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RESPONSE OF SOME WHEAT CULTIVARS TO ORGANIC, MINERAL AND FOLIAR FERTILIZATION

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ABSTRACT

Two field experiments were conducted at the private Farm in Mansoura, Dakahlia Governorate, Egypt, during 2013/2014 and 2014/2015 seasons to improve some wheat cultivars productivity under organic, mineral and foliar fertilization. The experiments were carried out in a strip-split plot design with three replications. The vertical plots were assigned to organic manure (compost) and mineral nitrogen combination treatments. The Horizontal plots were devoted to foliar fertilization treatments (commercial foliar fertilizers). While, the sub – plots were allocated to wheat cultivars (Sakha 93, Giza 168 and Gemmiza 10).

The obtained results showed that application of 100 % (214 kg N/ha) as mineral nitrogen alone increased all growth characters, yield and yield components as well as crude protein percentages in grains as compared with other compost and mineral nitrogen combination treatments. However, application of 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha) came in the second rank in both seasons.

Spraying wheat plants with Biohealth which considered as biostimulants foliar fertilizer produced the highest values of wheat growth, yields and its components and quality character and followed by spraying with Stimufol as macro and micro nutrients foliar fertilizer in both seasons.

Gemmiza 10 cultivar surpassed other studied cultivars (Giza 168 and Sakha 93) and recorded the highest values of most studied characters in both seasons. Giza 168 cultivar registered the longest spikes and the highest values of protein percentage in grains. Whereas, Sakha 93 cultivar recorded the highest values of 1000 – grain weight at the same time the lowest values of other studied characters.

It could be recommended that fertilizing Gemmiza 10 cultivar with 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha) and foliar spraying with commercial foliar fertilizer Biohealth to enhance wheat productivity and also to reduce sources of environmental pollution and maintain human health.

Keywords: Wheat, Organic fertilizers, Compost, Nitrogen fertilizer, foliar fertilizers, Cultivars, Varieties.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important nutritional cereal crops in Egypt, Iraq and all over the world. Wheat is the stable food crop to make bread, macaroni, biscuit and sweets. It is also worth mentioning that wheat straw is a source of fodder for animals. Wheat production is not sufficient for local consumption in Egypt. This calls for greater attention of all the concerned to increase the production to meet the continuous demand and reduce the gap between the production and consumption of wheat. Therefore, great efforts have been made to use suitable agronomic practices for obtaining maximum productivity of different wheat cultivars with optimum quality properties such as organic, mineral and foliar fertilization.

Compost is a natural way to rejuvenate and feed the soil. Compost recycles nutrient elements such as carbon, nitrogen, magnesium, sulfur, calcium phosphorus, and trace minerals. These nutrients not only feed the plants directly, but sustain the natural life cycles of the soil by feeding the microorganisms that live there. The organic acids in compost, like humic acid and fulvic acid make nutrients in the soil more available for plants to take up. Application of different composted materials were more effective in increasing available N, P and K in soil and wheat grains as well as some soil physical properties such as bulk density and aggregate parameters (Talha, 2013). Therefore, usage of compost (organic fertilizer) became necessary in agriculture process because of compost supply plants with essential nutrients and reduces pollution caused by using mineral fertilizers (El-Agamy, 2006).

Nitrogen is the most important element of those fertilizers applied to wheat, because most of Egyptian soils contain insufficient nitrogen in an available form, *i.e.* nitrate or ammonium, to provide for maximum growth. Where nitrogen is in short supply, yield is drastically reduced, and may even be halved on some soils. Nitrogen fertilizer has a remarkable effect on the appearance of the crop, most noticeably by improving the color and vigor of leaf canopy. This leads to a widespread over-use of nitrogen to improving growth characters, consequently, maximization wheat production as well as quality parameters. Many researchers decided that using nitrogen fertilizer in suitable needed level could improve growth, yield and its components as well as quality of wheat, including Seadh et al. (2009), Abedi et al. (2010), Tababtabaei and Ranjbar (2012), Atia and Ragab (2013), Haileselassie et al. (2014), Khan et al. (2014), Seadh and Abido (2014) and Seadh and El-Metwally (2015).

The continued use of chemical fertilizers causes health and environmental hazards such as ground and surface water pollution by nitrate leaching. So, reducing the amount of nitrogen fertilizers applied to the field without a nitrogen deficiency will be the main challenge in field management. One of the possible options to reduce the use of chemical fertilizer could be recycling of organic wastes. Compost as the organic waste can be a valuable and inexpensive fertilizer and source of plant nutrients. The combination of compost with nitrogen fertilizer further enhanced the biomass and grain yield of wheat crop in this regard, Antoun *et al.* (2010) found that the interaction between compost and mineral nitrogen level had significant effects on 1000-grain weight, grain yield/fed and N, P and K % in grains. El-Hamdi *et al.* (2012) reported that the combination of compost and nitrogen fertilizer improved yields, yield components and N-uptake. The best treatment was 50 kg N/fed with adding 10 tons compost/fed. Seadh (2014) concluded that fertilizing Gemmiza 10 cultivar plants with mineral nitrogen (67.5 kg N/fed) + compost (22.5 kg N/fed) to enhance wheat productivity and also to reduce sources of environmental pollution and maintain human health.

Foliar fertilization is an effective method to correct soil deficiencies, overcoming the soils inability to transfer nutrients to the plant under low moisture conditions and improve nutrient use efficiency (Mosali et al., 2006). Foliar fertilization is the most efficient way to increase yield and plant health by applying nutrients directly to their leaves, which may be vary according to environmental conditions, physiological state of development and state of nutrition. El-Naggar and El-Ghamry (2007) reported that foliar application of humic and amino acids exhibited a significant positive effect on grain and straw yields of wheat. Seadh et al. (2009) indicated that foliar application wheat plants with mixture of micronutrients can be maximize wheat straw and grain yields and gave the best quality of grains. Seadh and Abido (2014) reported that foliar spraying wheat plants with the mixture of yeast extract and humic acid resulted in the highest values of growth, yield components, grain and straw yields as well as grain quality. Seadh and El-Metwally (2015) revealed that foliar spraying wheat plants with antioxidants resulted in the highest values of growth, yields and its attributes and grain quality.

Chosen the high yielding ability cultivars undoubtedly is very important to raise wheat productivity per unit area. In this regard, El-Metwally *et al.* (2012) found that the largest flag leaf area resulted from Sakha 93 and Gemmeiza 9. Sakha 94 cultivar significantly surpassed all cultivars in plant height, while Gemmeiza 10 gave the highest number of spikes/m^2, while 1000-grain weight of Sakha 93 was the largest. The highest grain yield was achieved with Sakha 94 and Gemmeiza 9. Harb *et al.* (2012) revealed that Gemmeiza 9 cultivar exceeded Sakha 93 cultivar significantly in number of spikes/m^2, weight of grains/spike, number of grains/spike, 1000-grain weight and grain yield/fed. Atia and Ragab (2013) found that Gemmeiza 9 cultivar had the highest values of grain and straw yields as well as protein and potassium contents in grains. Seleem and Abd El –Dayem (2013) showed that the highest significant value of grain yield was obtained by Gemmeiza 9 followed by Misr 1 then Sakha 94 and Giza 168. Vice versa, the lowest ones resulted from Sakha 93 cultivar. Seadh (2014) showed that Gemmiza 10 variety surpassed other studied varieties (Gemmiza 9 and Sakha 93) in most studied characters. However, Gemmiza 9 variety registered the longest spikes and the highest values of protein percentage. Whereas, Sakha 93 variety recorded the highest values of 1000 – grain weight.

Therefore, this investigation was established to determine the effect of nitrogen and compost combination treatments and foliar fertilizers as well as their interactions on growth, yield and its components as well as grain quality of some wheat cultivars under the environmental conditions of Mansoura district, Dakhlia Governorate, Egypt.

MATERIALS AND METHODS

Two field experiments were conducted at the private Farm in Mansoura, Dakahlia Governorate, Egypt, during the two successive winter seasons of 2013/2014 and 2014/2015. The objective of these experiments was to improve some wheat cultivars productivity under organic, mineral and foliar fertilization.

The experiments were carried out in a strip-split plot design with three replications. The vertical plots were assigned to five organic manure (compost) and mineral nitrogen combination treatments as follows:

1. 100 % compost (214 kg N/ha).
2. 75 % compost (160.5 kg N/ha) + 25 % mineral nitrogen (53.5 kg N/ha).
3. 50 % compost (107.0 kg N/ha) + 50 % mineral nitrogen (107.0 kg N/ha).
4. 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha).
5. 100 % mineral nitrogen (214 kg N/ha).

The compost was obtained from El-Asria Company for Solid Waste Recycling and added after soil preparation to the experimental units at the previously mentioned rates on soil surface and then turned over via hack. Analysis of used compost was shown in Table 1. The nitrogen fertilizer in the form of ammonium nitrate (33.5 % N) was applied at the aforementioned rates in two equal doses prior the first (25 days from sowing) and the second (46 days from sowing) irrigations..

Table 1: Chemical analysis of used compost.

Properties	Value
Weight	680 kg/m^3
Moisture	27.5 %
Organic matter	33.1 %
Total N	1.4 %
Total P	0.7 %
Total K	1.0 %
Organic carbon	19.6 %
C/N ratio	16 : 1
NaCl	1.5 %
Fe	1650 ppm
Mn	35 ppm
Zn	180 ppm
Cu	105 ppm
pH	7.7
E.C.	3.1 mho/cm

The Horizontal plots were devoted to foliar treatments (commercial foliar fertilizers) as follows:

1- Control treatment (without foliar spraying).
2- Spraying with Stimufol at the rate of 1.50 g/liter water.
3- Spraying with Biohealth at the rate of 1.25 g/liter water.

Foliar fertilization treatments were carried out twice at the aforementioned rates after 30 and 50 days from sowing by using hand sprayer until saturation point. The commercial foliar fertilizer Stimufol was obtained from Shoura chemicals for Import and Distribution Co. The chemical composition of Stimufol is 25% N, 16% P, 12% K, 0.044% B, 0.170% Fe, 0.001 Mo, 0.030 Zn, 0.085 Cu, 0.010 Co, 0.020 Mg and 0.085 Mn. The other commercial foliar fertilizer Biohealth was obtained from Grow Tech for Agricultural Development Co, which contains *Trichoderma*, *Bacillus*, *Accophilum nodosum*, Amino acids, Trace elements, Humic acid, Fluvic acid, Vitamins, Auxin and Cytokinin.

While, the sub – plots were allocated to three wheat cultivars (Sakha 93, Giza 168 and Gemmiza 10). The Egyptian wheat cultivars that used in this investigation were obtained from Wheat Research Section, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt.

Each experimental unit was 3 X 3.5 m occupying an area of 10.5 m^2. The preceding summer crop was maize (*Zea mays* L.) in both seasons. Soil samples were taken at random from the experimental field area at depth of 15 and 30 cm from soil surface before soil preparation to determine the physical and chemical soil properties as shown in Table 2.

Table 2: Physical and chemical soil characteristics at the experimental sites during the two seasons.

Parameter	2013/2014	2014/2015
$CaCO_3$ (%)	2.60	2.62
Sand (%)	20.10	19.20
Silt (%)	32.90	32.70
Clay (%)	47.00	48.10
Soil texture	Clayey	Clayey
Organic matter (%)	2.90	2.85
E.C (ds m^{-1} at 25 ^{0}C)	1.65	1.71
pH	7.80	7.95
Available nitrogen (ppm)	17.00	13.00
Available P (ppm)	9.00	8.00
Exchangeable K (ppm)	310.00	308.00

Calcium super phosphate (15.5 % P_2O_5) was applied during soil preparation at the rate of 357 kg N/ha. The potassium fertilizer in the form of potassium sulphate (48 % K_2O) at the rate of 57 kg K_2O/ha was applied broadcasting in one dose before the first irrigation.

Sowing took place on the first week of November in the two growing seasons. Wheat grains at the rate of 178.5 kg N/ha were sown by using broadcasting Afir method. The first irrigation was applied at 25 days after sowing and then plants were irrigated every 21 days till the dough stage. The common agricultural practices for growing wheat according to the recommendations of Ministry of Agriculture were followed, except the factors under study.

Studied Characters:

A- Growth characters:

1- Number of days to heading.

After 120 days from sowing, 10 plants were randomly chosen from each sub – plot to estimate the following characters:

2- Flag leaf area (cm^2). It was calculated by the following formula:

$$a = L \times W \times 0.75$$ **(Gardner *et al.,* 1985).**

Where; a = Flag leaf area, L = Length of flag leaf and W = Maximum width of flag leaf.

3- Plant height (cm).

B- Yield and its components:

At harvesting (150 days from sowing), one square meter was randomly selected from each sub – plot to estimate the following characters:

4- Number of spikes/m^2.
5- Spike length (cm).
6- Number of spikelets/spike.
7- Number of grains/spike.
8- Grains weight/spike (g).
9- 1000 – grain weight (g).
10- Grain yield (t/ha). It was calculated by harvesting whole plants in each sub-plot and air dried, then threshed and the grains at 13 % moisture were weighted in kg and converted to ton per hectare.
11- Straw yield (t/ha). The straw resulted from previous sample was weighted in kg/plot, then it was converted to ton per hectare.

C- Grain quality characters:

12- Crude protein percentage in grains. Total nitrogen was estimated by the improved Kjeldahl – method according to A.O.A.C. method (1990). Crude protein percentage was calculated by multiplying the total nitrogen values in wheat flour by 5.75.

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the strip-split plot design as published by Gomez and Gomez (1984) by means of "MSTAT-C" Computer software package. Least significant of difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Effect of compost and mineral nitrogen combination treatments:

From obtained results in Tables 3 and 4, organic manure as compost and mineral nitrogen combination treatments showed significant effect on number of days to heading, flag leaf area, plant height, number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, grains weight/spike, 1000 – grain weight, grain and straw yields/ha and protein percentages in wheat grains in both growing seasons. It could be stated that application of 100 % of the recommended dose of nitrogen (214 kg N/ha) as mineral nitrogen fertilizer alone increased growth characters, yield and yield components as well as crude protein percentages in grains as compared with other compost and mineral nitrogen combination treatments in both seasons. However, application of 25 % of the recommended dose from compost (53.5 kg N/ha) + 75 % of the recommended dose from mineral nitrogen (160.5 kg N/ha) came in the second rank after application of 100 % of the recommended dose from mineral nitrogen alone without significant differences between them in number of days to heading, flag leaf area, plant height, number of spikelets/spike, 1000 – grain weight and grain yield/ha in both seasons. This treatment may be recommended when taking into consideration the economic costs and also environmental pollution with nitrite and nitrate. While, application of 50 % of the recommended dose from compost (107.0 kg N/ha) + 50 % of the recommended dose from mineral nitrogen (107.0 kg N/ha) came in the third rank and followed by application of

75 % of the recommended dose from compost (160.5 kg N/ha) + 25 % of the recommended dose from mineral nitrogen (53.5 kg N/ha) with respect to all studied characters in both seasons. On the other hand, application of 100 % of the recommended dose from organic manure as compost alone (214 kg N/ha) gave the lowest values of all studied characters in the two growing seasons of this study.

These results might be due to the low soil content of available nitrogen, phosphorus and potassium (Table 2), since nitrogen is considered as one of the major elements for plant nutrition and it increases the vegetative growth of plants through encouraging plants to uptake other elements and consequently improving photosynthesis and all yield components and consequently grain yield of wheat. It was worthy to mentioned that the decrease in grain yield/fed due to the increase in ratio of organic manure in fertilization treatment might be attributed to lower availability and mineralization of nitrogen which released from compost. These results are in compatible with those found by Antoun *et al.* (2010), El-Hamdi *et al.* (2012) and Seadh (2014).

2. Effect of foliar fertilization treatments:

Relevant data presented in Tables 3 and 4 revealed that, the effect of foliar fertilization treatments on wheat growth (number of days to heading, flag leaf area and plant height), yields and its components (number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, grains weight/spike, 1000 – grain weight, grain and straw yields/ha) as well as quality character (crude protein percentages in wheat grains) was significant in both seasons of this investigation. There were substantial differences in all studied characters among control treatment (without foliar spraying) and spraying with two commercial foliar fertilizers *i.e.* Stimufol at the rate of 3 g/liter water and spraying with Biohealth at the rate of 2.5 g/liter in both seasons. Spraying wheat plants after 30 and 50 days from sowing with commercial foliar fertilizer Biohealth at the rate of 2.5 g/liter water which considered as bio, organic and biostimulants foliar fertilizer produced the highest values of wheat growth, yields and its components and quality character in both seasons. However, spraying wheat plants after 30 and 50 days from sowing with commercial foliar fertilizer Stimufol at the rate of 3 g/liter water which considered as macro and micro nutrients foliar fertilizer came in the second rank after those sprayed with Biohealth in the two growing seasons on this study. On the other wise, control treatment (without foliar spraying) gave the lowest values of all studied characters in the two seasons.

Such these effects of foliar nutrition might have been due to the improvement in early growth, more dry matter accumulation and stimulated the building of metabolic products accompanying with foliar nutrition, which contains macro and microelements. Similar results were reported by several researchers such as Seadh et al. (2009), Seadh and Abido (2014), Seadh and El-Metwally (2015).

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3. Cultivars performance:

Significant differences among the three studied wheat cultivars *i.e.* Sakha 93, Giza 168 and Gemmiza 10 were detected in flag leaf area (in the first season), plant height, number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, grains weight/spike, 1000-grain weight, grain and straw yields/ha and protein percentages in grains during the two growing seasons as shown from data in Tables 3 and 4. Gemmiza 10 cultivar surpassed other studied cultivars (Giza 168 and Sakha 93) in number of days to heading, flag leaf area, plant height, number of spikes/m^2, number of spikelets/spike, number of grains/spike, grains weight/spike and grain and straw yields/ha, which recorded the highest values of these characters in the two growing seasons. However, Giza 168 cultivar registered the longest spikes and the highest values of protein percentage in grains in both seasons. Whereas, Sakha 93 cultivar recorded the highest values of 1000 – grain weight at the same time the lowest values of other studied characters in both seasons of this study.

These findings might be attributed to the differences in their genetical constitution and genetic factors makeup. These results are in agreement with those detected by Atia and Ragab (2013), Seleem and Abd El –Dayem (2013) and Seadh (2014).

4. Effect of interactions:

Regarding the effect of interactions, there are many significant effects of the interactions on the studied characters. We present only the effect of significant interactions on grain yield.

The interaction between compost and nitrogen combination treatments and foliar fertilization treatments significantly affected grain yield/ha in both seasons. Fertilizing wheat plants with 100 % of the recommended dose of nitrogen (214 kg N/ha) as mineral nitrogen fertilizer alone and foliar spraying with commercial foliar fertilizer Biohealth produced the highest values of grain yield in both seasons as graphically illustrated in Fig. 1. This treatment followed by fertilizing wheat plants with 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha) and foliar spraying with commercial foliar fertilizer Biohealth in both seasons.

The interaction between compost and nitrogen combination treatments and cultivars had a significant effect on grain yield/ha in both seasons. Data graphically illustrated in Fig. 2 show that, the highest values of grain yield/ha were obtained when fertilizing Gemmiza 10 cultivar with 100 % of the recommended dose of nitrogen (214 kg N/ha) as mineral nitrogen fertilizer alone in both seasons. Fertilizing Gemmiza 10 cultivar with 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha) ranked after the aforementioned interaction treatment in both seasons.

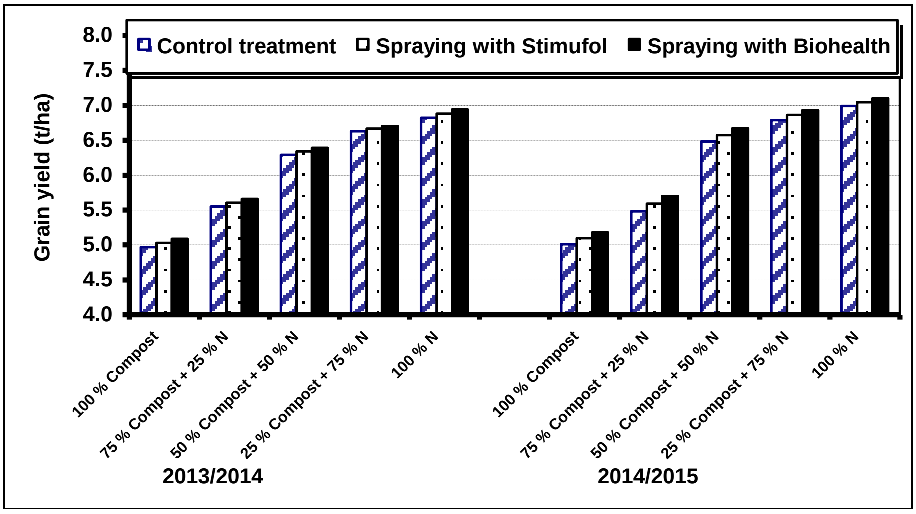

Fig. 1: Grain yield (t/ha) as affected by the interaction between compost and nitrogen combination treatments and foliar fertilization treatments during 2013/2014 and 2014/2015 seasons.

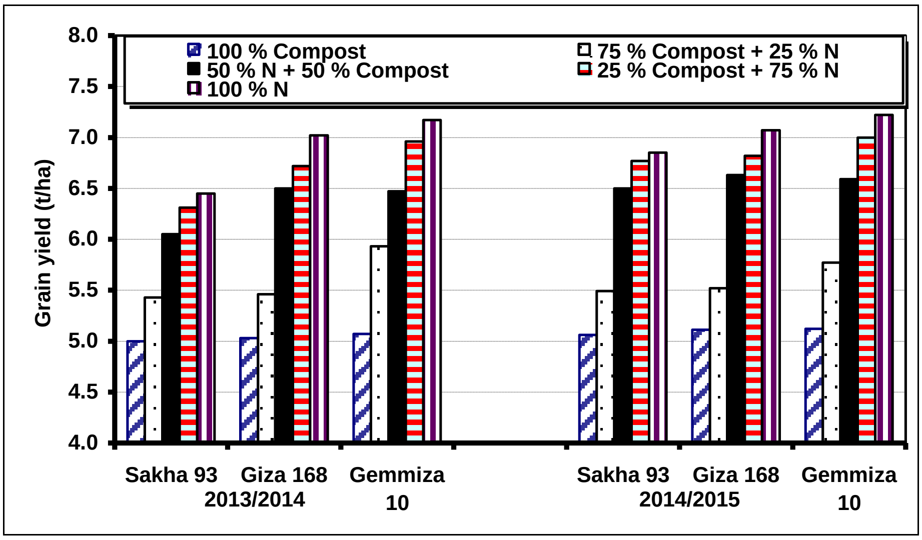

Fig. 2: Grain yield (t/ha) as affected by the interaction between compost and nitrogen combination treatments and cultivars during 2013/2014 and 2014/2015 seasons.

Grain yield/fed was significantly affected by the interaction between foliar fertilization treatments and cultivars in both seasons. From data graphically illustrated in Fig. 3, the highest values of grain yield/ha were obtained as a result of foliar spraying Gemmiza 10 cultivar after 30 and 50 days from sowing with commercial foliar fertilizer Biohealth at the rate of 2.5 g/liter water which considered as bio, organic and biostimulants foliar fertilizer in both seasons. The second best interaction treatment was foliar spraying Giza 168 cultivar with Biohealth as bio, organic and biostimulants foliar fertilizer in both seasons.

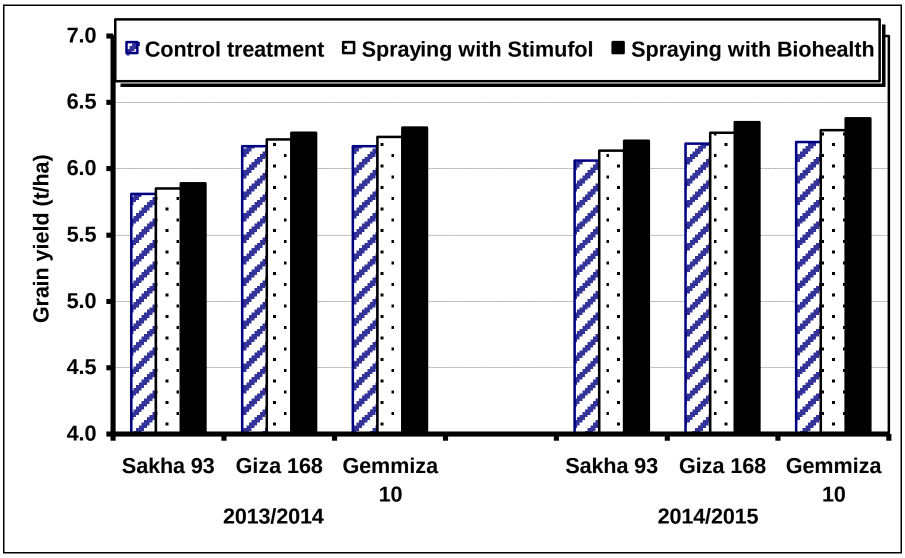

Fig. 3: Grain yield (t/ha) as affected by the interaction between foliar fertilization treatments and cultivars during 2013/2014 and 2014/2015 seasons.

The interaction among compost and nitrogen combination treatments, foliar fertilization treatments and cultivars excreted significant effect on grain yield/ha in both seasons. The highest values of grain yield/ha were obtained from fertilizing Gemmiza 10 cultivar with 100 % of the recommended dose of nitrogen (214 kg N/ha) as mineral nitrogen fertilizer alone and foliar spraying with commercial foliar fertilizer Biohealth (Fig. 4-a in the first season) and (Fig. 4-b in the second season). The second best interaction treatment was fertilizing Gemmiza 10 cultivar with 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha) and foliar spraying with commercial foliar fertilizer Biohealth in both seasons.

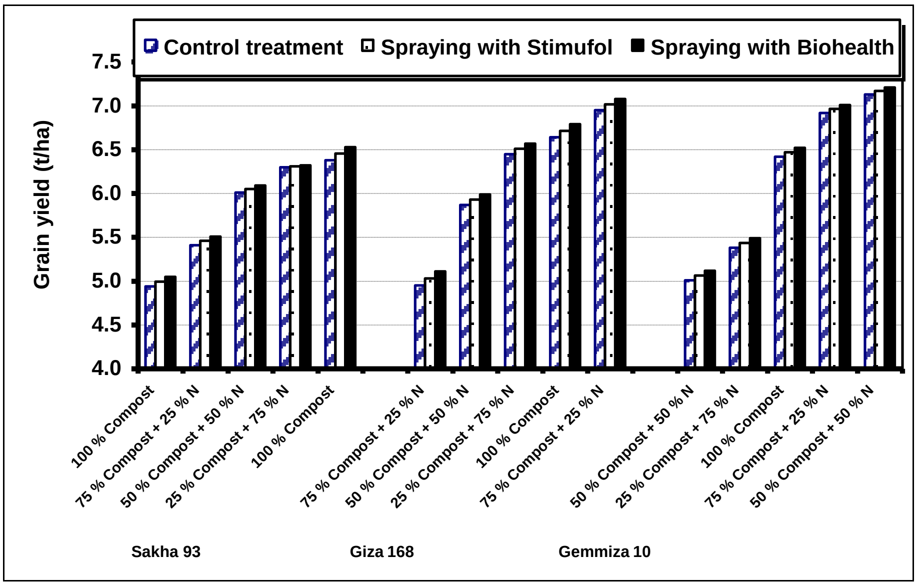

Fig. 4-a: Grain yield (t/ha) as affected by the interaction among compost and nitrogen combination treatments, foliar fertilization treatments and cultivars during 2013/2014 season.

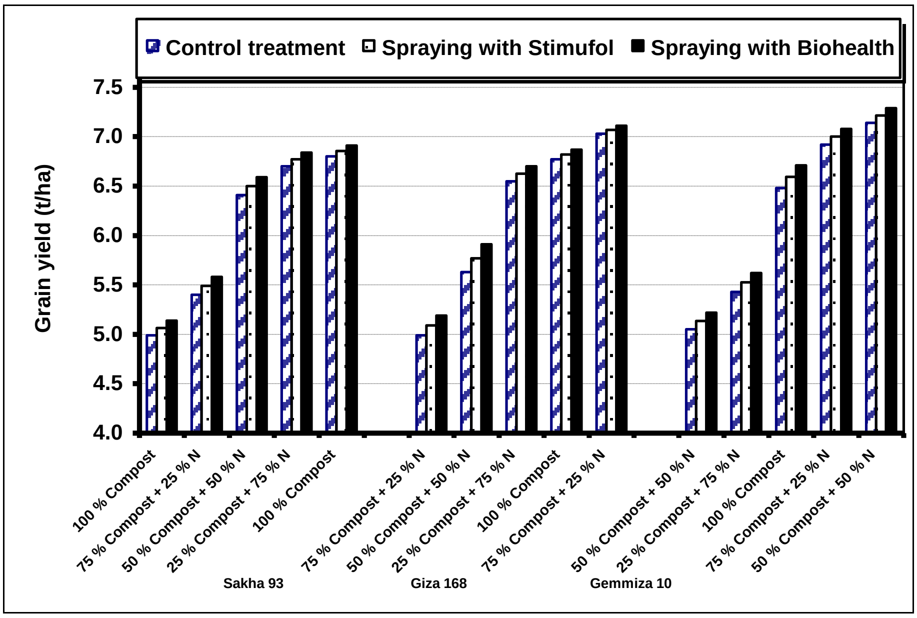

Fig. 4-b: Grain yield (t/ha) as affected by the interaction among compost and nitrogen combination treatments, foliar fertilization treatments and cultivars during 2014/2015 season.

CONCLUSION

From obtained results of this study, it could be recommended that fertilizing Gemmiza 10 cultivar with 25 % compost (53.5 kg N/ha) + 75 % mineral nitrogen (160.5 kg N/ha) and foliar spraying with commercial foliar fertilizer Biohealth to enhance wheat productivity and also to reduce sources of environmental pollution and maintain human health.

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إستجابة بعض أصناف القمح للتسميد العضوى والمعدنى والورقى

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2. قسم المحاصيل الحقلية- كلية الزراعة- جامعة تكريت - العراق.
3. قسم المحاصيل – كلية الزراعة – جامعة دمياط - مصر.

أجريت تجربتان حقليتان بمزرعة خاصة بمدينة المنصورة ، محافظة الدقهلية ، مصر، خلال موسمى 2014/2013 و 2015/2014 لتحسين إنتاجية وجودة حبوب بعض أصناف القمح من خلال التسميد العضوي والمعدني والورقى. أجريت التجارب في تصميم الشرائح المتعامدة المنشقة في ثلاث مكررات. تم تعيين الشرائح الرأسية لمعاملات التداخل بين السماد العضوي (الكمبوست) والسماد النيتروجينى المعدني. وخصصت الشرائح الأفقية لمعاملات التسميد الورقي بالأسمدة الورقية التجارية. في حين تم تخصيص القطع المنشقة لأصناف القمح وهى: سخا 93، جيزة 168 وجميزة 10).

أظهرت النتائج المتحصل عليها أن استخدام 100 % من السماد النيتروجينى المعدنى فقط (214 كجم نيتروجين/هكتار) أدى إلى زيادة معنوية في صفات النمو والمحصول ومكوناته وكذلك نسبة البروتين الخام في الحبوب مقارنة بغيره من معاملات التداخل بين السماد العضوي (الكمبوست) والسماد النيتروجينى المعدني في كلا الموسمين. ومع ذلك، جاء استخدام 25 % من سماد الكمبوست (53.5 كجم نيتروجين/هكتار) + 75٪ من السماد النيتروجينى المعدنى (160.5 كجم نيتروجين / هكتار) في المرتبة الثانية في كلا الموسمين.

أدى رش نباتات القمح بالسماد الورقى بيوهيلت والذى يعتبر من المنشطات الحيوية للحصول على أعلى القيم لصفات نمو القمح، والمحصول ومكوناته وأيضاً صفات جودة الحبوب ، يليها الرش الرش بالسماد الورقى ستيموفول والذى يحتوى على العناصر الغذائية الكبرى والصغرى في كلا الموسمين.

تفوق الصنف جميزة 10 على الأصناف الأخرى المدروسة (الجيزة 168 وسخا 93) حيث سجل أعلى القيم لمعظم الصفات تحت الدراسة في كلا الموسمين. أما الصنف جيزة 168 سجل أطول سنابل وأعلى نسبة للبروتين في الحبوب. في حين سجل الصنف سخا 93 أعلى القيم لصفة وزن 1000 حبة وفي نفس الوقت أدنى قيم للصفات المدروسة الأخرى في كلا الموسمين.

من النتائج المتحصل عليها في هذه الدراسة ، يمكن التوصية بتسميد القمح صنف جميزة 10 بـ2525 % من سماد الكمبوست (53.5 كجم نيتروجين/هكتار) + 75٪ من السماد النيتروجينى المعدنى (160.5 كجم نيتروجين/هكتار) والرش بالسماد الورقى بيوهيلت كمنشط حيوي لتحسين إنتاجية القمح وأيضا للحد من التلوث البيئي والحفاظ على صحة الإنسان.

Table 4: Number of grains/spike, grains weight/spike, 1000 – grain weight, grain and straw yields/ha and protein percentages in wheat grains as affected by compost and mineral nitrogen combination treatments and foliar fertilizers as well as their interactions of some wheat cultivars during 2013/2014 and 2014/2015 seasons.

Characters Seasons Treatments	Number of grains/spike		Grains weight/spike (g)		1000 – grain weight (g)		Grain yield (t/ha)		Straw yield (t/ha)		Protein (%)	
	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015
A- Compost and nitrogen combination treatments:												
100 % Compost	40.75	39.27	2.959	3.141	45.09	46.01	5.030	5.098	7.725	7.678	9.25	9.16
75 % Compost + 25 % N	47.02	44.93	2.966	3.142	47.73	48.14	5.605	5.594	8.185	8.156	10.02	10.05
50 % Compost + 50 % N	55.08	55.32	2.973	3.143	49.59	50.20	6.340	6.572	8.868	9.034	10.82	10.83
25 % Compost + 75 % N	57.97	58.10	2.978	3.148	50.42	50.67	6.672	6.862	9.234	9.211	11.08	11.19
100 % N	61.13	59.99	2.988	3.192	50.96	50.95	6.869	7.047	9.744	9.508	11.37	11.53
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.95	1.73	0.009	0.011	0.82	0.56	0.206	0.225	0.530	0.544	0.13	0.20
B- Foliar fertilization treatments:												
Control treatment	51.41	50.81	2.901	2.999	46.71	47.80	6.005	6.020	7.986	8.005	10.23	10.25
Spraying with Stimufol	52.61	51.25	2.971	3.199	49.52	49.24	6.138	6.293	8.985	8.921	10.59	10.56
Spraying with Biohealth	53.14	52.50	3.048	3.262	50.05	50.52	6.166	6.392	9.283	9.225	10.71	10.84
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.55	1.33	0.006	0.010	0.72	0.66	0.201	0.223	0.500	0.530	0.10	0.15
C- Cultivars:												
Sakha 93	51.51	50.75	2.955	3.149	49.41	49.80	5.855	6.133	8.525	8.556	10.22	10.33
Giza 168	51.91	50.85	2.978	3.151	47.89	48.28	6.219	6.280	8.835	8.711	10.70	10.68
Gemmiza 10	53.75	52.98	2.985	3.159	48.98	49.51	6.240	6.290	8.894	8.885	10.60	10.65
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.06	1.34	0.008	0.005	0.31	0.44	0.136	0.176	0.241	0.220	0.18	0.11
D- Interactions:												
A × B	*	*	NS	NS	*	*	*	*	*	*	NS	NS
A × C	*	*	*	*	*	*	*	*	*	*	*	*
B × C	NS	NS	*	*	*	*	*	*	*	*	*	*
A × B × C	NS	NS	NS	NS	*	*	*	*	NS	NS	NS	NS

Table 3: Number of days to heading, flag leaf area, plant height, number of spikes/m^2, spike length and number of spikelets/spike as affected by compost and mineral nitrogen combination treatments and foliar fertilizers as well as their interactions of some wheat cultivars during 2013/2014 and 2014/2015 seasons.

Characters Seasons Treatments	Number of days to heading		Flag leaf area (cm^2)		Plant height (cm)		Number of spikes/m^2		Spike length (cm)		Number of spikelets/spike	
	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015	2013/ 2014	2014/ 2015
A- Compost and nitrogen combination treatments:												
100 % Compost	88.1	87.7	29.99	25.29	88.2	77.9	212.6	216.0	9.13	9.28	13.58	13.01
75 % Compost + 25 % N	89.9	89.9	37.09	32.75	95.9	86.1	228.8	236.1	9.88	10.12	16.69	16.01
50 % Compost + 50 % N	92.6	93.6	43.10	42.82	96.8	96.7	264.7	261.9	10.95	11.23	19.80	19.85
25 % Compost + 75 % N	94.5	94.6	43.90	44.10	100.3	100.5	280.9	280.1	11.70	12.09	21.63	21.12
100 % N	95.3	95.3	44.75	45.18	103.9	104.0	291.4	291.3	12.33	12.57	22.47	21.90
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.8	0.8	1.79	1.30	3.9	3.6	4.1	4.6	0.26	0.20	1.29	0.99
B- Foliar fertilization treatments:												
Control treatment	88.2	87.5	37.45	35.02	93.8	89.0	250.1	248.6	10.57	10.83	18.00	17.20
Spraying with Stimufol	92.7	91.2	40.42	38.08	98.1	94.1	256.4	260.3	10.85	11.03	19.12	18.89
Spraying with Biohealth	95.4	94.8	41.45	41.00	99.0	96.0	260.4	262.4	10.99	11.32	19.38	19.05
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.7	0.6	1.52	1.25	2.9	2.6	3.8	3.6	0.21	0.17	1.09	0.91
C- Cultivars:												
Sakha 93	91.9	91.9	38.53	37.74	88.6	89.2	252.0	251.6	10.37	10.82	18.18	17.45
Giza 168	92.0	92.4	40.02	37.97	97.2	93.1	257.3	258.3	11.37	11.51	18.71	18.55

Gemmiza 10	92.3	92.5	40.75	38.38	105.3	96.8	257.7	261.4	10.67	10.85	19.61	19.15
F. test	NS	NS	*	NS	*	*	*	*	*	*	*	*
LSD at 5 %	-	-	1.98	-	4.9	3.9	3.0	3.1	0.14	0.11	0.92	0.77
D- Interactions:												
A × B	*	*	*	*	*	*	*	*	*	*	NS	NS
A × C	NS	NS	*	*	*	*	NS	NS	NS	NS	NS	NS
B × C	NS	NS	*	*	NS	NS	*	*	*	*	*	*
A × B × C	NS	NS	NS	NS	NS	NS	*	*	NS	NS	*	*