levels (kg/N fad.) (N)	Check	Cerealine	Phosphorein	Cerealine+ Phosphorein
	A	B	D	C
40	2.300 a	2.740 a	3.012 b	2.876 a
	B	C	A	D
60	3.302 b	3.900 b	2.822 a	5.148 c
	A	C	D	B
80	3.581 c	4.229 c	4.630 c	3.868 b

Table 18. Biological yield/fad., (ton) of wheat in response to the N×B interaction, integrated data

Biofertilizer (B) / Nitrogen levels (kg/N fad.) (N)	Check	Cerealine	Phosphorein	Cerealine+ Phosphorein
	A	C	D	B
40	3.921 a	5.094 a	5.474 b	4.819 a
	B	C	A	D
60	5.743 b	6.902 b	4.963 a	8.836 c
	A	B	D	C
80	6.185 c	7.162 c	8. 004 c	7.405 b

Table 19. Protein yield/fad. (ton) as influenced by the N×B interaction, pooled data

Biofertilizer (B) / Nitrogen levels (kg/N fad.) (N)	Check	Cerealine	Phosphorein	Cerealine+ Phosphorein
	A	B	C	B
40	0.114 a	0.240 a	0.256 a	0.226 a
	A	C	B	D
60	0.138 b	0.320 b	0.220 a	0.614 c
	A	B	B	B
80	0.348 c	0.430 c	o.418 b	0.408 b

the expensive costs of mineral fertilizers along with protecting the environment from the harmful adverse effects.In this regard, some workers allude to the importance of using the integrated nutrient management strategies including both mineral N and bio-fertilizers in wheat fields, of them: **Agamy *et al*. (2012), Seyed *et al*. (2013), AAzudi *et al.* (2014), Badran *et al*. (2011)** and **Khattb *et al*. (2016).**

Conclusion

Growing Gemmeiza 11 wheat cultivar under 60 kg N level/fad., along with the most efficient bio-fertilizer treatment (Cerealine + Phosphorein each at the rate 500 grams/fad.) is conditions worthwhile as for optimizing the final yields/ ad., beside raising the grain quality, especially under the low N deficient soil of Kafer El-Herawy Village, Zagazig Locality, Sharkia Governorate, Egypt. Also, the application of the previous bio-fertilizer treatment proved its efficiency in saving the amount of N level from 80 to 60 kg/fad., without any reduction in the final yields as well as reducing the harmful effect of the environment contamination.

REFERENCES

AAzudi, M.S., S.A. Siydat, M. Mehdi and E. Younest (2014). The study effect of nitrogen, *Azotobacter* spp. and *Azospirillum* spp. on phonological and morphological traits of durum wheat cultivars in Dehloran Region, Iran. Cerctari Agronomica in Moldova, XL. Vill., 1 (157): 15-21.

Abd El-Aziz, M.A., A.H. Salem, R.M. Aly and M.Sh. Abd El-Maaboud (2017). The role of humic acid and compost in maximizing productivity of some wheat cultivars grown under newly reclaimed sandy soil at North Sinai, Egypt. Egypt. J. Appl. Sci., 32 (9): 97-111.

Abd El-Hady, S.M.H. (2018). Response of some wheat cultivars to varying sowing dates and planting densities. M. Sc. Thesis, Fac. Agric., Zagazig Univ., Egypt

Abd El-Lattief, E.A. (2016). Response of wheat (*Triticum aestivum*, L.) to bio-organic fertilizers under southern Egypt conditions. Int. Conf. on Biotechnol. Appl. in Agriculture (ICBAA), Benha Univ., Moshtohor and Sharm El-Shiekh, Egypt.

Abd-Allah, A., H. Fadle, A.Y.A. El-Bana, A.E. A. Omar and M.E.I. Abdul-Hamid (2016). Response of some wheat cultivars to varying sowing dates and nitrogen fertilizer levels under sandy soil conditions. Zagazig J. Agric. Res., 43 (1): 29-48.

Agamy, R.A., G.F. Mohamed and M.M. Rady (2012). Influence of the application of fertilizer type on growth, yield, anatomical structure and some chemical components of wheat (*Triticum aestivum*, L.) grown in newly reclaimed soil. Aust. J. Basic and Appl. Sci., 6 (3): 561-570.

Ahmed, M.A., A.G. Ahmed, M.H. Mohamed and M.M. Tawfik (2011). Integrated effect of organic and bio-fertilizers on wheat productivity in new reclaimed sandy soil. Res. J. Agric. and Biol. Sci., 7 (1):105-114.

Anonymous (2017). The cultivated area and production of wheat in Egypt. Statistical Report of Wheat, Res. Section, Minist. Agric., Egypt.

AOAC (2002). Official Methods of Analysis. Association of Official Agriculture Chemistry, 17th Ed., Washington, D.C.

Badran, M.S.S. (2011). Effect of soil water stress and deficit mineral nitrogen fertilization on productivity of inoculated wheat seeds with bio-fertilizer Cerealine in sandy soil. J. Agric. and Env. Sci. Dam. Univ., Egypt, 10 (2) :61-90.

Badwan, F.I., M.A. Gomaa, M.A.A. Naser and I.F. Mussa (2014). Response of some wheat varieties to humic acid, mineral and biofertilization on productivity and quality. Middle East J.Agric. Res., 3(3):631-637.

Duncan, D.B. (1955). Multiple Range and Multiple F-test. Biometrics, 11: 1-42.

El-Hag, D.A.A. (2017). Effect of irrigation numbers on yield and yield components of some bread wheat cultivars in North Nile Delta of Egypt. Egypt. J. Agron., 39(2):137-148.

FAOSTAT (2017). Food and Agricultural Organization of the United Nations (FAO) Statistical Database, http://faostat 3. Fao. Org/ download/ Q/QC/E.

Khalid, M., M.F.S. Ali, M.W. Pervez, M. Rehman, S. Hussain and Kh. Rehman (2014). Optimization of nitrogen fertilizer level for newly involved wheat (*Triticum aestivum*, L.) cultivars. Appl. Sci. Report., 3 (2): 83-87.

Khattab, A.M., A. El-Khawaga, M.E. Salah and I.E. Ramadan (2016). Some bio-chemical and phosphorus fertilization regimes impacts on wheat (*Triticum aestivum*, L.) productivity. Zagazig J. Agric. Res., 43 (1): 11-28.

Malik, A.U., A.L. Malghani and F. Hussain (2012). Growth and yield response of wheat (*Triticum aestivum*, L.) to phosphobacteria inoculation. Russian, A. Sci., 38(1):11-13.

Namvar, A. and T. Khandan (2013). Response of wheat to mineral nitrogen fertilizer and bio-fertilizer (*Azotobacter* sp. and *Azospirillum* sp) inoculation under different levels of weed interference. Ecologia, 59 (2): 85-94.

SAS (2002). JMP statistics and graphics guide. SAS Institute Inc., Cary, NC.

Seyed, M.A., A. Farnia, M. Shaban and M. Lask (2013). Effect of different biofertilizers on seed yield of barely (*Hordum vulgare*, L.), Bahman cultivar. Int. J. Advan. Biol. and Bioch. Res., 1 (5): 538-546.

Seyed, R.S.H., R. Khalizadeh and M. Vatandoost (2017). Study of nitrogen fertilizer and cycocel on Fv/Fm and dry matter mobilization to grain yield of wheat (*Triticum aestivum*, L.) Cercetari Agron. in Moldova., L (1): 5-17.

Singh, M.P., P. Kumar, A. Kumar, R. Kumar, A. Diwedi, S. Cngwar, V. Kumar and N.K. Sepat (2016). Effect of NPK with biofertilizers on growth, yield and nutrient uptake of wheat (*Triticum aestivum*, L.) in Western Attar Pradesh Condition. Prog. Agric., 10 (1): 85-87.

Sokal, R.R. and F.J. Rohif (1997). Biometry. The Principles and Practice of Statistics in Biological Res., W.H. Freeman, New York, USA.

تأثير بعض الأســمدة الحيــوية على المحصول والجودة لثلاثة أصناف من قمح الخبــز تحت مستويات مختلفة من السماد النينروجينى

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أجريت هذه الدراسة فى قرية كفر الهراوى - مركز الزقازيق- محافظة الشرقية –مصر خلال الموسمين الزراعيين ٢٠١٥/٢٠١٤ و ٢٠١٦/٢٠١٥ لدراسة تأثير بعض الأسمدة الحيوية مثل السيريالين والفسفورين كملقحات بكتيرية على المحصول والجودة لثلاثة أصناف من قمح الخبز تحت مستويات مختلفة من السماد النيتروجينى، كان التصميم التجريبى المستخدم هو نظام القطع المنشقة مرتين فى ثلاث مكررات حيث وزعت الأصناف الثلاثة فى القطع الرئيسية وقد أحتوت القطع الشقية من الدرجة الأولى مستويات السماد النيتروجينى الثلاثة ٤٠ و ٦٠ و٨٠ كجم ن/فدان وأخيرا وزعت معاملات التسميد الحيوى الأربع (بدون إضافة) سيريالين، فسفورين وسيريالين + فسفورين) فى القطع الشقية من الدرجة الثانية، وقد أوضحت النتائج المتحصل عليها تفوق الصنف جميزة ١١ على الصنفين مصر١ وجيزة ١٦٨ وأيضاً المستوى ٨٠ كجم ن/فدان بالمقارنة بالمستويين ٤٠ و٦٠ كجم ن/فدان وأيضًا معاملة التسميد الحيوى بالسيريالين + الفسفورين فى صورة مختلطة بالمقارنة بكلا السمادين بصورة فردية ومعاملة الكنترول وقد كان ذلك واضحا للصفات المحصولية تحت الدراسة وهى أرتفاع النبات، كفاءة ورقة العلم، دليل التفريع، طول السنبلة، عدد السنيبلات الخصبة/سنبلة، وزن الحبوب/ سنبلة، وزن الألف حبة، المحصول النهائى/فدان (حبوب، قش، البيولوجى)، دليل الحصاد، محتوى الكربوهيدرات والبروتين فى الحبوب وأخيرا محصول البروتين للفدان، وعلى العكس من ذلك فقد أوضحت المعاملات السابقة تفوق الصنف مصر١ فى عدد السنابل/م^{٢} بالمقارنة بالصنفين الأخرين وأيضًا نقصا معنويا لصفة الكفاءة التمثيلية النسبية للمحصول البيولوجى / فدان بسبب تطبيق المعاملات السابقة، وأيضا أوضحت نتائج تداخل الفعل بين عوامل الدراسة الثلاثة أن الصنف جميزة ١١ قد تداخل معنوياً مع المستوى ٦٠ كجم ن/فدان ومعاملة السماد الحيوى سيريالين +فسفورين وكان تأثيره أكثر وضوحا للصفات المحصولية وهى محصول الحبوب والقش والبيولوجى والبروتين للفدان، وأخير يمكن التوصية بزراعة هذا الصنف الأكثر إنتاجا تحت ظروف قرية كفر الهراوى - مركز الزقازيق- محافظة الشرقية- مصر مع تسميده بالمستوى ٦٠ كجم ن/فدان مع معاملة السمادى الحيوى بالسيريالين + الفسفورين بمعدل ٥٠٠جم لقاح بكتيري لتقاوي الفدان وذلك لمعظمة المحصول النهائى للفدان وصفات الجودة لمحصول القمح.

المحكمـــــون:

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