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Comparitive of Some Microorganismus on Sandy Soil Fertility, and Wheat Productivity

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ABSTRACT

Field experiment was carried out at EL-Ismailia Governorate in the winter season of 2013-2014 to evaluate the role of Azolla pinnata, Anabaena Azolla, Pleurotus columbinus and Azotobacter sp in the presence of urea (46.5% N) as source of nitrogen fertilizer on growth and yield of wheat. It was found that total count *bacteria*, *fungi*, *azotobacter* and *algae* at different treatments were higher than those of other treatments especially with treatment (T16) of Mix only *which* gave the highest values of total bacteria count 4000 x 10^3 cfu g^{-1} dry soil, followed by (T_{17}) which recorded 3830 x 10^3 cfu g^{-1} dry soil.Also for different microbes such as fungal, algae and N_2-fixing bacteria counts it was noticed that treatment T17 (Mix of biofertilizer+ 75% of recommended dose of nitrogen) gave the more optimum results for different types of microbes count. The results showed that (T18) and (T17) recorded the highest values for IAA production which were (69.92 ad 68.7 mg $ml^{-1}g^{-1}$ dry soil). Where T16 and T17 gave mostly higher N_2-ase activity (32.36 and 21.97µ C_2H_4 g^{-1}dry wt. hr^{1}**)** at 120 days of incubation compared to other treatments.Also straw and grain yield was significantly increased with mixture +75% of recommended dose of nitrogen fertilizer (T17) (1365.04 g/m^2) straw and (999.83 g/m^2) grains. Also it was noticed that treatments of mixture of biofertilizer have a pivotal role in increasing N, P, and K uptake in straw with treatments T16, T16 and T17 respectively. Whereas with grain yield the treatments T17, T16 and T16 gave the highest values of wheat grain, respectively.

Keywords: Wheat, *Azolla pinnata, Anabaena azollae, Pleurotus columbinus Azotobacter* sp, sandy soil.

INTRODUCTION

Wheat is considered to be the main source of food in the world, especially in Egypt. Raising wheat production through increasing the productivity of land area unit and the cultivated area, represent the most important national target to minimize the gap between production and consumption.

Inoculation of bio-fertilizers are considered today to limit and minimize the use of mineral fertilizers and supports an effective tool for soil development under less polluted environments, decreasing agricultural costs, maximizing crop yield due to providing them with an available nutritive elements and growth promoting substances (Amany *et al*., 2016).

Azolla, a dichotomously branched free floating aquatic fern, is naturally available mostly in the tropical belt of India. The dorsal lobe which remains exposed to air has a specific cavity containing its symbiotic partner, a blue green algae *Anabaena azollae*. Abundant growth of Azolla not only makes a useful addition of combined nitrogen to the ecosystem but can also provide a green manure (Rkyadav *et.al.,* 2014). Cyanobacteria *Anabaena azallea* from the symbiosis have also been isolated and cultured independently of the fern as bio agent suppressor against *Fusarum oxysporum* and *Alternaria alternata*. This antifungal activity could be attributed to the presence of bioactive compounds found in the cyanobacterial culture filtrates such as phenolic compounds, saponins and alkaloids which act as natural defense mechanisms against pathogenic fungi, (Abd El-aal Azza, 2013). Algae are a large and diverse group of microorganisms that can carry out photosynthesis since they capture energy from sunlight. *Anabaena azallea* play an important role in agriculture where they are used as biofertilizer and soil stabilizers. (Naglaa *et.al.*, 2015) found that *Anabaena azollae* played an important role in increased yielding potentials of pelarogonium and antibiosis studies showed promising results in control of; *Fusarium oxysporum* and *Rhizoctonia solani*, by different microorganisms such as *Pseudomonas fluorescens* and/or the extracts of either *Pleurotus columbinus* or *Anabaena azollae* individually or in combination. The mixture of the extract of *Anabaena azollae*, *Spirulina platensis* and *Pleurotus columbinus* was the best treatment to obtain high yield in the herb and oil production. The reduction of 25% of N recommended dose with bio-agent treatment was more superior to recommended dose of N fertilizer in the yield of plant and in quality and quantity of oil production (Maie *et al*., 2015). Biofertilizer as a better supplement can improve the growth and yield of cereal crops. Nitrogen fixing biofertiIizers mainly Azospirillum and Azotobacter can able to fix 20-40 kg N/ha and produce growth promoting substances like IAA. Inoculation with a symbiotic nitrogen fixers like Azotobacter may improve plant growth and yield due to supplementing the growing plants with fixed nitrogen and growth-promoting substances (Essam.2016).

So, the main objective of this study was to assess the effect of different sources of biofertilizers compared to, mineral fertilization on some soil properties and wheat production.

MATERIALS AND METHODS

Field experiment:

Field experiment was carried out at EL-Ismailia Governorate in the winter season successive season 2013-2014 to evaluate the role of *Azolla pinnata*, *Anabaena Azolla*, *Pleurotus columbinus* and *Azotobacter* sp in the presence of urea (46.5% N) as source of nitrogen fertilizer on growth and yield of wheat. Wheat plant seeds variety *Triticum aestivum* Cv. Egypt 2 .Wheat seeds were kindly obtained from Crop Res. Institute, Agric. Res. Center (ARC), Giza, Egypt.

Initial soil analysis:

The experimental field soil was sampled initially before and after wheat grown conducting the experiment to determine its physical and chemical analyses according to Jackson (1976) .The results of these analyses are shown in Table (1).

Table 1. physic- chemical properties of the experimental soil

Coarse sand %	Fine sand%	Silt%	Clay%	Texture	$CaCO_3$ %	O.M%
33.2	56.7	5.30	4.80	sandy	0.6	0.27
Anions (meq L^{-1})			Cations (meq L^{-1})		pH 1:2.5	EC(dS.m^{-1})
HCO_3^-	Cl^-	SO_4^{--}	K^+	Na^+ Mg^{++} Ca^{++}		
1.53	1.32	0.64	0.18	1.02 0.68 1.61	7.86	1.18
Available nutrients (mg kg^{-1} soil)						
Cu	Zn	Mn	Fe	N	P	K
0.05	0.48	0.89	3.89	23.4	3.4	58.1

***Azolla pinnata* and Microorganisms source and growth conditions**

Azolla pinnata was grown on modified Yoshida medium Yoshida *et al.* (1976) and *Anabaena azolla* which isolated from *Azolla pinnata* Abd El-all, Azza (2013) was grown on BG11 medium Rippka *et al.*(1979). The culture was incubated in growth chamber under continuous illumination (2000 lux) and temperature of 25˚C± 2˚,and strain of white rot fungi *Pleurotus columbinus* was grown on Potato Dextrose Agar medium, PDA Martin (1950) and Azotobacter was grown on Modified Ashby's medium (Abd El-Malek and Ishac, 1968). Microorganisms and *Azolla pinnata* were obtained from Agricultural Microbiology Research Department, Soils, Water and Environment Res. Inst. (SWERI), Agric. Res., Center (ARC). One strain of white rot fungi (*Pleurotus columbinus*) was obtained from Unit of Mushroom Production, Faculty of Agriculture , Ain Shams University

Preparation of, *Azolla pinnata, Anabaena azolla*, *Pleurotus columbines* and *Azotobacter* sp.

Azolla pinnata was harvested from the culture medium and mixed well with distilled water (1:2 w/v) using an electric mixer, and after 30 days of incubation of *Anabaena azolla* algal biomass was taken, *Pleurotus columbinus* was mixed in an electric mixer and *Azotobacter* Sp.

Phosphorus was added in the form of super phosphate (15.5% $P2O_5$) at the rate of 100 kg.fed^{-1}, while potassium was added in the form of potassium sulphate (48% K_2O) at the rate of 50 kg K_2O.fed^{-1}. Both phosphorus and potassium were applied during soil preparation.

Before sowing of wheat seeds, Treatments were soaked in both Azolla and other microorganism's suspensions for 2 hours. Urea (46.5%N) was applied in two equal doses, 15 days after sowing and 40 days later, at the recommended dose of 75 kg urea/fed^{-1} individually or in combination with some tested biofertilizer treatments. Irrigation was carried out from sowing time and then at every 15 days intervals. The field was prepared by ploughing and Pouddling. It was then divided into 54 plots (3 X 3 m each) representing 18 treatments with three replicates in randomized block design. The treatments were arranged as follow:

T1=	urea 100%	T7=	Azolla only	T13=	Azotobacter only
T2=	urea 75 %	T8=	Azolla + urea 75%	T14=	Azotobacter + urea 75%
T3=	urea 50 %	T9=	Azolla + urea 50%	T15=	Azotobacter + urea 50%
T4=	Plurotus only	T10=	Anabaena Az only	T16=	Mix only
T5=	Plurotus + urea 75%	T11=	Anabaena + urea 75%	T17=	Mix + urea 75%
T6=	Plurotus + urea 50%	T12=	Anabaena+ urea 50%	T18=	Mix + urea 50%

At harvest, wheat plants were cut just above the soil surface to determine yield components such as straw and grain yield (ton fed^{-1}), 1000 grain weight (g), weight of grain m^{-2}, and harvest index (kg grain / kg grain+kg straw x100, Yanni, 1991). The remained soil after wheat harvesting was sampled and tested for available NPK (Jakson, 1976).

Soil biological activities:

Nitrogenase activity was measured by acetylene reduction assay as described by Dart *et al.* (1972) and total microbial counts (Allen 1959),

Statistical analysis procedure:

All obtained data were subjected to analysis of variance (ANOVA) Gomez and Gomez (1984) and means were compared by using L.S.D. at 5% level of significance

Determination of extracellular growth regulators of Azolla pinnata, Anabaena azolla, Pleurotus columbines and Azotobacter sp.

Culture growth parameters and extracellular growth regulators in culture filtrates were determined. Growth regulation substances (indole acetic acid, gibberellic acid) were fractioned and quantified by HPLC according Kowalczyk and Sandberg (2001).

RESULTS AND DISCUSSION

Data in Table 2 indicate the effect of *Azolla* or *Pleurotus sp, azotobacter, anabaena azolla,* and mix from them when added on wheat seeds before sowing with different nitrogen levels (100%, 75%and 50%) on total microorganism's count, nitrogenase activity and IAA in soil.

Data in Table 2 showed that all tested soil biological activity (total count *bacteria*, *fungi*, *azotobacter* and *algae* at different treatments were higher than those of zero time ($2x10^3$, $4.4x10^3$, $5x10^3$ and $1.1x10^3$) respectively. However the treatment (T16) of Mix only gave the highest values of total bacteria count 4000 x 10^3 cfu g^{-1} dry soil, followed by (T_{17} and T_{18}) recorded that 3830 and 3380 x 10^3 cfu g^{-1} dry soil respectively.

The number of total bacteria shows a positive significant response to both mix only (T_{16}) and *Azolla* (T_7). The highest bacterial counts $x10^3$ cfu g^{-1} dry soil were recorded in response to T_{16}, T_{17}, T_{18}, and T_7 being (4000, 3830 , 3380 and 3820 x 10^3 cfu g^{-1} dry wt. soil at 120 days, respectively.

The fungal counts $x10^3$ cfu g^{-1} dry soil were recorded high value and response to *Azolla* only and Mix only treatments significantly increased being $98x10^3$ after 120 days of inoculation.

Table 2. Total count (bacteria, fungi, Azotobacter and algae) and determinate of N_2-ase activity and IAA as affected by bio and nitrogen fertilization .

Parameters / Treatments	Bacteria	Fungi	Azotobacter	Algae	N_2-ase activity µ Mol/ C_2H_4 /g dry wt. / hr		IAA mg ml^{-1} g^{-1} dry soil
	X 10^3 cfu g^{-1} dry soil		X 10^3 cell g^{-1} dry soil		60 days	120 days	
1)Urea 100%	900	18	1860	0.99	12.09	7.92	18.19
2)Urea 75%	830	18	2100	1.12	7.80	5.71	20.30
3)Urea 50%	780	13	860	0.52	3.73	0.78	14.09
4)Plurotus only	2960	58	1190	1.60	24.32	21.31	45.11
5) Plurotus +75 % U	2540	71	930	1.78	23.18	21.41	48.32
6) Plurotus +50 % U	2840	66	1150	1.81	13.78	11.69	50.12
7)Azolla only	3820	98	1006	3.17	20.44	19.16	38.21
8)Azolla+75 % U	3210	72	1270	3.81	17.36	14.85	35.9
9)Azolla+50 % U	3110	87	1790	3.90	13.99	12.11	33.52
10)Anabaena Az only	2830	94	1340	3.72	6.23	4.70	33.1
11)Anabaena Az+75%U	2650	83	1300	2.68	5.56	4.89	36.24
12)Anabaena Az+50%U	2530	87	820	2.69	5.69	5.00	35.65
13)Azotobacter only	1970	90	1160	2.53	13.25	10.83	29.07
14)Azotobacter+75 %U	1820	89	1240	2.71	12.00	9.86	28.69
15)Azotobacter+50 %U	1170	18	1007	2.99	9.78	9.06	30.15
16)Mix only	4000	98	1860	4.12	36.70	32.36	65.05
17)Mix +75 % U	3830	93	2100	4.52	21.97	21.97	68.7
18)Mix +50 % U	3380	88	1860	4.60	21.18	21.18	69.92

The highest value of *Azotobacter* counts were recorded in response to Mix + 75 % urea (T_{17}) and (T_7) cfu g^{-1} dry wt. soil compared with treatment urea 50% (T_3). However, it was noticed that the application of T_{16}, T_7 significantly increased the total count of *Azotobacter*.

The highest value of Algae count increased in Mix (T_{16}) and Azolla (T_7) treatments recorded that 4.60 and 3.90 cfu g^{-1} dry wt. soil respectively.

However, it is noticed that increasing nitrogen levels led to decrease the soil biological activity in terms of the results for the above-mentioned tested parameter. The addition of biofertilizer increased the soil biological activity due to the increase in the soil microbial community (Mandal *et al,* 1999).

Nitrogenase activity:

Nitrogenase is considered as an indicator for N2- fixation activity of the tested soil determined after 120 days of planting. Data in (Table 2) and fig.1 revealed that, all bio-agent treatments enhanced the activity of N2-ase activity at the 75 and 50% of recommended dose of nitrogen .recorded for T16 and T17 was mostly higher N2-ase activity (32.36 and 21.97µ C_2H_4 g^{-1}dry wt. hr^1**)** at 120 days of incubation than N_2-ase activity estimated for all treatments and the highest recorded value was observed with (T_{16} =Mix+75 units as Urea).

Determinate IAA:

The results observed that (T18), (T17), (T16) and (T6) recorded highest value for IAA production were (69.92, 68.7, 65.05and 50.12 mg $ml^{-1}g^{-1}$ dry soil).

These results were in agreement with Eletr Wafaa, *et al*.(2013) and Kamble and Galerao (2015), Who found that IAA considered an important attribute of plant growth hormones production from used strains. Generally, it could be concluded that application of Pleurotus Sp., Azolla, mix, anabaena azolla, and Azotobacter combined with 50% urea technical in wheat production gave the chance for saving the expensive chemical nitrogen fertilizers with priority to biofertilizer inoculation. El-Zeky *et al*, (2005) explained that microorganisms fix atmospheric nitrogen but also released secondary metabolites into soil, such as polysaccharides, peptides, lipids, amino acids, vitamins and growth promoting like substances, which in turn enhance the soil microbial community, soil enzymatic activities.

Yield:

It was noticed that Data in Table (3) shows the bio and mineral fertilization treatments effect on wheat grain yield which were highly significant affected by each of studied treatments. Table (3) revealed that addition of mixture of different sources of N2-fixing microbes (T16) and T17 (mixture +75% of urea as recommended dose) gave the highest shoot and grain yield of wheat crop per square meter. The highest grain yield (999.83 g/m^2) was obtained with mixture +75% of recommended dose of nitrogen fertilizer and the increasing values was 69.1% compared to 100% of the recommended dose of nitrogen. Whereas shoot yield was (1365.04 g/m^2) was obtained with mixture +75% of recommended dose of nitrogen fertilizer and the increasing values was 59.4% compared to 100% of the recommended dose of nitrogen. Also, weight of 1000 grains was increased with mostly t16 and t17 treatments which gave 57.2 and 56.79 g and these values gave an increasing percentage 24.48% and 23,59 respectively compared to 100% of pure mineral fertilizer. These results gave the maximum total yield with T17 which was 2364.87 g/m^2 as illustrated in Fig 1

Bio-fertilization addition led to an increase of wheat harvest index with nearly to 47% compared with no addition of bio-fertilizers (mineral fertilization) especially with T18 (Mix+50% urea). Bio-fertilizer ability to increase wheat yield comes from many enhancements such its ability to provide plants with macro-nutrients by fixing it from the atmosphere or by improving mineralization and consequent increase microbial status of the soil, the previous results are in agreement with those by Acea *et al.* (2003), Jarak *et al.* (2006) and Maie *et al.(*2015).

Table 3. The effect of mineral and bio-fertilizers treatments on some yield components of wheat crop at 2013/2014 season

Characteristics Treat ments	shoot d.w g/m^2	Grain d.w g/m^2	1000 grain weight (g)	yield index harvest index%
1)Urea 100%	856.49	591.14	45.95	40.80
2)Urea 75%	648.71	491.10	43.39	43.08
3)Urea 50%	626.66	464.19	39.68	42.54
4)Plurotus only	1048.39	689.81	57.70	39.77
5) Plurotus +75 % U	981.14	786.23	55.12	44.48
6) Plurotus +50 % U	849.29	601.40	49.37	41.48
7)Azolla only	1198.63	912.78	54.29	43.26
8)Azolla+75 % U	1136.19	936.03	48.16	45.20
9)Azolla+50 % U	1076.78	888.21	42.24	45.19
10)Anabaena Az only	986.52	724.46	54.72	42.29
11)Anabaena Az+75%U	993.09	739.53	46.28	42.68
12)Anabaena Az+50%U	922.09	705.15	41.66	43.37
13)Azotobacter only	832.82	595.51	51.75	41.63
14)Azotobacter+75% U	812.32	535.80	52.60	39.75
15)Azotobacter+50% U	913.12	507.24	46.46	35.72
16)Mix only	1230.64	981.36	57.20	44.39
17)Mix +75 % U	1365.04	999.83	56.80	42.30
18)Mix +50 % U	998.67	904.66	46.79	47.50
F. test	**	**	**	
LSD at 5%	79.25	54.24	3.63	

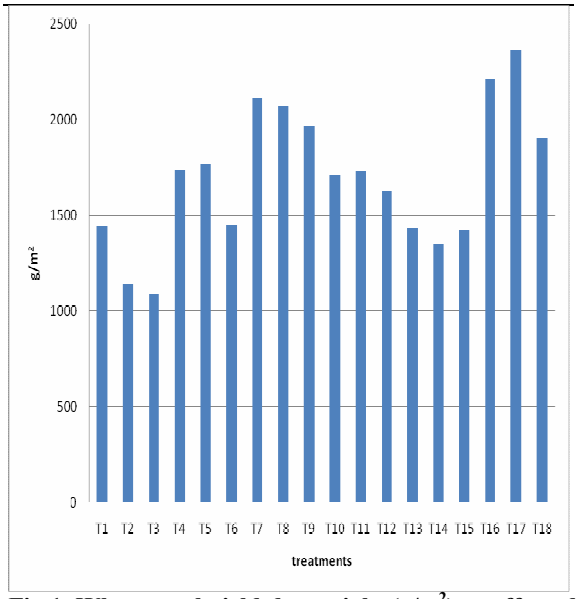

Fig 1. Wheat total yield dry weight (g/m^2) as affected by bio and mineral fertilization in sandy soil

Soil properties

Results in table 4 revealed that the values of pH and EC in soil have slightly decreased in corresponding to initial soil pH and EC, as affected by the studied treatments. Application of Mixture of biofertilizers with different doses of urea gave the lowest pH values whereas ploroutus gave the lowest values of EC in winter season. These results may be due to plant growth promoting regulators (PGPRs) which found with biofertilizers which may decrease soil EC, in the same trend pH values would decreased in response to extracellular compounds, like polysaccharides, peptides, lipids, organic acids (As mentioned by Molnar and Ordog (2005) El- Ayouty *et al.,* 2004).

With regard to organic matter (OM), results showed that T16 increased the OM compared to 100% of mineral fertilizer by 143% after wheat harvesting. Also it is noticed that different biofertilizerts treatments gave higher increasing in om% in the following order Mixture of biofertilizer> Plurotus > Azotobacter > Anabaena Azolla> Azolla only > mineral fertilizer. So, these different types of biofertilizers have a big role in building up soil fertility. They provide (1) Excretion of growth – promoting substances (Rodriguez et al., 2006), (2) increase in soil biomass after their death and decomposition (Saadatnia and Riahi, 2009). Also, crrosponding to addition of these biofertilizers to the soil lead to increase the soil organic matter, which is consequently, increased the soil biological activity by increasing the soil CO2 evolution leading to increase the soil fertility (Singh et al., 2008).

Table 4. Effect of Bio-treatments and nitrogen fertilization on some soil properties cultivated with Wheat crop

Characteristics Treatments	Soil pH (1:2.5)	EC (dSm^{-1}) (1:2.5)	O.M %	W.H.C %
1)Urea 100%	7.83	0.79	0.84	21.57
2)Urea 75%	7.82	0.72	0.76	20.50
3)Urea 50%	7.84	1.24	0.44	19.43
4)Plurotus only	7.14	0.61	1.73	37.91
5) Plurotus +75 % U	7.09	0.92	1.79	31.67
6) Plurotus +50 % U	7.79	0.46	1.86	30.30
7)Azolla only	7.75	1.18	1.76	35.04
8)Azolla+75 % U	7.72	1.07	0.99	33.20
9)Azolla+50 % U	7.71	0.88	0.58	32.24
10)Anabaena Az only	7.77	1.01	0.98	29.45
11)Anabaena Az+75 % U	7.72	0.71	1.68	25.51
12)Anabaena Az+50%U	7.78	0.57	1.40	23.44
13)Azotobacter only	7.73	0.58	1.84	18.36
14)Azotobacter+75 %U	7.71	0.71	1.91	23.45
15)Azotobacter+50 %U	7.72	0.77	1.57	22.41
16)Mix only	7.15	0.82	2.04	36.40
17)Mix +75 % U	7.17	1.05	1.79	35.07
18)Mix +50 % U	7.16	1.02	1.60	27.07

Results in table 4 revealed that the water holding capacity (WHC) has slightly increased due to the applied treatments compared to 100% of mineral fertilizer. However the maximum WHC was for the treatments of t4, t16 and t17 which represent inoculation with Plurotus only, Mixture of biofertilizers and Mixture with 75% of recommended dose of mineral fertilizer (urea) at winter season.

Uptake at harvest stage:

Statistical analyses of data in Table (5) show that the uptake of N,P and K in straw and grains of wheat had significantly influenced by different biofertilzers treatments, compared to the 100% recommended dose of mineral fertilizer . The highest values of N-uptake in straw were recorded by the treatment received mixture of biofertilizer without any mineral fertilizer (53.24 g/m^2) whereas with grain T17 (Mixture of biofertilizer + 75% of mineral fertilizer) gave the superior N-uptake (46.76 g/m^2). On the other hand, for P-uptake in straw and grains it was noticed that T16 gave the best results (3.61 and 6.28 g/m^2) respectively. Also, results in Table 5 showed that K-uptake in straw and grains of wheat had significantly influenced by inoculation of biofertilizers, in comparison with 100% recommended dose of mineral fertilizer.

Table 5. Effect of bio and mineral fertilization on nutrients uptake by wheat at 2013/2014 season

Characteristics	Straw			grain			total protein yield g/m^2
Treatments	N-uptake g/m^2	P-uptake g/m^2	K-uptake g/m^2	N-uptake g/m^2	P-uptake g/m^2	K-uptake g/m^2	
1)Urea 100%	28.46	1.701	25.88	22.75	2.248	23.09	294.47
2)Urea 75%	20.26	1.304	24.78	19.14	1.998	18.82	226.56
3)Urea 50%	19.32	1.111	22.43	14.91	1.939	17.50	196.83
4)Plurotus only	32.87	3.467	44.21	28.54	3.406	28.95	353.09
5) Plurotus +75 % U	40.30	1.910	40.39	33.60	4.244	34.07	424.90
6) Plurotus +50 % U	27.75	1.604	33.62	24.47	2.809	24.89	300.30
7)Azolla only	38.98	2.365	64.31	41.62	5.568	39.89	463.46
8)Azolla+75 % U	34.60	2.335	47.43	40.22	5.368	46.11	430.22
9)Azolla+50 % U	34.35	2.100	43.72	37.50	3.989	39.18	413.11
10)Anabaena Az only	32.00	1.884	32.72	24.58	3.198	29.58	325.30
11)Anabaena Az+75%U	32.94	1.859	37.20	24.54	2.812	22.04	330.49
12)Anabaena Az+50%U	30.85	1.695	32.60	21.86	2.397	30.04	303.11
13)Azotobacter only	26.19	1.522	24.74	17.66	2.349	20.66	252.10
14)Azotobacter+75% U	27.30	1.465	23.15	16.36	2.094	17.69	251.07
15)Azotobacter+50% U	28.94	1.735	34.21	14.08	1.776	16.76	247.39
16)Mix only	53.24	3.609	63.25	45.25	6.280	56.75	566.27
17)Mix +75 % U	45.15	2.908	69.01	46.76	5.931	51.90	528.48
18)Mix +50 % U	31.93	2.111	48.23	38.51	4.636	45.59	404.98
F. test	**	**	**	**	**	**	**
LSD at 5%	2.84	0.276	3.83	2.25	0.393	7.11	24.34

The highest values of K-uptake in straw were recorded by the treatment received T17 (Mixture of biofertilizer + 75% of mineral fertilizer) (69.01g/m^2), whereas in grains mixture of biofertilizer without any mineral fertilizer gave the superior K-uptake (56.75 g/m^2) respectively. Finally total protein yield as illustrated in Fig 2 had increased with the same trend with nitrogen uptake and dry weight yield of wheat plant

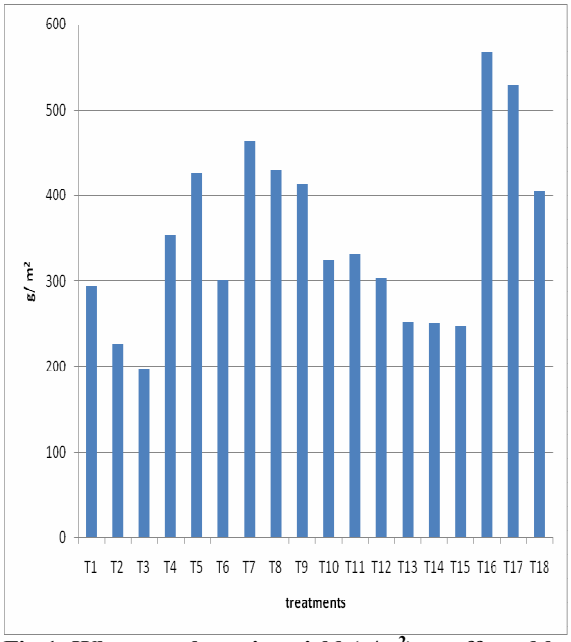

Fig 1. Wheat total protien yield (g/m^2) as affected by bio and mineral fertilization in sandy soil

Bio-fertilizer ability to increase all wheat yield parameters and nutrients uptake , comes from its ability to provide plants with macro-nutrients by fixing it from the atmosphere or by improving mineralization in soil and consequent increase microbial status of the soil, the previous results are in hormony with those obtained by Paudel *et al.* (2012) and Maie *et al.*(2015).

CONCLUSIONS

The use of microorganisms in plant production especially in cereal crops can improve growth and yield components, lower use of mineral fertilizers and higher microbiological activity of soil. In conclusion, the application of different kinds of biofertilizers enriched soil fertility and so it is helpful to improve the soil properties such as organic matter content As well as, macronutrients uptake (N, P and K) in wheat cropping system, which in is reflected on the yield and its components. Hence, it is imperative to popularize the use of biofertilizers, which is a low-cost input technology to reduce the dependence on inorganic fertilizers and contribute to pollution-free atmosphere, which is the need of the day.

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مقارنة تأثير بعض الكائنات الحية الدقيقة على خصوبة الأراضى الرملية وانتاجية نبات القمح

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نفذت تجربة زراعة قمح خلال موسم شتاء 2013/ 2014 في محطة البحوث الزراعية – محافظة الاسماعيلية -مصر. وكان هدف التجربة تقييم تاثير مستويات من التسميد النيتروجينى باليوريا (50، 75 و 100% من التوصية السمادية لنبات القمح) وكذلك التلقيح بالأسمدة الحيوية المختلفة مثل (البلوروتس Pleurotus columbines – الأزولا كطحلب وكسرخس Azolla pinnata, Anabaena Azolla - الأزوتوباكتر Azotobacter sp , وخليط منهم) وذلك فى تصميم قطاعات كاملة العشوائية فى ثلاث مكررات على بعض أصفات التربة ومحصول القمح .ووجد من خلال نتائج التجربة أن العد الميكروبى لمختلف الكائنات (طحالب-فطر - بكتيريا) قد زاد فى المعاملات الحيوية المختلفة مقارنة بالمعاملات بالتسميد المعدنى فقط وخاصة المعاملة t16 وt17 حيث اعطتا اعد بكتيرى كلى اكبر (4000 x 3830 x 10^3 cfu g^{-1} dry soil و 10^3 cfu g^{-1} dry soil) على الترتيب . كذلك اوضحت النتائج أن المعاملتين t16 و t17اعطت اعلى انتاجية لأندول حمض الخليك (69.92 و68.70 ملجم لكل مل لكل جم تربة جافة) على الترتيب كما اعطتا نفس المعاملتين اعلى نشاط لأنزيم النيتروجيناز (32.36 و 21.97 ميكروجرام ايثانول /جم تربة جافة فى الساعة) فى مرحلة الحصاد .كما زاد محصول الحبوب والقش معنويا تحت معاملة خليط التسميد الحيوى مع 75% من التسميد المعدنى (T17) فأعطى 1365.04 جم/م^2 قش و 999.83 جم/م^2 حبوب . كذلك اظهرت معاملات التسميد الحيوى الخليط الثر الأكبر فى زيادة الممتص من النيتروجين والفسفور والبوتاسيوم فى محصول القش مع معاملات T16, T16 ، T17 على الترتيب. بينما فى محصول الحبوب كان لمعاملات 7T1 , T16 ، T16 على الترتيب الأثر الأكبر فى زيادة الممتص منهم.