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Effectiveness of Organic and Bio-Fertilization on Reduce Rates of Mineral Nitrogen Fertilizers and Impact on Productivity of some Wheat Cultivars

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ABSTRACT

Present study was conducted during two winter seasons of 2017/2018 and 2018/2019 in farm (Ghazala Village), Faculty of Agriculture, Zagazig University, to evaluate the impact of seven fertilization treatments *i.e.* F_1: humic acid (4 kg/fad), F_2: F_1 +50% recommended dose of nitrogen (37.5 kg N/fad), F_3: commercial organic-fertilizer (3G-101), F_4: F_3+50% recommended dose of nitrogen (37.5 kg N/fad), F_5: yeast extract, F_6: F_5+ 50% recommended dose of nitrogen(37.5kg N/fad) and F_7: 75kgN/fad (recommended dose), on productivity of two wheat cultivars *i.e.* Shandawel-1 and Misr 2. Results alluded that Shendawel-1 cultivar surpassed Misr2 cv in each of chlorophyll content (SPAD unit), flag leaf area (cm^2), spike length (cm), number of spikelets and grains/spike, 1000 grain weight (g), spike weight, number of spikes/m^2, biological, straw and grain yields as well as harvest index (HI). Treatment F_2 outperformed others in chlorophyll content. Treatment F_6 recorded the highest value in each of: flag leaf area, plant height, spike length, number of spikelets and grains/spike, 1000 grain weight, number of spikes/m^2, biological, straw and grain yields/fad and protein content. Treatment F_1 gave the lowest values for the previous traits, but give higher harvest index compared to treatment F_5. Grain yield/fad positively and significantly correlated with plant height, spike length, No. of spikletes/spike, 1000 grain weight, spike weight and number of spikes/m^2.

Keywords: Wheat, cultivars, yeast extract, humic acid, organic fertilization.

INTRODUCTION

Wheat (*Triticum aestivum, L*) is one of the most important cereal crops used in human food and animal feed globally and in Egypt. Increasing wheat production is an essential national target.

Nutrition is essential for plant life and yield therefore, the mineral fertilization is a common agronomic practice that leads to improve crop productivity. Nitrogen is the most important nutrient supplied to most non-legume crops, including wheat. The important roles of N in the plant is its presence in the structure of protein and nucleic acids, which are important for building and formation substances in every cell. In addition, N is also found in structure of chlorophyll that enables plants to convert energy from sunlight by photosynthesis. Thus, N supply to the plant will influence the amount of protein, amino acids, protoplasm and chlorophyll formation. Moreover, it influences cell size, leaf area and photosynthetic activity (Azeez, 2009; Daneshmand *et al*., 2012; Namvar *et al*., 2012; Diacono *et al*., 2013; Piccinin *et al*., 2013). Therefore, adequate supply of N is necessary to achieve high yield potential in crops. N fertilizer is known to affect the yield and yield components of wheat (Kizilkaya, 2008; Wortman *et al*., 2011). But, with the steadily prices increasing of chemical fertilizers especially nitrogen fertilizers, it has become an economic problem and expensive input, in addition soil and water pollution. So, management methods that decrease requirements for agricultural chemicals are needed in order to avoid adverse environment impacts. So, it was an urgent need to studies about reducing the use of chemical fertilizers while maintaining the productivity of the unit area of wheat (Abdel-Lateef, 2018). Therefore, it is necessary to go to reduce the added quantities of chemical fertilizers and compensate by using organic or bio-fertilizers as a safe alternative and to maintain soil fertility and high productivity of the crop. Basha (2004) and Abdel- Aal *et al.* (2007) observed that combined application of organic and inorganic fertilizer increased the growth and yield of wheat than when any of the fertilizer was used alone.

Yeast extract was suggested to participate in a beneficial role during vegetative and reproductive growth through improving flower formation and their set in some plants due to its high auxin and cytokinins content and enhancement of carbohydrates accumulation (Mahmoud, 2001 and Bevilacqua *et al*., 2008). Also, its stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation was reported (Wanas, 2002), in addition to its content of cryoprotective agent, *i.e*. sugars, protein, amino acids and several vitamins. Moreover, improving growth, flowering and fruit set by using foliar application with yeast extract was reported by Abou-Aly (2005) and Wanas (2006).

Humic acid is water-soluble organic acid naturally present in soil organic matter. It can be recognized that

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humic substances (HS) have many beneficial effects on soil structure and soil microbial populations, as well as, increase modify mechanisms involved in plant growth stimulation, cell permeability and nutrient uptake (Rahmat *et al.*, 2010). On the other hand, Delfine *et al.* (2005) investigated the effect of humic acid application on growth and yield of durum wheat, they specified that the application of humic acid caused a transitional production of plant dry mass with respect to unfertilized control. However, more research is needed to evaluate the effectiveness of humic acid as an organic fertilizer and to compare higher humic acid rates that an increase crop production (Daur, 2013).

Therefore, this experiment was conducted to study the effect of combined organic fertilizer, humic acid and commercial organic-fertilizer, biofertilizer "yeast" and urea form (50% N as a slow release nitrogen) on improving growth, yield, quality and its attributes and chemical constituents of wheat cultivars Misr2 and shandewel-1, under the conditions of the experimental farm, Faculty of Agriculture in Ghazala, Zagazig University, Sharkia Governorate.

MATERIALS AND METHODS

Site Description and Soil Analysis:

Two field experiments were conducted at the Experimental Farm (Ghazala Village), Zagazig distnict, Faculty of Agriculture, Zagazig University, Sharkia Governorate Egypt, during the two successive winter seasons of 2017/2018 and 2018/2019. The objective of these experiments were study the effectiveness of yeast extract, humic acid and organic fertilizer in reducing mineral nitrogen fertilizer rates and their impact on wheat productivity. The preceding crop was Rosell (*Hibiscus sabdarriffa*, L) in first season and corn (*Zea mays*) in second one .Before sowing, experimental soil samples were randomly collected from the top soil layer (0-30 cm) for estimating some mechanical and chemical properties of soil according to Jackson (1973). Mechanical and chemical analyses of soil (Table 1) were carried out in Central Laboratory Faculty of Agriculture, Zagazig University.

Table 1. Soil mechanical and chemical analyses of the experimental site.

Soil analyses	Averaged two seasons
Soil mechanical analysis	
Sand%	22.63
Clay %	46.70
Silt %	30.67
Soil texture	clay
Soil chemical analysis	
Organic matter%	1.04
Soil EC ds/m	1.88
P^H	7.99
Available N (meg/ l)	58.91
Available P (meg/ l)	8.95
Available K (meg/ l)	148.10

Studied Factors and Experimental Design:

Each experiment included fourteen treatments which were the combination of two wheat cultivars (Misr2 and Shandawel-1) and seven fertilization treatments as fallows:-

F_1: Humic acid (4 kg/fad), was applied as potassium humate-granules (MONBAND) 67.25% humic acid.

F_2: F_1 +50% of recommended dose of nitrogen (37.5 kg N/fad).

F_3: Commercial organic-fertilizer (3G -101) natural organic-fertilizer (chemical analysis of 3G -101 presented in Table 2).

F_4: F_3 + 50% of recommended dose of nitrogen (37.5 kg N/fad).

F_5: Yeast extract (20ml/L), was prepared from brewer's yeast (*Saccharomyces cerevisiae*), dissolved in water followed by adding sugar at a ratio of 1:1 and kept 24 hours for reproduction according to the methods of Morsi *et al*. (2008). Chemical analysis of yeast extract according to Mahmoued (2001) is presented in Table (3).

F_6: F_5 + 50% recommended dose of nitrogen (37.5 kg N/fad).

F_7: 75 kg N / fad (recommended dose), (fad = faddan= 4200 m^2).

Table 2. Chemical analysis of the commercial organic-fertilizer (3G -101)

Structure	(%)	structure	(%)
Gibberellic	2	Cu	0.25
N	3	Mo	0,9
K	4.7	Mg	0,6
P	0.53	SL	0.35
Fe	0.4	S	1
zn	1.3	Si	0.01
Mn	0.5	Co	0.15

The source: label on the product bottle

Table 3. Chemical analysis of yeast extract

Amino acids mg/100g dry weight		Vitamins and carbohydrates mg/100g dry weight	
Arginine	1.99	Vitam.B1	2.23
V	2.63	Vitam.B2	1.33
Isoleucine	2.31	Vitam.B6	1.25
leucine	3.09	Vitam.B12	0.15
Lysine	2.95	Thiamin	2.71
Methionine	0.72	Riboflavin	4.96
Phenyl alanine	2.01	Inositol	0.26
Threonine	2.09	Biotin	0.09
Tryptophan	0.45	Nicotinic acid	39.88
Valine	2.19	Pantothenic acid	19.56
Glutamic acid	2.00	P amino benzoic acid	9.23
Serine	1.59	Folic acid	4.36
Aspartic acid	1.33	Pyridoxine	2.90
Cystine	0.23	Total carbohydrates	23.20
Proline	1.53	Glucose	13.33
Tyrosine	1.49		

The experimental design was a complete randomized blocks in three replications in each season, the experimental plot area was 9 m^2 (3 m x 3 m). Grains of wheat were obtained from Wheat Research Department, Algemmezah Research Station, Egypt.

Experimental Procedures:

The basal doses of P and K fertilizers as calcium superphosphate (15.5% P_2O_5) and potassium sulphate

(48%K_2O) were added at soil preparation. Sowing date was on 25 and 18 of November in the first and second seasons, respectively. Urea (46.5%) was used as source of nitrogen which was applied in two equal doses, before the first and second irrigation. Humic acid and yeast extract rates were sprayed three times during the growth period (30, 45 and 60 days after sowing). Treatments were sprayed handly. Other cultural practices for growing wheat were conducted as recommended.

Data Measurement

Yield and yield attributes

Chlorophyll content (Chl.) was determined quantitatively in five developed leaves at 75 days from sowing using a self-calibrating SPAD chlorophyll meter (Model 502, Spectrum Technologies, Plainfield, IL) as described by Monje and Bugbee (1992).

Flag leaf area (cm^2), it was measured at 75 days from sowing according to Gardner *et al. (*1985) as follow:

Leaf area = leaf length x maximum leaf width x 0.75.

At harvest, ten random spikes were chosen in each plot to measure: spike length (cm), number of spikelets/spike, number of grains/pike, spike grain weight (g) and thousand grain weight (g), plant height (cm) (Mean of 10 plants) was also recorded at harvest. One square meter was randomly taken in each plot to measure each of: number of spikes/m^2 (No. of fertile tillers), biological, grain and straw yields and converted to ton/fad, as well harvest index (%) was calculated as a ratio of grain yield to biological yield (Abdel-Gawad *et al.,* 1987).

Chemical analysis

Grain nitrogen content (%), was estimated by the modified Kjeldahel, s method according to AOAC (1980). Grain protein content was calculated by multiplying total nitrogen by 5.9. Protein yield (kg /fad), was calculated by multiplying the crude protein content by seed yield/fad (kg) and dividing by100.

Statistical Analysis

The obtained data were analyzed with the appropriate method of statistical analysis of variance (ANOVA) as described by Gomez and Gomez (1984) by using MSTAT-C software, and the means were compared using least significant differences (LSD test) at 0.05 level of probability (Waller and Duncan, 1969). The error mean squares of randomized complete blocks design were Homogenous (Bartlet's test), the combined analysis was calculated for all studied traits in both seasons. Simple correlation coefficient was calculated between grain yield/fad., and the other attributes by using the data of combined analysis.

RESULTS AND DISCUSSION

Chlorophyll content (%) and Flag leaf area (cm^2):

Cultivars variation

Results shown in Table 4 reveal that wheat cultivars differed significantly in chlorophyll content (%) and flag leaf area (cm^2) during the second season and the combined analysis of both seasons, where Shandawel-1 cultivar was superior to Misr2 cultivar for both traits. These results may be due to the genetic variability between the two tested cultivars and the response of each to the environmental conditions during the growing seasons. The same trend emerged from the differences between cultivars in several studies such as Said and Abd El-Moneem (2016) where they found that Shandawel-1 had the highest content of chlorophyll in both seasons. Withal, Shambhoo *et al. (*2016) placed significant differences between wheat genotypes in total chlorophyll content. Moreover, Seleiman and Abdel-Aal (2018) recorded significant differences among the wheat cultivars in total chlorophyll and flag leaf area.

Table 4. Chlorophyll content (%) and flag leaf area (cm^2) of wheat cultivars as affected by fertilization treatments and their interaction during 2017/ 2018 and 2018/ 2019 seasons and their combined.

Treatment	Chlorophyll content (%)			Flag leaf area(cm^2)		
Cultivar :- (V)	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.
Misr 2	38.95	38.09 b	38.52 b	34.60	34.73 b	34.67 b
Shandawel-1	40.11	41.01a	40.66 a	35.70	36.04 a	35.87 a
F.test	NS	*	*	NS	*	*
Fertilization treatment: (F)						
F_1	29.20 e	28.92 d	29.06 g	21.49 de	23.80 d	22.65 e
F_2	45.58 a	44.63 a	45.11 a	36.89 d	34.89 c	35.89 d
F_3	39.23 cd	39.57 c	39.40 e	21.57 e	23.56 d	22.57 e
F_4	41.90 b	41.36 bc	41.63 c	39.70 c	38.32 b	39.01 c
F_5	37.72 d	39.16 c	38.44 f	38.41 c	40.88 b	39.65 c
F_6	42.20 b	42.65 b	42.43 b	45.16 a	43.23 a	44.20 a
F_7	40.87 c	40.55 c	40.71 c	42.85 b	43.03 a	42.94 b
F test	*	*	*	*	*	*
Interaction:-						
VxF	NS	NS	*	NS	NS	NS

Where: F_1: humic acid, F_2:F_1 + 50%N (37.5 kg), F_3: Organic fertilizer, F_4:F_3 +50%N (37.5 kg), F_5: Yeast extract, F_6:F_5+ 50%N (37.5 kg) and F_7: Recommended dose (75 kg N/ fad).

Effect of fertilization treatments

Results recorded in Table 4 show that chlorophyll content (%) and flag leaf area (cm^2) were affected significantly by different fertilization regimes in both seasons and their combined analysis. The treatment F_2 (humic acid + 50% recommended dose of nitrogen) recorded the maximum chlorophyll content (%), which valued 45.58, 44.63 and 45.11 in 1st, 2nd seasons and the combined, respectively. Treatment F_6 (yeast extract + 50% recommended dose of nitrogen) ranked second. From these results, an increase in leaf content of chlorophyll could be observed in the fertilization treatments that combined 50% of the mineral fertilizer with any form of the biological or organic fertilizers that used in the study compared to the single addition of them. Increase in chlorophyll content referred to the favorable effect of humic acid and yeast extract for improving growth. Regarding to flag leaf area (cm^2), F_6 recorded the highest value (44.20 cm^2) followed by F_7 treatment (42.94 cm^2). The minimum chlorophyll content (29.06 %) and flag leaf area (22.65 cm^2) were recorded due to application humic acid only (F_1) (combined results). In this connection, El-Hawary *et al.* (2019) avowed that differences between plants fertilized with 215 kg N/ha and those received 145 kg N/ha plus foliar application of yeast extract were effectless regarding photosynthetic pigments. Otherwise, Mona, Dawood *et al.* (2013) on soybean, attested that all concentrations of yeast extract caused significant increases in chlorophyll a. Moreover, they added that yeast extract at 2, 3 and 4% caused significant increases in chlorophyll a+b.

Yield and yield attributes

Cultivars variation

The results present in Tables (5 ,6 ,7 and 8) clarify that there were significant differences between the two wheat cultivars (Misr2 and Shandawel-1) in spike length(cm), number of spikelets/spike, number of grains /spike, 1000 grain weight (g), number of spikes/m^2, grain weight/spike(g), biological, straw and grain yields (ton/ fad) in combined analysis. While the differences between cultivars did not reach to significant level for characteristics of plant height (cm), harvest index (%), protein content (%) and protein yield kg/fad.

Results present in Table 5 show that Shandwel-l cultivar was significantly superior over Misr2 cultivar in spike length and No. of spikelets/spike, the increase in these traits are mainly due to ability of cultivar in forming metabolites and its translocation from source to sink. Significant difference between wheat cultivars in spike length and No. of spikelets/spike were also recorded by EL- Hawary and Shahein (2015), Anwar *et al.* (2016), El-hag, Dalia (2016), Kandil *et al.* (2016), El-Hag, Dalia (2017), El -Hag, Dalia and El Mantawy, Rania (2017), Galelah *et al.* (2018) and El-Hawary *et al.* (2019).

Results presented in Table 6 show in general that, Shandawel-1 cv surpassed Misr2 cv in number of grains/spike, 1000 grain weight (g), number of spikes/m^2 and grain weight/spike (g). The disparity in 1000 grain weight and grain weight/spike among studied wheat cultivars might be due to the genetic makeup reflecting on grain filling rate and translocation of biochemical assimilates from source to sink. Several investigators observed significant differences among wheat cultivars in number of grains/spike, 1000 grains weight (g), number of spikes/ m^2 and grain weight/spike (g) such as Abd El-Kreem, Thanaa and Ahmed (2013), El-Hag, Dalia and El Mantawy, Rania (2017), Ali and Alsaady (2019) and El-Hawary *et al*. (2019).

Results illustrated in Table 7 exhibited that, Shandawel-1 wheat cultivar show superiority compared to Misr2 cultivar in biological, straw and grain yields/fad. The increase of shandawel-1 cv over Misr2 cv reached about 3.9 %, 3.1 % and 9.7 % in combined analysis for biological, straw and grain yields/fad, respectively. This superiority in biological and straw yields are to be expected since the same cultivar gained the highest mean values of plant height and number of spikes/m^2 consequently produced higher biological and straw yields. Also, the superiority of shandawel-1 cv in grain yield might be attributed to its superiority in yield components, i.e. number of spikes/m^2, No. of grains/spike and grain weight/spike (g). These results are in harmony with those obtained by Atia and Ragab (2013), Shambhoo *et al.* (2016), Osman and Nor Eidein, Gehan(2017), Galelah *et al.* (2018), El-Hawary *et al.* (2019) and Ibrahim *et al.* (2020).

Results shown in Table 8 reveal that the differences between cultivars in traits of the harvest index, grain protein content and protein yield do not reached to significant level, spite of, the high harvest index value for Shandawil-1 cv and the increase in protein content of Misr 2 cv. Studies conducted by Abd EL-Hameed and Ash-Shormillesy, Salwa (2005) and El-Hawary *et al*. (2019) recorded significant differences among barley cultivars in harvest index and protein content.

Effect of fertilization treatments

Results documented in Tables (5, 6, 7 and 8) clearly show the significant differences among fertilization treatments in each of plant height (cm), spike length (cm), number of spikelets/spike, number of grains/spike, 1000 grain weight (g), number of spikes/m^2, biologic, straw, grain and protein yields (ton/fad). Furthermore, grain weight/spike (g), harvest index (%) and protein content (%) showed significant response to fertilization treatments during the combined analysis. Perusal of the results in Table 5, it is obvious that the greatest value for each of plant height, spike length and number of spikelets/spike was in favor of fertilization regime included spraying with yeast extract + 50 % of recommended mineral fertilizer treatment (F6) followed by F7 treatment (100% mineral nitrogen) compared to other fertilization systems. Also, means comparison showed that spike length and number of spikelets/spike under either organic fertilizer 50% + mineral fertilizer (F_4) or yeast extract only (F_5) treatments were keeping and without significant variation than F_6 treatment, while, the lowest values were recorded by application of humic acid only (F1) treatment in the two seasons and combined analysis. Enhancing effect of yeast on plant height may be due to that yeast is a natural source of phytohormones especially cytokinins which enhance cell division and cell enlargement, it gave the tallest plants according to enhancement of dry matter accumulation and stored in spike, therefore gave increase in spike length (El-Sheshtawy and Hager, 2015). Generally, from these results it becomes clear that fertilization with 50% mineral + (organic fertilizer) or 50% mineral + yeast extract gave the same result as adding 100% mineral. In this respect, El-Hawary *et al.* (2019) recorded no significant differences between plants fertilized with 215 kg N/ha and those received 145 kg N/ha plus foliar application of yeast extract compared to adding organic fertilizers alone (humic acid only) as it gave the lowest results. The stimulatory effect of yeast extract can be attributed to the increased contents of different nutrients as well as the concentration of protein, vitamin B and natural plant growth regulators such as cytokynine (Table 3). The physiological roles of vitamins and amino acid in yeast extract can increase the metabolic processed levels of endogenous hormones which encourage the growth. These results are in agreement with those obtained by Hemdan *et al.* (2016), Seadh *et al.* (2017), El-Hawary *et al. (*2019) and Mokhtar *et al.* (2020).

The results presented in Table 6 show that F_6 treatment recorded the highest value in each of number of grains/spike, 1000 grain weight (g), number of spikes/m^2 and grain weight/spike(g), while F_1 treatment gave the lowest values in these traits. It is also evident from the aforementioned table that F_5 and F_7 treatments are similar in their effect on number of grains/spike and outnumber the other fertilization treatments. The difference between fertilization treatments F_6 and F_7 did not reach to level of significance in No. of spikes/m^2, in addition, F_3 treatment gave the lowest grains weight/spike (2.251 g). El-Hawary *et al.* (2019) scored insignificant differences between plants fertilized with 215 kg N/ha and those received 145 kg N/ha plus foliar application of yeast extract regarding for 1000- grain weight. Such effects of fertilization treatments might have been due to the hormonal balance activating physiological and biochemical processes in plant, and also may be due to its effect on nitrogen metabolism in the plant which reflected on a better growth, more dry matter accumulation and stimulation the building of metabolic products accompanied with foliar nutrition plants with foliar fertilizers which contain yeast extract (Shehata *et al.*, 2012). Similar trends were obtained by Attia and Abd El Salam (2016) and AL-Amin *et al.* (2017).

Table 5. Plant height (cm), spike length (cm) and number of spikelets / spike of wheat cultivars as affected by fertilization treatments and their interaction during the 2017/ 2018 and 2018/ 019 seasons and their combined.

Treatment	plant height (cm)			spike length (cm)			Number of spikelets/ spike		
Cultivar :- V	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.
Misr2	107.16 b	109.12	108.14	12.84 b	12.87 b	12.85 b	22.46	22.23 b	22.35 b
Shandawel-1	108.91 a	111.63	110.27	13.62 a	13.51 a	13.56 a	23.17	23.83 a	23.50 a
F.test	*	NS	NS	*	*	*	NS	*	*
Fertilization treatment : F									
F_1	95.32 e	97.89 e	96.605 f	12.37 c	12.70	12.54 c	22.07 c	21.97 c	22.02 d
F_2	107.68 c	111.46 c	109.57 d	13.50 a	12.80	13.15 ab	22.67 bc	22.97 ab	22.82 bc
F_3	99.27 d	101.66 d	100.46 e	12.63 bc	12.93	12.78 bc	22.42 bc	22.47 bc	22.44 cd
F_4	110.27 bc	112.33 bc	111.30 cd	13.57 a	13.47	13.52 a	23.07 ab	23.00 ab	23.03 ab
F_5	111.52 b	114.62 b	113.07 bc	13.30 ab	13.37	13.34 a	23.00 ab	23.47 ab	23.23 ab
F_6	119.51 a	119.47 a	119.49 a	13.60 a	13.57	13.59 a	23.27 a	23.73 a	23.50 a
F_7	112.67 b	115.19 b	113.93 b	13.63 a	13.47	13.55 a	23.23 a	23.63 ab	23.43 a
F test	*	*	*	*	NS	*	*	*	*
Interaction:- VxF	NS	NS	*	NS	NS	NS	NS	NS	NS

Where: F_1: humic acid, F_2:F_1 + 50%N (37.5 kg), F_3: Organic fertilizer, F_4:F_3 +50%N (37.5 kg), F_5: Yeast extract, F_6:F_5+ 50%N (37.5 kg) and F_7: Recommended dose (75 kg N/ fad).

Table 6. Number of grains /spike, 1000 grain weight (g), number of spikes / m2 and grain weight / spike (g) of wheat cultivars as affected by fertilization treatments and their interaction during the 2017/ 2018 and 2018/ 019 seasons and their combined.

Treatment	Number of grains /spike			1000 grain weight (g)			Number of spikes / m^2			Grain weight / spike (g)		
	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.	2017 / 2018	2018/ 2019	Comb.
Cultivar :- V												
Misr2	64.38	66.15 b	65.26 b	36.40	37.13 b	36.77 b	346.30 b	364.4 b	350.3 b	2.347	2.538 b	2.443 b
Shandawel-l	66.65	69.33 a	67.99 a	37.59	38.29 a	37.94 a	352.50 a	381.3 a	371.9 a	2.505	2.695 a	2.600 a
F.test	NS	*	*	NS	*	*	*	*	*	NS	*	*
Fertilization treatment:F												
F_1	63.92c	65.95bc	64.93bc	34.95 e	35.47f	35.21f	243.30 d	265.50 e	254.4 d	2.340	2.517	2.429 c
F_2	64.7c	66.72c	65.71b	35.23d	35.69f	35.46ef	327.50 c	340.30 d	333.9 c	2.351	2.525	2.438 c
F_3	60.77d	64.4d	62.58c	35.69d	36.08e	35.88e	355.70 b	374.30 c	365.0 b	2.175	2.328	2.251 d
F_4	63.23	67.18b	65.20b	36.32cd	37.27d	36.80d	368.50ab	388.70 c	378.6 b	2.369	2.541	2.455 c
F_5	66.65b	68.6b	67.62a	37.63c	38.58c	38.10c	373.20ab	403.30 b	388.3 b	2.470	2.687	2.578 b
F6	70.4a	71.47a	70.93a	40.31a	41.35a	40.83a	386.70 a	411.30ab	399.0 a	2.717	2.955	2.836 a
F7	68.93b	69.88b	69.40a	38.84b	39.55 b	39.19b	391.00 a	426.70 a	408.9 a	2.562	2.764	2.663 b
F test	*	*	*	*	*	*	*	*	*	NS	NS	*
Interaction:- VxF	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	*

Where: F_1: humic acid, F_2:F_1 + 50%N (37.5 kg), F_3: Organic fertilizer, F_4:F_3 +50%N (37.5 kg), F_5: Yeast extract, F_6:F_5+ 50%N (37.5 kg) and F_7: Recommended dose (75 kg N/ fad).

Table 7. Biological, straw and grain yield (ton /fad) of wheat cultivars as affected by fertilization treatments and their interaction during the 2017/ 2018 and 2018/ 2019 seasons and their combined.

Treatment	Biologic yield/ fad(ton)			Straw yield/ fad(ton)			Grain yield / fad(ton)		
	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.
Cultivar :- V									
Misr2	9.945	9.991 b	9.971 b	6.570 b	6.393	6.481 b	3.372 b	3.598 b	3.485 b
Shandawel-1	10.234	10.481 a	10.36 a	6.856 a	6.515	6.682 a	3.682 a	3.966 a	3.824 a
F.test	NS	*	*	*	NS	*	*	*	*
Fertilization treatment: F									
F_1	6.650 d	6.891 f	6.770 f	4.243 c	3.846 c	4.044 d	2.407 f	3.045 e	2.726e
F_2	9.420 c	9.608 e	9.514 e	6.243 b	6.043 b	6.143 c	3.177 e	3.557 d	3.367 d
F_3	9.638 c	9.831 d	9.734 e	6.216 b	6.123 b	6.165 c	3.422 de	3.708 c	3.565 c
F_4	9.893 c	10.055 d	9.974 d	6.291 b	6.255 b	6.272 c	3.602 cd	3.800 c	3.701 c
F_5	11.275 b	11.454 c	11.364 c	7.443 a	7.434 a	7.446 b	3.812 bc	4.020 b	3.916 b
F_6	12.095 a	12.073 a	12.084 a	7.900 a	7.806 a	7.853 a	4.195 a	4.267 a	4.268 a
F_7	11.660 ab	11.750 b	11.705 b	7.660 a	7.672 a	7.665 ab	4.000 ab	4.078 b	4.039 ab
F test	*	*	*	*	*	*	*	*	*
Interaction:- VxF	*	*	*	NS	*	*	NS	NS	*

Where: F_1: humic acid, F_2:F_1 + 50%N (37.5 kg), F_3: Organic fertilizer, F_4:F_3 +50%N (37.5 kg), F_5: Yeast extract, F_6:F_5+ 50%N (37.5 kg) and F_7: Recommended dose (75 kg N/ fad).

Table 8. Harvest index (%), protein content (%) and protein yield (kg)/fad of wheat cultivars as affected by fertilization treatments and their interaction during the 2017/ 2018 and 2018/ 2019 seasons and their combined.

Treatment	Harvest index (%)			Protein content (%)			Protein yield (kg)/fad		
	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.	2017/ 2018	2018/ 2019	Comb.
Cultivar :- V									
Misr2	33.92 b	36.01	34.96	9.96 a	10.29 a	10.12	335.72	370.23	352.68
Shandawel-1	35.97 a	37.84	36.92	9.15 b	9.41 b	9.28	336.94	373.20	354.86
F.test	*	NS	NS	*	*	NS	NS	NS	NS
Fertilization treatment: F									
F_1	36.20	44.19 a	40.27 a	8.792	8.93	8.86 d	211.28 e	267.72 f	239.67 f
F_2	33.73	37.05 b	35.40 bc	8.877	9.12	9.00 cd	282.02 d	315.75 e	298.89 e
F_3	35.53	37.72 b	36.64 bc	8.985	9.26	9.12 c	307.47 c	333.16 cd	320.31 c
F_4	36.40	37.79 b	37.10 b	9.813	10.27	10.04 a	353.27 c	372.89 de	363.08 d
F_5	33.82	35.10 c	34.47 c	10.52	10.33	10.43 a	401.02 b	422.90 b	411.96 b
F_6	34.67	35.34 c	35.01 bc	10.35	10.86	10.60 a	434.18 a	441.63 a	437.91 a
F_7	34.31	34.71 c	34.51 c	9.533	10.22	9.876 b	381.32 b	388.76 bc	385.04 b
F test	NS	*	*	NS	NS	*	*	*	*
Interaction:- VxF	NS	NS	NS	*	NS	*	*	NS	NS

Where: F_1: humic acid, F_2:F_1 + 50%N (37.5 kg), F_3: Organic fertilizer, F_4:F_3 +50%N (37.5 kg), F_5: Yeast extract, F_6:F_5+ 50%N (37.5 kg) and F_7: Recommended dose (75 kg N/ fad).

Results recorded in Table 7 (combined analysis) show that the highest biological (12.084 ton/fad), straw (7.853 ton/fad) and grain (4.268 ton /fad) yields were obtained from F_6 treatment (yeast extract + 50% mineral nitrogen). F_1 fertilization treatment gave the lowest value for each of biological, straw and grain yields (6.770, 4.044 and 2.726 ton /fad, respectively). The relative increase present in biological, straw and grain yields were about (78.49%, 94.19% and 56.57%, respectively) when fertilized with F_6 treatment compared to F_1 treatment. Barnett *et al*. (1990) mentioned that, yeast extract may play a beneficial role in improving flower formation and their set of some plants as well as enhancing the accumulation of carbohydrate due to its high auxin and cytokinin contents. Other researchers found that grain yield of wheat was increased by application of 50 % chemical fertilizer + 50% poultry manure (Al-Amin *et al*., 2017), 75 kg mineral nitrogen (El-Seidy *et al*., 2017). El-Hawary *et al*. (2019) ensured that non-significant differences were observed between plants fertilized with 215 kg N/ha and those received 145 kg N/ha plus foliar application of yeast extract respecting to grain yield.

It can be concluded that bio-fertilizers in combination with chemical fertilizer may increase availability and uptake of nutrient for wheat plants. The increment in yield and its components may be due to the increase in vegetative growth of plants and effects of bio-fertilizer on enhancing root growth and dry matter accumulation. Atta and Abd El-Salam (2016) and El-

Metwally *et al*. (2018) purported that the use of bio-fertilizers (yeast extract) may have additional benefits such as increasing the phytohormones *i.e*. Indole acetic acid (IAA), Gibberellins (GA3) and Cytokines like substances (CKs) which plays an important role in formation a large active root system and hence, increasing water and nutrients uptake, photosynthesis rate and translocation. The obtained results are in harmony with previous findings of Karimi and Marashi (2017), Khalilzadeh *et al*. (2018) and Singh *et al*. (2018).

Looking at the results in Table 8, it is clear that the highest values of grain protein content (10.60%) and protein yield (437.91kg/fad) were obtained due to application of F_6 treatment, during the combined analysis without significant differences among F4, F5 and F6 concerning grain protein content (%). The lowest values recorded for protein content and protein yield were obtained when plants fertilized by the treatment F_1 (8.86 % and 239.67 kg/fad, respectively). The increase present in protein content was about (19.64 %) and about (82.71%) for protein yield when fertilized by F_6 treatment compared to F_1 treatment. The increase in the protein content when adding treatment F6 is due to contribution of yeast to produce the growth hormones and the role of nitrogen fertilizer to support a photosynthetically active of wheat canopy ensuring grain yield and to produce storage protein in the wheat grain (Gaballah and Gomaa, 2004). Other researchers found that protein yield of wheat was increased by application of 50 % chemical fertilizer + 50% poultry manure (Al-Amin *et al*., 2017), 75 kg mineral nitrogen (El-Seidy *et al*. 2017). However, El-Hawary *et al*. (2019) found that non-significant differences were observed between plants fertilized with 215 kg N/ha and those received 145 kg N/ha plus foliar application of yeast extract for grain yield. Results at the same Table clear that the highest value for harvest index was recorded by adding F_1 treatment with an increase of about (16.82%) compared to F_5 treatment. On the other hand, F_5 treatment, F_7 and F_6 produced the lowest values of harvest index in the second season and combined analysis, The increase of harvest index caused by added humic acid (F_1) may be due to increasing grain yield per fad as a ratio from biological yield per fad, thus increased harvest index (El-Sheshtawy and Hager 2015).

Interaction effect

Results in Table (4), show that interactions effect between cultivars and fertilization treatments was significant on chlorophyll content (combined analysis) and was insignificant on flag leaf area in both seasons and combined analysis. From Fig.1, it is clear that, the highest value for chlorophyll content was resulted from the interaction between Shandawel-1 cultivar with F_6 fertilization treatment (foliar with yeast extract+ 50% mineral nitrogen), while the lowest one was obtained with F_1treatment (plants foliared with humic acid only).

Results in Table 5 show that the interaction relationships between the two wheat cultivars and the seven fertilization treatments under study were significant in each of plant height, grain weight/spike, biological, straw and grain yields/fad and protein content. Interaction effect was nonentity on each of, spike length, number of spikelets/spike, number of grains/spike, 1000 grain weight and number of spike/m^2 in both seasons and combined analysis.

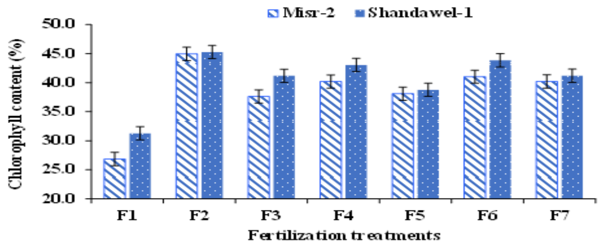

Fig. 1. Chlorophyll content of wheat as influenced by interaction between cultivars and fertilization treatments in the combined analysis.

From Fig. 2 it could be noted that the tallest plants were resulted from shandawel-1 cultivar when fertilized by F_6 fertilization treatment (yeast extract +50% mineral nitrogen), while the shortest plants were obtained from the same cultivar with F_1 fertilization treatment (humic acid only).

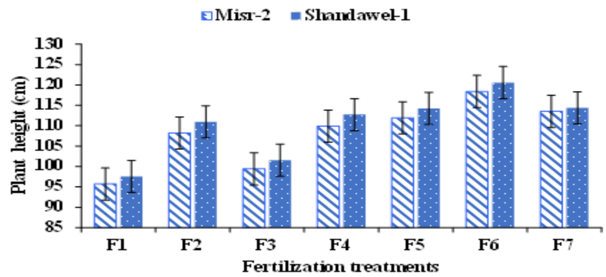

Fig. 2. Plant height (cm) of wheat as influenced by the interaction between cultivars and fertilization treatments in the combined analysis.

Fig. 3 views that shandawel-1 and Misr2 cultivars recorded the maximum grain weight/spike when fertilized by F_6 treatment, while, F_3 fertilization treatment recorded the minimum values of grain weight/spike for the two cultivars.

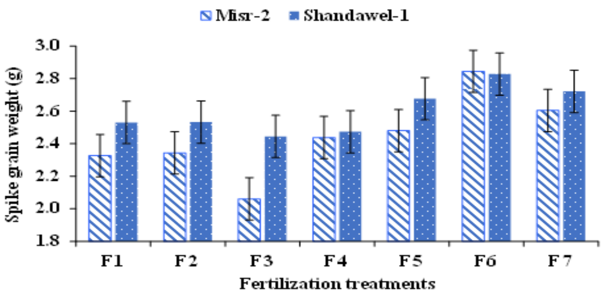

Fig. 3. Spike grain weight (g) of wheat as influenced the interaction between cultivars and fertilization treatments in the combined analysis.

Fig .4 show that both shandawel-1 and Misr2 cultivars recorded the best values for biologic yield/ fad when fertilized by F_6, F_7 and F_5 treatments, respectively, where fertilization treatments were arranged as follows $F_6 > F_7 > F_5$, while, F_1 fertilization treatment both cultivars interaction recorded lowest value for biologic yield/ fad.

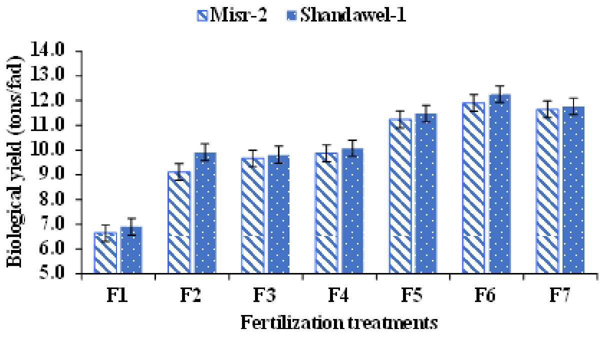

Fig .4. Biological yield/fad (ton) of wheat as influenced the interaction between cultivars and fertilization treatments in the combined analysis

Also, the interaction effect between the seven fertilization treatments and the two wheat cultivars in the straw and grain yields/fad (Fig. 5 and Fig. 6) took the same trend as biological crop where the best values were obtained by F_6, F7 and F_5 treatments, respectively for the two cultivars. The lowest values for straw and grain yields/fad were recorded by the two cultivars when fertilization with the F_1 treatment was done where fertilization treatments were arranged as follows $F_6 > F_7 > F_5 > F_4 > F_3 > F_2 >$ F1.

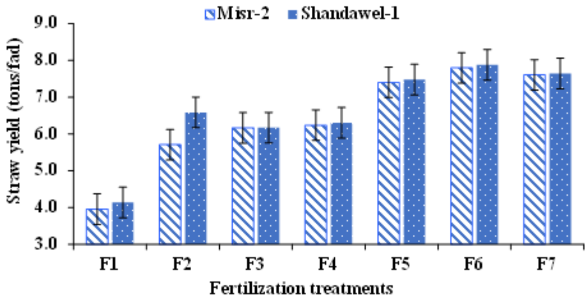

Fig. 5. Straw yield /fad (ton) of wheat as influenced the interaction between cultivars and fertilization treatments in the combined analysis

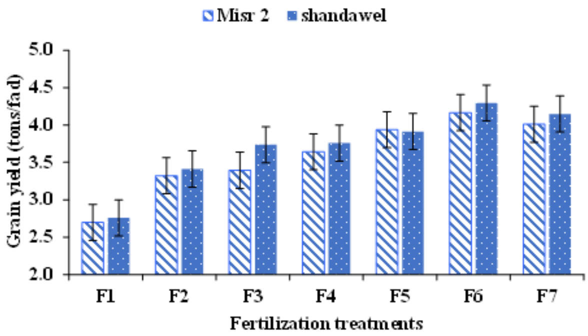

Fig .6. Grain yield (ton)/ fad of wheat as influenced the interaction between cultivars and fertilization treatments in the combined analysis

It can be noticed from Fig. 7 that the tested cultivars showed various responses to fertilization systems for protein content. It is interesting to note that the most pronounced interaction for increasing protein content was happened when the plants of cultivar Misr2 were fertilized by F $_6$ treatment. Moreover, Shandawel-1 cultivar ranked second rank when its plants received the same fertilization treatment, while F_1 fertilization treatment recorded the minimum values for protein content in both cultivars. The fertilization treatments were ranked as follows: Misr2 $F_6>F_5>F_7>F_4>(F_3,F_2)>F_1$ and Shandawel-1 $F_6 >F_5 >F_4 >F_7 >F_3>F_2>F_1$.

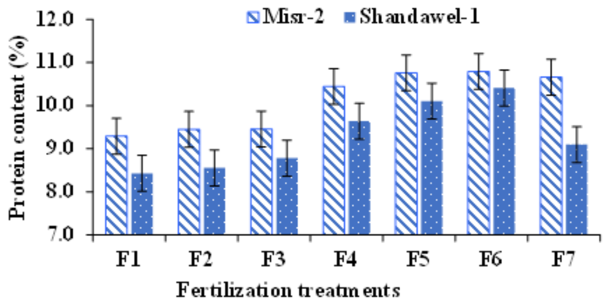

Fig .7. Protein content % of wheat as influenced the interaction between cultivars and fertilization treatments in the combined analysis.

Yield analysis

Correlation study

The inter relationships among grain yield of wheat and its attributes as affected by the studied factors as simple correlation are shown in Table (9). It is evident that correlation between grain yield and all yield attributing characters (plant height, spike length, No. of spikletes/spike, 1000 grain weight, spike weight and No. of spikes/m^2) was positive and significant. The correlation was positive and highly significant regarding number of spike/m^2 (**0.9078). These results are in agreement with those reported by Abd El-Hameed and Ash-Shormillesy, Salwa (2005), Athar *et al*. (2016) and Ebrahimnejad and Rameeh (2016).

Also, plant height was positive and significant correlated with each of spike length, No. of spikelets /spike, 1000 grain weight, Spike weight and number of spikes/m^2. Weak relation was seen between plant height and No. of grains/spike (0.2596).

In addition, there were positive and significant correlation between spike length and the following characters: No. of spikeletes/spike, 1000 grain weight, spike weight and number of spikes/m^2, and not significant with No. of grains/spike only.

Number of spikelets /spike showed positive and significant correlation coefficient with each of 1000 grain weight, spike weight and number of spike/m^2, while positive and not significant with number of grains/spike (0.3043). Number of grains/spike appeared positive and highly significant correlation coefficient with spike weight while that correlation with number of spikes/m^2 was negative and not significant with 1000 grain weight.

Besides, 1000 grain weight showed positive and highly significant correlation coefficient with spike weight and positive and significant with number of spikes/m^2.

Moreover, spike weight showed weak relation with number of spikes / m^2.

Table 9. Simple correlation coefficient between grain yield (ton/fad) and other characters of wheat for combined analysis.

Characters	Plant height	Spike length	No. of spikelets /spike	No. of grains/spike	1000 grain weight	Spike weight	No .of spike /m^2
1-Grain yield	0.7711*	0.4433*	0.5697*	0.1861	0.7891*	0.6009*	0.9078**
2- Plant height		0.5010*	0.5029*	0.2596	0.7244*	0.5997*	0.7058*
3- Spike length			0.6136*	0.2932	0.4706*	0.4408*	0.4232*
4-No. of spikelets /spike				0.3043	0.5717*	0.5341*	0.5652*
5- No. of grains/spike					0.3919*	0.8165**	-0.0358
6- 1000 grain weight						0.8503**	0.6636*
7- Spike weight							0.3976
8- No .of spike /m^2							--

CONCLUSION

The results obtained from this study summarized that wheat yield influenced strongly by cultivar differences, fertilization treatments. Shandawel-1 was superior in all traits nearly. Moreover, the results showed that applying F6 fertilization treatment (50% mineral nitrogen + foliar yeast extract) gave the best value for wheat yield and its attributes compared with 100% recommended does from mineral nitrogen or other organic fertilizer treatments under this study. That is, it is possible to reduce the addition of chemical nitrogen fertilizers by 50% and foliar with yeast extract while obtaining the same yield from the wheat crop. Thus, we can contribute to reducing soil and water pollution with low additions of mineral fertilizers and reduce production costs on farms.

REFERENCES

Abdel- Aal, Y. A. S.A, Taha, M. A. Mohamed and Mona F- Abdel- Ghana (2007). Effect of inoculation with Vesicular- arbuscular- mycorrhizae fungi and phosphate Solubilizing bacteria on growth and phosphorus uptake of wheat plant. J. Agric. Sci. Mansoura Univ., 32 (6): 5049- 5064.

Abdel-Gawad, A.A., K.A. El-Shouny, S. A. Saleh and M.A. Ahmed (1987). Partition and migration of dry matter in newly cultivated wheat cultivars. Egypt. J. Agron., 12 (1-2): 1-16.

Abd El-Hameed, I. M. and Ash-Shormillesy, M. A. I. Salwa (2005). Effect of nitrogen and micronutrients fertilizations on yield of some barley cultivars grown under sandy soil. Zagazig J. Agric. Res., 32(5):1381-1401.

Abd El-Kreem, H. A. Thanaa and El-Hussin, G. G. Ahmed (2013). Evaluation of four new bread wheat (*Triticum aestivum*, L.) cultivars in sandy soils under different irrigation regimes and nitrogen fertilizer rates for yield and its components. Alex. J. Agric. Res., 58(3): 241-250.

Abdel-Lateef, A. A. (2018). Effect of mineral and bio-fertilizers on productivity of wheat (*Triticum aestivum L.*) under South West Suez Canal Conditions J. Plant Proud., Mansoura Univ., 9(2):173 – 179.

Abou-Aly, H. A. (2005). Stimulatory effect of some yeast application on response of tomato plants to inoculation with biofertilizeres. Annals. Sci., Moshtohor, 43 (2): 595-609.

Al-Amin M, Hasan A, Ali M, Nessa S, Islam M. (2017). Effect of mulching and organic manure on growth and yield performance of wheat. Archives of Agriculture and Environmental Science. 2(3):134-140.

Ali, A. F., Salim, H. A. and Alsaady, M. H. M. (2019). Response of two wheat cultivars to inoculation of *Bacillus subtilis* and Phosphorus fertilizer, J. Physics: Conference Series, 1294(9):159–163. doi: 10.1088/1742-6596/1294/9/092036.

Anwar, S., Israeel, B. Iqbal, A. A. Khan, I., W. A. Shah, M. Islam, W. A. Khattak, Ikramullah1, W. Akram and W.Abbas(2016). Nitrogen and phosphorus fertilization of improved varieties for enhancing phonological traits of wheat. Pure Appl. Biol., 5(3): 511-519.

AOAC (1980). Association of Official Agricultural Chemists Official Methods of Analysis, 13th Ed, Washington, DC, USA.

Atia R. and Ragab K.E. (2013). Response of some wheat varieties to nitrogen fertilization. J. Soil Sci. and Agri. Engin., 4(3):309-319.

Attia, M. A. and Abd El -Salam, A. A. (2016). Effect of mineral, organic and bio-fertilizer on yield and yield components of bread wheat at Siwa Oasis. Alex. J. Agric. Sci., 61(3): 211-219.

Azeez J. O. (2009). Effects of nitrogen application and weed interference on performance of some tropical maize genotypes in Nigeria. Pedosphere, 19(5): 654–662.

Barnett, J.A., R.W. Payne and D. Yarrow (1990). Yeasts Characteristics and Identification. Cambridge Camb. CBZBR, 40 west 20, pp: 999

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

Bevilacqua, A., Corbo, M. R., Mastromatteo, M. and Sinigaglia, M. (2008). Combined effect of pH, yeast extract, carbohydrates and di-ammonium hydrogen citrate on the biomass production and acidifying ability of a probiotic *Lactobacillus plantarum* strain, isolated from table olives, in a batch system. World J. Microbiol Biotechnol, 24: 1721-1729.

Athar, H. B., Asghar, A. R., Shahmir, A. K., Amjad A., Fahad A. K., Muneer A., Sajjad, A.and Niaz A. K. (2016). Correlation and regression analysis for yield traits in wheat (*Triticum aestivum* L.) genotypes. Natural Sci. 8(03):96-104.

Delfine, S., R. Tognetti, E. Desiderio and A. Alvino (2005). Effect of foliar application of N and humic acids on growth and yield of durum wheat. Agron. Sustain Dev., 25: 183-191.

Daneshmand N. G., A. Bakhshandeh and M. R. Rostami (2012). Biofertilizer effects on yield and yield components of wheat. Inter. J. of Agric. 2(6): 699–704.

Daur, I. (2013). Comparative study of farmyard manure and humic acid in integration with inorganic-N on wheat (*Triticum aestivum L.*) growth and yield. Tarim Bilimeleri Dergisi. J. Agric. Sci., (19):170-177.

Diacono M., P. Rubino, and F. Montemurro (2013). Precision nitrogen management of wheat; a review. Agron. Sustain. Dev. 33(1): 219–241.

Ebrahimnejad S. and Rameeh V. (2016). Correlation and factor analysis of grain yield and some important component characters in spring bread wheat genotypes. Cercetari Agronomice in Moldova. 49(1):5-15.

EL-Hag, Dalia A. A. (2016). Effect of seeding rate on yield and yield components of two bread wheat cultivars. J. Agric. Res. Kafr El-Sheikh Univ. J. Plant production 42(1):29-39.

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

El-Hag, Dalia. A. A. and Rania F. El Mantawy (2017). Performance of three bread wheat cultivars under different sowing pattern. Bull. Fac. Agric., Cairo Univ. 68(1): 1-19.

EL- Hawary, M. N. A. and Alaa. M. E. A. Shahein (2015). Response of some wheat cultivars to sowing and raised bed under different nitrogen levels on some agronomic and quality traits. J. Agric. Res. Kafr elsheikh Univ.41 (4):1340-1354.

El-Hawary, M. M, K. I. Gad and A. O. A. Ismail (2019). Physiological response of some wheat varieties to foliar application with yeast, potassium and ascorbic acid under salt affected soil conditions Bioscience Res., 16(2): 1009-1027.

El-Metwally, E. A., M. E. R. Mekkei, R. M. Abd El-Salam and H. M. Abo Shama (2018). Effect of some mineral and bio fertilization treatments on yield and yield components of bread wheat under two seeding rates. J. Plant Prod., Mansoura Univ., 9 (9): 733 – 738

El-Sheshtawy, A. A. and M.A. Hager (2015). The role of different bio-fertilizers and nitrogen rates in improving yield and yield components of wheat. J. Plant Production, Mansoura Univ., Vol. 6(12): 1991 - 2001

Gaballah, M.S. and A.M. Gomaa (2004). Performance of faba bean varieties grown under salinity stress and biofertilized with yeast. Pakistan Gaballah, M.S.

Galelah, A. A. M.; Dalia A. A. El hag and H. A. A. Hendawy (2018) . Response of two wheat cultivars to nitrogen and phosphorus fertilizer rates J. Plant Production, Mansoura Univ., Vol. 9 (2): 159 – 163.

Gardner, F.P.; R.B. Pearce and R.L. Michell (1985). Physiology of Crop Plant. Iowa State Univ. Press Ames. Iowa. USA (C.F. Computer Search).

Gomez, A.K. and A.A. Gomez (1984). Statistical Procedure for Agricultural Research. 2^{nd} Ed. John Wiley and Sons, Inc., New York.

Hemdan I. Mahmoud1; Nabil A. Aziz; Yassir A. M. Khalifa; Mohammed A. Mahmoud , and Gamal-Fakhry (2016). Effect of foliar application with active yeast extract and benzyladenine on some vegetative growth criteria and chemical composition of Lupine (Lupinus termis, L.) plants. Minia J. Agric. Res. & Develop. 36 (2):193-214.

Ibrahim,M.E. ;A.M.S.Hussein ;A.A. Aliand Amany and H.A.Elkousy(2020). Effect of mineral and organic fertilizers on yield and technological traits of some bread wheat varieties. Menoufia J.plant prod., 4 (1):19-38

Jackson, M.L.(1973).Soil Chemical Analysis .Prentic Hall of india private Limited .New. Delhi.

Kandil, A. A.; A. E. Sharief and A. M. A. Abozied (2016). Growth characters of some maize hybrids as affected by inter and intra row spacings. J. Plant Prod., Mansoura Univ., 7 (8): 877 -881

Karimi, M. and Marashi, S.K. (2017). Effect of combined application of chemical and biological phosphorus and nitrogen fertilizers on yield and yield components of wheat. J. Agric. Res., 8 (5):41-52.

Khalilzadeh, R.; Sharifi, R.S. and Jalilian, J. (2018). Growth, physiological status, and yield of salt stressed wheat (*Triticum aestivum* L.) plants affected by biofertilizer and cycocel applications. Arid Land Res. Manag., 32(1): 71-90.

Kizilkaya R. (2008). Yield response and nitrogen concentrations of spring wheat (*Triticum aestivum*) inoculated with *Azotobacter chroococcum* strains. Ecological Engineering. 33(2): 150– 156

Mahmoued, T. R. (2001). Botanical studies on the growth and germination of mahnolia (*Magnolia grandiflora L.*) plants. M. Sci. Thesis. Fac. of Agric. Moshtohor, Zagazig Univ., Egypt.

Mokhtar H. Abdel- Rahman; Hassan R. Hassan; Rania M.A. Nassa and Hend S. M. Abdel-Aziz (2020). Influence of foliar spray with yeast extract on faba bean plant (*Vicia faba* L.) Plant Archives 20(1):1439-1449

Dawood, Mona G.; Safaa R. El-Lethy and Mervat Sh. Sadak (2013). Role of methanol and yeast in improving growth, yield, nutritive value and antioxidants of soybean. World Appl. Sci. Jo., 26 (1): 06-14

Monje, O.A. and B. Bugbee (1992). Inherent limitation of nondestructive chlorophyll meters- Acomparison of types meters. Hort. Sci., 27: 69-71

Namvar A.; T. Khandan and M. Shojaei (2012). Effects of bio and chemical nitrogen fertilizer on grain and oil yield of sunflower (*Helianthus annuus*,L.) under different rates of plant density. Annals of Bio. Res., 3(2): 1125–1131.

Osman,E. A. M.and Gehan A. Nor Eldein (2017).Response of three bread wheat to nitrogen fertilizer with or without ascorbic acid grown on a clay soil.J.Soil Sci.and Agric. Eng.,Mansoura Univ.,8 (6):267 – 274

Piccinin G. G.,; A. L. Braccini; L. G. M. Dan; C. A. Scapim; T. T. Ricci and G. L. Bazo (2013). Efficiency of seed inoculation with *Azospirillum brasilence* on agronomic characteristics and yield of wheat. Industrial Crops and Products. 43: 393–397.

Rahmat, U. K. A. Rashid; M. S. Khan and E. Ozturk (2010). Impact of humic acid and chemical fertilizer application on growth and grain yield of rainfed wheat (*Truticum aestivum, L*.). Paki. J. Agric. Res.23 (3-4):113-121.

Said M.T. and A.M.A. Abd El-Moneem (2016). Response of two bread wheat cultivars to foliar spray by salicylic and ascorbic acids under water stress conditions. Assiut J. Agric. Sci., 47 (6-2):391-404.

Seadh, S. E.; W. A. E. Abido and Samar E. A. Ghazy (2017). Impact of foliar and NPK fertilization treatments on bread wheat productivity and quality. J. Plant Prod., Mansoura Univ., 8 (1): 65 – 69.

Seleiman, M. and Abdel-Aal, M. (2018).Response of growth, productivity and quality of some Egyptian wheat cultivars to different irrigation regimes," Egyptian Jo. Argon. 40 (3): 313–330.

Shambhoo, P. ; Ajit T. ; Navnesh, K. ; Bandana, J. ; Sonam,S. ;Rakeshwivedi; Ajay, K. ; Adesh, K. ; Sujeet, K. and B.N. Singh (2016). Evaluation of wheat (*Triticum aestivum*, L) genotypes for heat tolerance at grain filling stage. Natural and Applied Sci., 3(1):97-106.

Shehata, S.; Fawzy, Z., and El-Ramady, H. (2012). Response of cucumber plants to foliar application of chitosan and yeast under greenhouse conditions. Australian J. Basic and Applied Sci., 6 (4): 63-71.

Singh, V.; Rana, N. S.; Dhyani, B.P.; Kumar, R.; Naresh, R. K. and Kumar, A. (2018). Influences of organic and inorganic fertilizers on productivity and soil fertility of wheat (*Triticum aestivum* L.) in Typic Ustochrept soil of Uttar Pradesh. J. Pharmacognosy and Phytochemistry, 7(1):260-265.

Wanas, A.L. (2002). Response of faba bean (*Vicia faba* L.) plants to seed soaking application with natural yeast and carrot extracts. Annals. Agric. Sci. Moshtohor, 40(1): 259-278.

Wanas, A.L. (2006). Trails for improving growth and productivity of tomato plants grown in winter. Annals. Agric.Sci. Moshtohor, 44(3):466-471.

Waller, R.A. and D. B. Duncan (1969). A bayes rule for the symmetric multiple comparisons problems. J. Ame. Stat. Assoc., 64 (328): 1484 - 1503.

Wortman S. E.; A. S. Davis; B. J. Schutte and J. L. Lindquist (2011). Integrating management of soil nitrogen and weeds.Weed Science. 59: 162–170.

فاعلية التسميد العضوي والحيوي في خفض معدلات الأسمدة النيتروجينية المعدنية وتأثيرها على إنتاجية بعض أصناف القمح.

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أقيمت تجربتان حقليتان خلال الموسم الشتوي من عامي 2018 و 2019 م بالمزرعة التجريبية (بقرية غزالة) التابعة لكلية الزراعة - جامعة الزقازيق - محافظة الشرقية، بهدف دراسة فاعلية استخدام صور مختلفة من الأسمدة وهي: أسمدة عضوية (حمض الهيومك والمخصب 3G 101)، أسمدة حيوية (مستخلص الخميرة) ومقارنتها بالصورة الكيماوية (الأسمدة النتروجينية) في خفض المعدلات المستخدمة من الأسمدة النتروجينية المعدنية بغرض الحد من التلوث وتقليل تكاليف الإنتاج لصنفين من القمح (مصر2 وشندويل 1) وكانت معاملات الدراسة كما يلي :- F_1: الرش بحامض الهيومك فقط ، F_2 : F_1 + 50% من الجرعة الموصي بها من السماد النتروجيني (37.5 كجم نتروجين)، F_3 : الرش بمخصب عضوي تجاري (3G101)، F_4 : F_3 + 50% من الجرعة الموصي بها من السماد النتروجيني (37.5 كجمنتروجين)، F_5: الرش بمستخلص الخميرة، F_6 : F_5 + 50% من الجرعة الموصي بها من السماد النتروجيني (37.5 كجم نتروجين)، F_7 : 75 كجم نتروجين / فدان. واستخدم تصميم القطاعات كاملة العشوائية في ثلاث مكررات. وتتلخص أهم النتائج المتحصل عليها فيما يلي :- وجود اختلافات معنوية بين صنفى الدراسة في غالبية الصفات تحت الدراسة في كلا الموسمين وتحليل التباين المشترك. أظهر الصنف شندويل -1 تفوق معنوي علي الصنف مصر 2 في كل من: محتوى الأوراق من الكلوروفيل، مساحة ورقة العلم، طول السنبلة، عدد السنيبلات/سنبلة، عدد حبوب السنبلة، وزن الـ 1000 حبة، وزن حبوب السنبلة، عدد السنابل / م^2، المحصول البيولوجي، القش والحبوب/فدان في حين لم يصل الفرق بين صنفى الدراسة إلي مستوي المعنوية في كل من: ارتفاع النبات، دليل الحصاد، نسبة البروتين في الحبوب ومحصول البروتين/فدان. تفوقت المعاملة F_2 (حامض الهيوميك + ٥٠% من الجرعة الموصي بها من الأسمدة النتروجينية) في صفة محتوي الكلوروفيل حيث أعطت أعلى القيم يليها المعاملة F_6 (مستخلص الخميرة +٥٠% من الجرعة الموصي بها من الأسمدة النتروجينية) بينما أعطت المعاملة F_1 (حامض الهيوميك فقط) أقل القيم لمحتوي الكلورفيل. سجلت المعاملة F_6 (مستخلص الخميرة + 50% من الجرعة الموصي بها من الأسمدة النتروجينية) أعلى القيم في كل من : مساحة ورقة العلم، ارتفاع النبات/سم، طول السنبلة/ سم، عدد السنيبلات/السنبلة، عدد حبوب السنبلة، وزن الـ ١٠٠٠ حبة، عدد السنابل/م^2، المحصول البيولوجي، القش والحبوب/ فدان ومحتوي البروتين بينما أعطت المعاملة F_1 (الرش بحمض الهيوميك فقط) أقل القيم للصفات السابقة في حين أعطت أعلي قيمة لصفة دليل الحصاد بالمقارنة بالمعاملة F_5 التي أعطت أقل قيمة لصفة دليل الحصاد وكذلك المعاملات F_6و F_7 . يتضح أيضا أن المعاملات السماديةF_4 ,F_5 و F_6 تشابهت في تأثيرها علي صفة نسبة البروتين بالحبوب. كذلك لم تكن الفروق معنوية بين المعاملات F_6 و F_7 في صفات طول السنبلة، عدد السنيبلات/سنبلة، عدد حبوب السنبلة، عدد السنابل/م^2 ومحصول القش والحبوب/ فدان. أي أنه يمكن تقليل إضافة الأسمدة النتروجينية الكيميائية بنسبة 50% والرش بمستخلص الخميرة مع الحصول علي نفس الانتاجية من محصول القمح. وبذلك نقلل من تلوث التربة والمياه بالإضافات المنخفضة من الأسمدة المعدنية وخفض تكاليف الانتاج. أظهر محصول الحبوب/ فدان ارتباط موجب ومعنوي جداً مع صفة عدد السنابل/ م^2، وارتباط معنوي وموجب مع كل من ارتفاع النبات، طول السنبلة، عدد السنيبلات/ سنبلة ووزن الـ ١٠٠٠ حبة. التوصية : توصي الدراسة بزراعة صنف القمح شندويل -1 وخفض الكمية المضافة من الأسمدة النيتروجينية المعدنية إلى النصف والرش بمستخلص الخميرة للحصول علي أعلى إنتاجية من القمح وبالتالي الحد من تلوث التربة والمياه بالأسمدة الكيميائية.