Response of Some Wheat Cultivars to A- mycorrhizal Inoculation, Phosphate Solubilizaing Bacteria and Organic Fertilization

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ABSTRACT: Two field experiments were conducted at the Experimental Station Farm of Faculty of Agriculture (Saba- Basha) Alexandria University. Egypt during 2014/2015 and 2015/2016 growing seasons. The objective of this study was to investigation the effect of organic manure and biofertilization on yield, yield components and grain quality of three wheat cultivars to improve wheat productivity and minimizing of pollution. The results could be summarized as follows. Sids 12 cultivar gave higher spike length, number of spikelets/spoke, grain number/spike 1000- grain weight, grain, straw and biological yields (ton/fed) as well as harvest index (%) than Sakha 94 cultivar. Also, Sids 12 cultivar significantly surpassed Sakha 94 cultivar in crude protein (%) and potassium percentage in both seasons. The addition of organic manure at 10 m^3/fed resulted in a significant increment in yield components and crude protein (%) percentages, phosphorus and potassium of wheat grains in both seasons.

Significant variation were recorded between the tested biofertilization treatments for plant height, spike length, number of spikes/m^2, 1000- grain weight in both seasons. The effective treatment for plant height, spike length, grain straw and biological yield (ton/fed) as well as harvest index were obtained by Sids 12 cultivar with adding organic manure at 10 m^3/fed, in the both seasons. Sids 12 cultivars with all biofertilizers inoculation surpassed Sakha 94 cultivar for plant height, grain, straw and biological yields (ton)/fed, in the both seasons.

Keywords: Wheat cultivars, Organic, Biofertilization, yield, chemical composition

INTRODUCTION

Wheat (*Triticum eastivum*, L.) is one of the most important crops used in human food and animal feed in Egypt. Recently, a great attention of several investigation has been directed to increase the productivity of wheat to minimize the gap between the production and consumption by increasing the cultivated area and wheat yield per unit area.

The total biomass is a result of the integration of metabolic reaction in the plant. Consequently any factor influencing the metabolic activity of the plant at any period of its growth can affect the yields. Thus, Meanwhile, processes in wheat plants are greatly governed by both internal i.e. genetic makeup of the plant and external conditions which namely clamitc and edaphically environmental factors. This increasing wheat production per unit area can be achieved by breading and cultivating the promising wheat cultivars and applying the optimum cultural practices such as suitable fertilizer. Gomaa *et al.* (2011) reported that their were significant differences between the two cultivars (Gemmeiza 7 and Sakha 93) in all characters under study such as plant height at harvest, number of spikes/m^2, spike length, number of tillers/m^2, number of grains/spike, grain weight/spike, grain, straw and biological yields/fed. Also, nitrogen, phosphorus potassium percentages and protein content differed significantly between the two cultivars.

Additionally, organic manures in the from of compost, animal manure farm yard manure (FYM) and green manure of organic materials are generally added in soils to improve their physical and chemical properties. They enhance the soil fertility by their composition of macro and micro elements, amino acid, organic acids sugars and organic matter (Zaki *et al.,* 2007; Hosam El- Din, 2007; Zeidan *et al.,* 2009 and Gomaa *et al.,* 2011). Furthermore, biofertilization is an important factor being used to produce without some mineral fertilizer that cause environmental pollution problems and high rates of it leads in decrease the potential activity of microbial and the mobility of organic matters. Hence, the attention has been focused on the researches of biofertilization to safe alternative specific chemical fertilizers. Biofertilizers plays vital role of increasing the number of microorganisms and accelerate certain of microbial process in the rhizosphere of inoculated soil of plants which can changes the available form of some nutrients to be plants (El- Kholy and Omar, 2000; Abdalla, 2002; Basha, 2004; Ibrahim *et al.,* 2004 and Radwan *et al.,* 2015).

The aim of this investigation was designed to study the effect of organic manure and biofertilization on yield and its components as well as quality of three wheat cultivars.

MATERIALS AND METHODS

Two field experiments were conducted at the experimental farm, Faculty of Agriculture (Saba Basha), Alexandria University, Egypt, during 2014/2015 and 2015/2016 seasons. The experiments were carried out to study the combined effect of organic manure and biofertilization on yield, yield components and quality of grains of three wheat cultivars (*Triticum aestivum*, L.).

The experimental design was split – split plot design with three replications. Wheat cultivars were allocated in the main plots, organic manure rates were allocated in the sub- plots and bio-fertilizer treatments were allocated in the sub- sub plots. The size of each plot was 10.5 m^2 (1/400 feddan) 3.5 m long and 3.0 m wide. Each experiment included 27 treatments which were the combination of three wheat cultivars, three organic manure rates and three biofertilization treatments which can be described as follows:

A- Cultivars
1- Sids 12
2- Gemmeiza9
3- Sakha 94
B- Organic manure rates
1- Zero (control)
2- 5 m^3/fed
3- 10 m^3/fed
C- Biofertilizers
1- Uninoculation (control)
2- Phosphorein inoculation
3- A- mycorrhzal inoculation

Nitrogen fertilizer was added at a rate of 70 kg N/fed (the recommended dose, where 20 kg N/fed, were added at sowing time, 25 kg N/fed added at the first irrigation (24 days after sowing) and the third dose 25 kg/fed were applied 25 days of the first irrigation in the two experiments. N- Fertilizer added in the form of ammonium nitrate (33.5%N). Super phpshate fertilizer (15.5% P_2O_5) was applied before sowing of the rate of 150 kg/fed (the recommended dose). Potassium fertilizer was applied before sowing (During seed bed preparation at rate of 50 kg/fed in the form of potassium sulfate (48% K_2O) (The recommended dose).

The farmyard manure from cattle manure as organic manure was obtained from Abeas region in the form of fime FYM organic fertilizers was applied at a rates Zero (untreated), 5 and 10 m^3/fed) and well mixed with the soil two weeks before sowing, raked it highly at a depth of 10- 15 cm. the chemical analysis of organic fertilizer is shown in Table (1).

Table (1). Analysis of the applied organic manure (Sheep manure)

Analysis	Values
pH	7.1
O.M. (%)	36.0
O.C (%)	20.9
Total (N%)	2.20
Total(P%)	1.20
Total (K%)	1.50
C:N ratio	9.5

Table (2). Some physical and chemical properties of the experimental soil in 2014/2015 and 2015/2016 seasons

Soil properties	2014/2015	2015/2016
A- Mechanical analysis		
Sand%	16.50	15.80
Clay%	42.50	43.00
Silt%	41.00	41.20
Soil texture	**Clay loam soil**	
B- Chemical analysis		
pH (1:1)	7.50	7.60
EC (dS/m), 1:2	2.30	2.40
1- Soluble cations (1:2) (cmol/kg soil)		
K^+	0.92	0.91
Ca^{++}	4.10	4.15
Mg^{++}	3.10	3.00
Na^+	8.10	8.15
2- Soluble anions (1:2) (cmol/kg soil)		
CO^-_3+ HCO^-_3	2.70	2.60
CL^-	11.10	11.30
SO^-_4	0.47	0.49
Calcium carbonate (%)	7.50	7.60
Total nitrogen%	0.47	0.48
Available Phosphorus (mg/kg)	3.50	3.60
Organic matter (%)	0.93	0.90

Inoculation with strain A- Mycorrhizal fungi at the rate of 250 spores added with grain at sowing time. Local strain of *Glomus macrocarpum* was kindly obtained from plant production Dept., Fac. of Agric. (Saba Basha) described by Radwan (1996). Phosphorein commericed biofertilizer contains a highly active dissolving bacteria (*Bacillus megatherium*) which converte the insoluble tricalcium phosphate to the soluble mono calcium phosphate. Phosphorein was added at a rate of 400 g/fed, produced by the general-organization for Agriculture Equalization Fund, Ministry of Agriculture and Land Reclamation, Egypt. Inoculation with phospharein was performed by coating wheat grains with each product in dividedly using a sticking substance (Arabic gum 5%) just before sowing. The preceding crop was maize for the two growing seasons. Soil samples of the experimental sites were taken at the depth of 0-30 cm. Physical and chemical analysis are presented in Table (2) was done according to (Page *et al.,* 1982). Sowing dates were November 18th and 22nd in the both seasons, respectively.

A- Yield and its components

At harvest time, yield, and its components were calculated from an area of one square meter from each sub- sub plot. The following charaters were recorded:

1- Plant height at harvest (cm)
2- Spike length (cm)
3- Number of spikes/m^2
4- Number of spikelets/spike
5- Number of grains/spike
6- 1000- grain weight (g)
7- Grain yield (ton/fed)
8- Straw yield (ton/fed)
9- Biological yield (ton/fed)

B- Grain quality

1- Grain Crude protein percentage
2- Phosphorus content percentage
3- Potassium content percentage

Data obtained were exposed to the proper method of ststistical analysis of variance as described by Gomez and Gomez (1984). The treatments mean were compared using the least significant differences (L.S.D.) test at 0.5% level of probability.

RESULTS AND DISCUSSION

A- Yield and its components

Data in Tables (3,4 and 5) revealed that the differences among the studied cultivars in yield and its components i.e. plant height at harvest, spike length (cm), number of spikelets/spike, grain number/spike,1000- grain weight (g), and grain, straw and biological yields (ton/fed) and harvest index (%) in both seasons were significant.

Sids 12 cultivar significantly surpassed the other two cultivar in spike length, number of spikelets/spike, grain number/spike,1000- grain weight (g), and grain, straw and biological yields (ton)/fed. Sakha 94 cultivar recorded the longest plant height and greatest number of spikes/m^2 in both seasons. These differences may be due to the genetic differences among the cultivars. Also, the differences in 1000- grains weight might be attributed to the variation in translocation rate of photosynthesis from leaves to the storing organs i.e. grain. These finding are in similar trend with those of Zaki *et al.* (2004), and in agreement with those reported by Hasseinen and Gomaa (2001) Abdel-Maksoud (2002), Fraga (2003), Abdu Grab *et al.* (2006), Shoman *et al.* (2006) and Gomaa *et al.* (2011).

Data presented in Tables (3, 4 and 5) showed that plant height (cm), spike length (cm), number of spikes/m^2, number of spikelets/spike, grain number/spike,1000- grain weight, grain and straw biological yields (ton/fed) as will as harvest index (%) during the two growing seasons were affected significantly by adding organic manure rates. The highest mean values of all characters were obtained by adding organic manure at 10 m^3/fed, while, the lowest values of all characters were recorded by untreated (control) in both seasons. Also, from the same tables there is no significant differences between adding 5 m^3/fed for grain, straw and biological yields (ton/fed) as well as harvest index in both seasons.

In addition, the increase in grain yield and other studied traits could be due to the increase in dry weight of vegetative organ which might be consider as a criterion for the photosynthesis efficiency of the plant. Similar results were obtained by Hayam and El- Sayed (2001) and Abo El-Ala (2006).

In general, application of organic manure at rate of 10 m^3/fed, gave the highest yield and its components compared to the untreated treatment. This superiority may be due to the effect of organic fertilizer through flowering and grain production (Kabesh *et al*., 2008). Also, in some characters treatment with organic fertilizer gave the highest significant increase. Similar results were obtained by Shoman *et al*. (2006), Sadur *et al.* (2008) and Gomaa *et al*. (2011). With regarded to the effect of biofertilization on wheat yield and its components, the results given in Tables (3,4 and 5) generally showed that all characters under this study were significantly affected by inoculation of wheat grain with A-mycorrhizal except plant height and 1000- grain weight was recorded the highest with phosphorein and while no significant differences between A-mycorrhizal and phospharein in both seasons.

Results presented in the same Tables show the effect of phosphorein and A- mycorrhizal inoculation on plant height, spike length, number of spikes/m^2 and 1000- grain weight in both seasons and grain number/spike and grain yield first and the second season, respectively.

Also, it could be concluded that inoculation of wheat grains with biofertilizers encourages the increase of plant height, spike length, number of spikes/m^2 and 1000- grain weight. This may be due to the effect of biofertilization which play an important role in the assimilation of wheat plants that reflected on enhancing these characteristics. Also, this could be attributed to the role of plant phytohormones like, IAA, GAs and CKs which promote plant growth, cell division breaking the special dominances Irence encouraging the photosynthesis and assimilation accumulation (El- Khawas, 1990).

Similar results were obtained by Abdel- Hamid *et al*. (2001), Abdalla (2002), Ali *et al.* (2003), Basha (2004), Zaki *et al*. (2007) and Radwan *et al.* (2015).

The effect of the interaction between the three wheat cultivars and organic manure rates on plant height, spike length, grain straw and biological yields (ton/fed) as well as harvest index were significant in Tables (3,4 and 5)in the both growing seasons.

Sids 12 cultivar with application of organic manure at the rate of 10 m^3/fed gave the highest spike length, grain and straw biological yields (ton/fed) as well as harvest index in both seasons.

The effect of interaction between three wheat cultivars and biofertilization on plant height, grain, straw and biological yields (ton/fed) were significant and reported in Tables (3,4 and 5).

The effect of interaction between organic manure rates and biofertilization on plant height, number grain/spike, 1000- grain weight, straw and biological yields (ton/fed) as well as harvest index (%) were significant in the both seasons.

The interaction among the three wheat cultivars organic manure rates and biofertilization were significant for plant height, grain, straw and biological yields (ton/fed) as well as harvest index in the two growing seasons, Tables (3, 4 and 5). Sids 12 cultivars gave the highest grains, straw and biological yields as well as harvest index (%) and applying organic manure rate at 10 m^3/fed, with A- mycorrhizal inoculation. Also, Gemmeiza 9 cultivar under 10 m^3/fed with A- mycorrhizal inoculation gave the highest plant height at harvest in both seasons.

Table (3). Yield and its components as affected by three wheat cultivars, organic manure rates and biofertilization during 2014/2015 and 2015/2016 seasons

Treatments	Spike length (cm)		Number of spikes/m^2		Number of spikelets/spik	
	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
A) Cultivars						
Sids 12	12.96a	13.76a	281.00c	310.78b	19.74a	18.74a
Gemmeiza 9	12.09b	12.96b	286.00b	316.00ab	18.29b	17.59b
Sakha 94	10.87c	11.56c	290.48a	320.48a	17.81c	16.81c
L0.S.D. (0.05)	**0.42**	**0.34**	**1.17**	**7.61**	**0.44**	**0.44**
B) Organic rates						
Untreated	11.45b	11.78b	264.00c	291.78c	16.17c	15.11c
5 m^3/fed	12.25a	13.26a	286.00b	318.00b	19.44b	18.44b
10 m^3/fed	12.23a	13.25a	307.48a	337.48a	20.59a	19.59a
L.S.D. (0.05)	**0.37**	**0.33**	**0.92**	**2.92**	**0.73**	**0.73**
C) Biofertilizers						
Uninoculation	10.93	11.77c	228.00c	255.59c	18.48	17.48
Phosphorein	12.29b	12.94b	290.33b	322.33b	18.67	17.67
A-mycorrhizal	12.69a	13.58a	339.15a	369.33a	19.00	18.00
L.S.D. (0.05)	**0.43**	**0.45**	**0.88**	**7.19**	**ns**	**ns**
Interations						
AxB	*	*	ns	ns	ns	ns
AxC	ns	ns	ns	ns	ns	ns
BxC	ns	ns	ns	ns	*	*
AxBxC	ns	ns	ns	ns	ns	ns

Means with the each letter (s) within each column are not significant differences at 0.05 level of probability
ns: not significant
* Significant at 0.05 level of bribability
** Significant at 0.01 level of bribability

Table (4). Grains number/spike, 1000- grain weight, grain yield and straw yield (ton)/fed as affected by three cultivars, organic manure rates and biofertilization during 2014/2015 and 2015/2016 seasons

Treatments	Grains number/spike		1000- grain weight (g)		Grain yield (ton/fed)		Straw yield (ton/fed)	
	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
A) Cultivars								
Sids 12	57.04a	55.48a	54.76a	56.66a	1.77a	1.82a	2.76a	2.80a
Gemmeiza 9	53.23b	51.85b	51.56b	54.36b	1.69b	1.75b	2.69b	2.73b
Sakha 94	52.85b	49.96c	48.17c	50.41c	1.57c	1.63c	2.57c	2.61
L0.S.D. (0.05)	**1.71**	**0.63**	**0.31**	**0.59**	**0.025**	**0.024**	**0.36**	**0.18**
B) Organic rates								
Untreated	46.93c	44.74c	44.68c	47.48c	1.51b	1.56b	25.12b	2.55b
5 m^3/fed	53.23b	54.19b	53.05b	55.43b	1.76a	1.82a	2.76a	2.80a
10 m^3/fed	59.93a	583.37a	56.26a	58.25a	1.75a	1.81a	2.75a	2.79a
L.S.D. (0.05)	**2.41**	**2.22**	**1.00**	**0.92**	**0.06**	**0.07**	**0.66**	**0.67**
C) Biofertilizers								
Uninoculation	53.79b	52.00	49.93b	52.35b	1.66	1.71b	2.67	2.70
Phosphorein	54.15b	52.41	51.84a	54.50a	1.67	1.74a	2.67	2.72
A-mycorrhizal	55.19a	52.89	52.71a	54.59a	1.68	1.75a	2.68	2.73
L.S.D. (0.05)	**1.00**	**ns**	**0.88**	**0.95**	**ns**	**0.02**	**ns**	**ns**
Interations								
AxB	ns	ns	ns	ns	*	*	*	*
AxC	ns	ns	ns	ns	*	*	*	*
BxC	*	*	*	*	*	*	*	*
AxBxC	ns	ns	ns	ns	*	*	*	*

Means with the each letter (s) within each column are not significant differences at 0.05 level of probability
ns: not significant
* Significant at 0.05 level of bribability
** Significant at 0.01 level of bribability

Table (5). biological yield (ton/fed) and harvest index as affected by three cultivars, organic manure rates and biofertilization during 2014/2015 and 2015/2016 seasons

Treatments	biological yield (ton/fed)		harvest index (%)	
	2014/2015	2015/2016	2014/2015	2015/2016
A) Cultivars				
Sids 12	4.52a	4.61a	38.88a	39.35a
Gemmeiza 9	4.37b	4.78b	38.88b	39.06b
Sakha 94	4.14c	4.25c	37.93c	38.47c
L0.S.D. (0.05)	**0.06**	**0.04**	**0.07**	**0.18**
B) Organic rates				
Untreated	4.02b	4.11b	37.47b	38.02b
5 m^3/fed	4.52a	4.62a	38.93a	39.40a
10 m^3/fed	4.50a	4.61a	38.93a	39.39a
L.S.D. (0.05)	**0.13**	**0.13**	**0.40**	**0.35**
C) Biofertilizers				
Uninoculation	4.32	4.42	38.35	38.85
Phosphorein	4.35	4.45	38.53	39.01
A-mycorrhizal	4.37	4.47	38.55	39.05
L.S.D. (0.05)				
Interations				
AxB	ns	ns	ns	ns
AxC	ns	ns	ns	ns
BxC	*	*	*	*
AxBxC	ns	ns	ns	ns

Means with the each letter (s) within each column are not significant differences at 0.05 level of probability
ns: not significant
* Significant at 0.05 level of bribability
** Significant at 0.01 level of bribability

B- Grain quality

Data in Table (6) indicated that percentages of grain crude protein, phosphorus and potassium in both seasons of wheat plant affected by three wheat cultivars. Where, Sids 12 cultivar significantly surpassed Sakha 94 cultivar for crude protein (%) and potassium percentage in both seasons, while, Sakha 94 cultivars significantly surpassed Sids 12 cultivar for phasphorus percentage in both seasons.

The variation between the three studied cultivars may be due to their genetic differences. These results are in a greement with those obtained by Abo Shetaia *et al.* (2001), who found that Sids 1 cultivar surpassed Sids 7 and Sakha 69 in grain protein content and protein in wheat grain resulted from other part of wheat plant, especially, leaves and translocated to the grain during filling period. Grain protein expressed as percentage is essentially as express of the ratio of protein and non- protein aqueous material in grain (Carter *et al.*, 2002).

Obtained results recorded in Table (6) revealed that percentages of phosphorus, potassium and crude protein in grains were significantly affected by adding organic manure rates.

The highest values of percentages of crude protein, phosphprus and potassium were obtained by applying organic manure rate at 10 m^3/fed, while the lowest values of this charactes was recorded by untreated treatments in both seasons.

On the other hand, these results agree with those of Zeidan and El-Kramany (2001), Hosam El- Din (2007) who found that, application of organic manure had gradually increased chemical content of wheat plant if compared with the plants untreated only. This may be due to possible increase in the availability of macro and micro nutrients and improvement of physical and chemical soil properties.

Data in Table (6), indicated that percentage of crude protein in the first season and percentages of phosphorus and potassium in both seasons significantly increased by inoculation of wheat grain with A-mycorrhizal and phosphorein when compared with uninoculation (control): This may be due to the role of dissolving phosphate on increasing the endogenous phytohormones IAA, Gas and CKs which play an important role in formation a big active root system. Increasing the nutrient uptake and photosynthesis rate and translocation as well as accumulation within different plant part (El- Khawas, 1990). These results are in agreement with those obtained by El- Kholy and Omar (2000), Hussein and Radwan (2001), Shoman *et al* (2006) and Hosam El-Din (2007).

The maximum increment of crude protein percentage (11.38%) were obtained by A- Mycorrhizal treatment in the first season and potassium (1.99 and 2.34%) in the both seasons while, the inoculation phosphorein gave the highest phosphorus percentage (0.696 and 0.767%) in both seasons, respectively compared with uninoculation (control).

All first and second order interactions among the three factors were not significant for crude protein (%), phosphorus percentage and potassium percentage in both seasons, Table (6)

Table (6). Crude protein (%) Phosphorus and Potassium percentages as affected by three wheat cultivars, organic manure rates and biofertilizer during 2014/2015 and 2015/2016 seasons

Treatments	Crude protein (%)		P (%)		K (%)	
	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
A) Cultivars						
Sids 12	12.20a	11.78a	0.548c	0.601c	2.08a	2.43a
Gemmeiza 9	10.60b	9.90b	0.599b	0.665b	1.63b	1.98b
Sakha 94	10.16b	10.06b	0.690a	0.775a	1.42c	1.77c
L0.S.D. (0.05)	**1.24**	**1.44**	**0.045**	**0.060**	**0.09**	**0.06**
B) Organic rates						
Untreated	8.98c	8.83c	0.569c	0.625c	1.14c	1.49c
5 m^3/fed	10.47b	9.96b	0.613b	0.673b	1.63b	1.98b
10 m^3/fed	13.50a	12.96a	0.654a	0.720a	2.37a	2.72a
L.S.D. (0.05)	**0.74**	**0.63**	**0.035**	**0.040**	**0.15**	**0.15**
C) Biofertilizers						
Uninoculation	10.62c	10.44	0.528c	0.579c	1.49c	1.86c
Phosphorein	10.96b	10.45	0.696a	0.767a	1.66b	2.01b
A-mycorrhizal	11.38a	10.84	0.615b	0.672b	1.99a	2.34a
L.S.D. (0.05)	**0.85**	**ns**	**0.070**	**0.080**	**0.14**	**0.16**
Interations						
AxB	ns	ns	ns	ns	ns	ns
AxC	ns	ns	ns	ns	ns	ns
BxC	ns	ns	ns	ns	ns	ns
AxBxC	ns	ns	ns	ns	ns	ns

Means with the each letter (s) within each column are not significant differences at 0.05 level of probability
ns: not significant
* Significant at 0.05 level of bribability
** Significant at 0.01 level of bribability

REFERENCES

Abdalla, G. S. S. (2002). Response of some new wheat varieties to bio-fertilization M. SC. Thesis. Fac. Agric (Saba- Basha), Alex. Univ. Egypt.

Abdel- Hamid, M., G. A. Mohamed and M. M. El- Kolley (2001). Evaluation of different species for biofertilizer and percentage for recommended rate applied nitrogen fertilizer on yield components for some barley varieties. Egypt. J. Appl. Sci., 16 (9) 120- 131.

Abdel- Maksoud, M. E. (2002). Response of some wheat cultivars to biofertilizer and nitrogen fertilizer levels. Zagazig J. Agric. Es. , 29 (3): 891- 905.

Abo El- Ela, S. H. (2006). Influence of mineral and bio- organic fertilization on three new bread wheat genotypes. Egypt. J. Agric. Res., 84 (6): 1833-1841.

Abo- Shataia, A. M., A. A. Abdel- Gawad, A. K. Abdel- Haleem and S. F. Habbasha (2001). Effect of seeding rates and nitrogen fertilization on yield and its attributes of some newly released wheat cultivars. Arab Univ., J. Agric., 9 (1): 267- 282.

Abu- Grab, O. S., A. M. Moussa and G. A. El- Shaarawy (2006). Photosynthetic and N- use efficiencies for some wheat cultivars in relation to planting density and nitrogen fertilization levels. Egypt. J. Appl. Sci., 21 (2B): 475- 492.

Ali, G., O. Caglar and F- Sabin (2003). Yield response of wheat and barley to inoculation of plant growth promoting Rhizobacterien at various levels of nitrogen fertilization. J. plant Nutr. Soil Sci., 166: 262- 266.

Basha, M. B. I. (2004). Agronomic studies on wheat. M.S. Thesis. Agric. Tanta Univ., Egypt.

Carter, B. P., K. K. Kidwell, S. S. Jones and T. Harris (2002). The differences between protein content and quality p^{th} . Prairia Gaino, March 2002.

El- Khawas, M. A. (1990). Effect of *Azotobacter chroococum* and *Azosprillium brasilience* inoculation under graded levels of nitrogen growth and yield of wheat. Plant and Soil, 69: 61-67.

El- Kholy, M. H. and M. N. A. omar (2000). Growth response of wheat as affected by yeast and some diaztotzophs inoculation under two levels of nitrogen fertilizer. International symposium of Biological Nitrogen Fixation and Creopprodction, 211- 215.

Farag, A. M. H. (2003). Response of wheat plants in some treatments of soil leveling and fertilization wheat with both nitrogen and biological fertilizer. Ph. D. These, Fac. Agric. Mansoure.

Gomaa, A. A., N. M. Zaki, F. I. Radwan, M. N. Hassanein and A.M. Wali (2011). The combined effect of mineral, organic and bio- fertilizers on growth of some wheat cultivars. J. of Appl. Sci. Res., 7 (11): 1591- 1608**.**

Gomez, K. A. and A. A. Gomez (1984). Statistical procedures for agricultural research John Wiley Sons. Inc. New York.

Hassanein, M. S. and A. M. Gomaa (2001). Productivity efficiency of certain wheat cultivars biofertilized with phosphate solubilizing Bacillus Azotobacter and Yeast under varying levels of phosphoru. Annals , Agric. Sci. Moshtohor 39 (4): 1907- 1992.

Hayam, S. M. and M. A. El- Sayed (2001). Response of two cultivars to irrigation amount and nitrogen level in sandy soil. Mansoura Univ. J. Agric. Sci., 26 (4) 1863- 1873.

Hosam El- Din, A. T. S. (2007). Productivity of some wheat varieties by using bio and organic fertilization in the New Valley. M. Sc. Thesis. Fac. of Agric. Ain Shams Univ., Egypt.

Hussein, R. F. and S. M. A. Radwan (2001). Effect of biofertilization with different level of nitrogen and phosphorus on wheat and associated weeds under weed control treatments, Paki J. of Biological Sci., 1 (4): 435- 441.

Ibrahim, E. M., S. A. A. Bassal and M. M. A. Badr (2004). Effect of Tillage systems, biofertilization and Spraying Urea on wheat productivity. Zagazig. J. Agric. Res., 31 (2): 491- 507.

Kabesh, M. O., M. F. El- Kramany, G. A. Saryi, H. M. El- Naggar and Gehan, Sh. N. Bakhoum (2008). Effect of sowing Methods and some bio-organic fertilization treatment on yield and yield components of wheat. Res., J. Agric & Biol. Sci. In press 377-396.

Page, A. L., R. H. Miller and D. R. Keenny (1982). Methods of soil analysis 2^{nd} American Society of Agronomy Madison. WI. USA.

Radwan, F.I. and H. M. el- Nimr (1996). Effect of soil nitrogen application and bio- fertilization on yield and yield components of wheat Adv. Agric. Res., 1 (1): 45- 55.

Radwan, F. I., M. A. Gomaa, I. F. Rehab and Samira, I. A. Adam (2015). Influence of humic acid, foliar application of micro nutrients and biofertilization on growth. Productivity and quality of wheat Middle east J. of Agric. Sci., 3 (3): 631-637.

Sadur, Rehman, S. K. Khalil, A. Rahman and A. U. R. Salioqi (2008). Organic and inorganic fertilizer increase wheat yield components and biomass under rainfed condition. Sarhad, J. Agic., 24 (1): 11- 20.

Saleh, M. E. (2003). Effect of row spacing rate of seeding and nitrogen levels on the productivity of Sifds 1 wheat cultivar. Zagazig J. Agric. Res. 30 (1)1203- 1221.

Shoman, H. A., A. M. Abo- Shataia, K. A. El- Shouny and M. A. Abdel-Gawad (2006). Effect of biological and organic fertilization on yield and its components of two wheat cultivars under Al- Wadi. Al- Gadeed condition Alex. J. Agric. Res., 51: 49- 65.

Zaki, N. M., M. A. Ahmed and M. S. Hassanein (2004). Growth and yield of some wheat cultivars irrigated with saline water in newly cultivated land as affected by nitrogen fertilization. Ann. of Agric. Sci., Moshtohor, 42: 515-525.

Zaki, N. M., M. S. Hassaein and K. M. Gamal El- Din (2007). Growth and yield of some wheat cultivars irrigated with saline water in newly cultivated land as affected by bio- fertilization J. Appl. Sci.,(October): 1121- 1162.

Zeidan, M. S. and M. F. El- Kramany (2001). Effect of organic manure and slow- releazied N- fertilizer on productivity of wheat (*Triticum aestivum*, L.) in sandy soils Egypt J. Agron, 23: 50- 70.

Zeidan, E. M., I. M. Abdel- Hameed, A. H. Bassiouny and A. A. Waly (2009). Effect of irrigation intervals , nitrogen and organic fertilization on yield , yield attributes and crude protein content of some wheat cultivars under newly reclaimed saline soil conditions. 4^{th} conference on Recent Technologies in Agriculture. 2 (33) : 298-307.

الملخص العربي

استجابة بعض أصناف القمح للتلقيح بالميكوريزا والبكتريا المذيبة للفوسفات والتسميد العضوي

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أجريت تجربتان حقليتان بمزراعة كلية الزراعة (سابا باشا) – الإسكندرية – مصر أثناء موسمي النمو ٢٠١٥/٢٠١٤، ٢٠١٦/٢٠١٥ وكان الهدف من الدراسة استجابة التسميد العضوي والحيوي على المحصول ومكوناته لثلاث أصناف من القمح لتحسين إنتاجية القمح وتقليل التلوث البيئي.

ويمكن تلخيص أهم النتائج فيما يلي:

- أعطى الصنف سدسي ١٢ أعلى طول للسنبلة عدد السنتيلات/سنبيلة عدد الحبوب/سنبلة ومحصول الحبوب، محصول القش (طن/فدان) مقارنة بالصنف سخا ٩٤.
- تفوق الصنف سدس ١٢ معنوياً على الصنف سخا ٩٤ في النسبة المئوية لمحتوى البروتين والنسبة المئوية للبوتاسيوم.
- التسميد العضوي عند معدل ١٠م٣/فدان أنتج زيادة معنوية لمكونات المحصول ومحتوى البروتين والنسبة المئوية لكل من الفوسفور والبوتاسيوم في حبوب القمح في كلا الموسمين.
- سجلت اختلافات معنوية بين معاملات التسميد الحيوي المختبرة لطول النبات، طول السنبلة عدد السنابل/م٢، وزن ١٠٠٠ حبة في كلا الموسمين.
- المعاملة أثرت على طول النبات وطول السنبلة ومحصول الحبوب ومحصول القش (طن)/فدان.
- دليل الحصاد التي تحصل عليها بواسطة الصنف سدس ١٢ مع إضافة التسميد العضوي عند معدل ١٠م٣/فدان في كلا الموسمين تفوق الصنف سدس ١٢ مع جميع معاملات التسميد الحيوي الملحقة على الصنف سخا ٩٤ في طول النبات، محصول الحبوب، القش، والمحصول البيولوجي (طن/فدان) في كلا الموسمين.