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EFFECT OF MINERAL AND ORGANIC FERTILIZERS ON YIELD AND TECHNOLOGICAL TRAITS OF SOME BREAD WHEAT VARIETIES

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ABSTRACT: ***Two field experiments were carried out at the Experimental Farm, faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt during 2015/2016 and 2016/2017 seasons to investigate the effect of various combinations of mineral and organic fertilization systems (mineral nitrogen, organic nitrogen, phosphate ore and potassium ore) beside without fertilization treatment on yield and its components and technological traits of some bread wheat varieties (Gemmeiza 11, Gemmeiza 12, Misr 1, Giza 171 and Sids 13). The results obtained could be summarized as follows:***

Fertilization with any mineral and/or organic fertilizers caused increases in most yield and technological characters studied herein. Application of 50% mineral N + 50% organic N/fed was superior to the other fertilization systems in yield and its components (number of spikes/ m^2, number of grains/spike, grain yield /fed and straw and biological yields/fed) and technological properties (protein, crude fiber, wet gluten and dry gluten percentages) followed by 100% mineral N/fed compared to other fertilization systems especially unfertilized plants which recorded the lowest values. However, the highest values of 1000-grain weight, spike weight and carbohydrates and ash percentages were recorded by application of 50% organic N + phosphate ore + potassium ore/fed.

Data indicated that Giza 171 and Gemmeiza 11 varieties surpassed the other varieties in yield and its components (number of spikes/ m^2, number of grains/spike, 1000-grain weight, spike weight, grain yield/fed and straw and biological yields/fed) and technological properties (protein, wet gluten and dry gluten percentages) in favor of Giza 171 variety in most economic characters. However, the highest values of carbohydrates and ash percentages were obtained by Gemmeiza 12 and Sids 13, respectively. On the other hand, Misr 1 variety was the inferior variety in most characters studied.

The interactions between fertilization systems and wheat varieties were found to be significant for most characters studied. It could be concluded that Giza 171 variety fertilized with 50% mineral N + 50% organic N/fed being the most effective combined treatment for maximizing most effective characters in yield and grain quality, where recorded the highest values of grain yield (3.869 and 3.906 ton /fed in the first and second seasons, respectively) under the environmental conditions of Menoufia governorate.

Key words: ***Egyptian bread wheat, Varieties, Fertilization, Yield and Grain quality.***

INTRODUCTION

Wheat is the most important cereal crop cultivated in the world and considered as a human stable food for urban and rural societies as well as source of straw for animal feeding (Ibrahim *et al*., 2011). Grains are important sources of proteins, dietary fibers, phytochemicals, vitamins and minerals. Grains contains about 10-15 % protein and concentrated sources of starch (Salleh, 2015). Egypt is suffering

from insufficient local production of wheat. Local production of wheat flour varied annually and covers about only 40-55% of consumer requirements. In 2017/18 season, the cultivated area of wheat roughly equaled 3.15 million fed which produced in same marketing year about 8.1 million tons. Wheat imports were equaled about 11.7 million tons annually according to Global Agricultural Information Network (GAIN report 2017).

The wheat new varieties have a good yield potentiality but still yield per fed is much less to face the food security threat. Wheat grain yield per unit area involves the number of spikes, number of grains per spike and single grain weight. Grain yield is significantly affect by genetical and environmental factors. Nutrients availability affects plant growth and cause changes in yield and its components (Noureldin *et al*., 2013 and El-Seidy *et al.,* 2017). Consequently, improving yield and quality of wheat varieties requires deciding fertilizers requirement.

Fertilization with major nutrients cause increases in leaf area, chlorophyll content and dry matter production during vegetative growth period and contributed greatly in raising grain and straw yields (Al Mamun *et al*., 2012 and Daur 2013). Intensifying cultivation led to use of large amounts of chemical fertilizers, which have become too expensive and cause ecosystem's pollution. Recently, organic manures has received a serious attention to avoid the dangerous of environmental pollution. Organic fertilization sustain soil fertility through affecting physical, chemical and biological properties of soil. Using a mixture of organic and mineral fertilizers improved soil structure and water related characteristics *via* increasing total porosity, water holding capacity, available moisture, nutrients content and water use efficiency (Shaaban, 2006). Phosphate and potassium ores are agro and industrial natural products. Phosphate ore exist in Egypt in three main provinces (Western desert, Nile valley and Red sea). Upgrading of phosphate ore reduces the phosphatic fertilizers quantity used for the same P_2O_5 units, consequently reduces costs for transportation and fertilizer and/or phosphoric acid production (Abouzeid, 2007 and Kandil *et al*., 2017). Potassium ore (commonly called potash ore) is mined from underground deposits in many parts of the world. It contains iron that imparts a red tint to the final fertilizer that contains K_2O about 10.10%.

The objective of this recent study is to determine the differences in yield and technological characters of new bread wheat varieties, i.e. Giza 171, Sids 13, Gemmeiza 12 and Misr 1 in comparison with Gemmeiza 11 cultivated under various fertilization systems at Menoufia governorate.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm, Faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt to study the effect of mineral and organic fertilization systems on yield and technological properties of some bread wheat (*Triticum aestivum* L.) varieties during 2015/2016 and 2016/2017 seasons. Each experiment included 35 treatments, which were the combination of seven fertilization systems and five wheat varieties. The tested experimental treatments are as follow:

A- Mineral and organic fertilization systems:

1- without fertilization “control”
2- 100% mineral N/fed “ 75 kg N”
3- 100% organic N/fed “ 6 ton compost”
4- 50% mineral N + 50% organic N/fed “37.5 kg N + 3 ton compost”
5- 50% organic N + 100% phosphate ore /fed “3 ton compost + 74 kg

phosphate ore"

6- 50% organic N + 100% potassium ore /fed "3 ton compost + 238 kg potassium ore"

7- 50% organic N + 100% phosphate ore + 100% potassium ore /fed "3 ton compost + 74 kg phosphate ore + 238 kg potassium ore"

B- Varieties:

Five bread wheat varieties were evaluated namely, Gemmeiza 11, Gemmeiza 12, Misr 1, Giza 171 and Sids 13.

The recommended fertilizers rate (100%) for wheat growth under experiment conditions was 75 Kg N, 15.5 kg P_2O_5 and 24 K_2O/fed for nitrogenous, phosphatic and potash fertilizers, respectively. Nitrogen was added in the form of ammonium nitrate (33.5 % N). However, phosphorus and potassium were added in the form phosphate ore (21.0% P_2O_5) and potassium ore (10.10% K_2O), respectively. Mineral nitrogen fertilizer was divided into three doses; first dose (20%) applied before sowing, while remain amount (80%) was equally splitted and applied before the first and second irrigations. Organic fertilizers (compost) and nature ores (phosphate ore and potassium ore) were applied as one dose and thoroughly incorporated in the soil before sowing. Compost was obtained from the Egyptian Company for Solid Waste Recycling at El-Obour city, Cairo, Egypt. Phosphate and potassium ores were obtained from Al Ahram Mining Company at Al Maadi, Cairo, Egypt. The properties of tested compost and ore are presented in Table (1).

Table 1. Properties of compost and ores fertilizers used in the investigation.

Compost		Phosphate ore		Potassium ore	
Bulk density (kg m^{-3})	650	P_2O_5 (%)	21.00	K_2O (%)	10.10
Moisture content (%)	28.0	SiO_2 (%)	11.69	SiO_2 (%)	68.9
Water holding compacting (%)	204	TiO_2 (%)	0.03	TiO_2 (%)	0.03
pH (1:10 suspension)	7.12	AL_2O_3 (%)	0.65	AL_2O_3 (%)	16.24
EC (1:10 suspension)	1.51	FeO_3 (%)	1.35	FeO_3 (%)	0.36
Organic matter (%)	27.6	MnO (%)	0.08	MnO (%)	0.02
Total N (%)	1.25	MgO (%)	0.61	MgO (%)	0.05
Total P (%)	0.60	CaO (%)	48.34	CaO (%)	0.47
Total K (%)	0.85	Na_2O (%)	0.65	Na_2O (%)	3.13
C / N ratio	16:1	SO_3 (%)	1.98	L.O.I* (%)	0.70
Available N (mg kg^{-1})	686	L.O.I* (%)	13.62		
Available P (mg kg^{-1})	201				
Available K (mg kg^{-1})	302				
Extractable (Fe) (mg kg^{-1})	583				
Extractable (Mn) (mg kg^{-1})	101				
Extractable (Zn) (mg kg^{-1})	57				
Extractable (Cu) (mg kg^{-1})	92				
Total bacteria (Log No. cfu/ml)	7.13				

Total actinobacteria (Log No. cfu/ml)	5.87				
Total fungi (Log No. cfu/ml)	4.66				

* L.O.I: Loss on ignition

The treatments were arranged in a split plot design with three replications, where the fertilization systems were randomly distributed in the main plots, while wheat varieties were occupied in the sub plots. The tested varieties grains were obtained annually from Wheat Research Department, Field Crops Research Institute, ARC, Giza, Egypt.

Experimental site description

Before sowing, experimental soil samples were randomly collected from the top soil (0-30 cm) for estimating some mechanical and chemical properties of soil according to Jackson (1973) and Page *et al*. (1982). The data of soil analysis are presented in Table (2).

Crop management practices

Each sub plot area was 10.5 m^2 (3.5 m long and 3 m width) consisted of 20 rows with distance 15 cm between rows. Sowing was done by hand drilled using a rate of 400 grains/m^2 on 10th and 8th November in the first and second seasons, respectively. Other cultural practices were performed as recommended for the district.

Measurements

A- Yield and its components:

At maturity stage, yield and its components, i.e. number of spikes/ m^2, number of grains/spike, 1000-grain weight (g.), spike weight (g.), grain yield/fed (ton), straw yield/fed (ton), biological yield/fed (ton) and harvest index (%). Ten guarded spikes were taken from each experimental plot to estimate spikes characters. However, grain, straw and biological yields of the central m^2 in each plot were estimated and converted to ton/fed.

B- Technological properties:

After harvest, grain samples of first and second seasons were mixed (as an average of the two seasons) to estimate the technological properties. Grains were manually cleaned, tempered to reach 14% moisture content, then milled using Quadrumat Junior flour mill (Model MLV-202, Switzerland). The chemical composition, i.e. moisture, protein, fat, ash and crude fiber percentages were determined in whole meal of grains according to A.O.A.C. (2005). Carbohydrates were calculated by difference method. Wet and dry gluten of wheat flour dough were determined according to the method of A.A.C.C. (2000).

Statistical analysis

All data were analyzed using analysis of variance according to the methods described by Snedecor and Cochran (1980). The statistical analysis was done using CoStat package program, version 6.3 (Cohort software, USA). The differences among the means of different treatments were tested using Least Significant Differences (LSD) at probability 5%.

Table 2. Physical and chemical properties of the experimental soil.

Properties	Texture class	pH	E.C. ds/m	O.M. %	nutrients (ppm)					
					N	P	K	Fe	Zn	Mn

2015/16	Clay loam	7.51	0.59	1.73	29.5	9.28	316.2	3.26	0.90	2.16
2016/17	Clay loam	7.43	0.58	1.76	30.3	9.11	320.7	3.02	0.92	2.09

RESULTS AND DISCUSSION

A- Yield and its components

A-I. Effect of fertilization systems

Data presented in Table (3) shows that number of spikes/ m^2 was significantly increased by application of all fertilization systems compared to unfertilized plants. The highest increase was obtained by application of 50% mineral N + 50% organic N/fed, 100% mineral N/fed and 50% organic N + phosphate ore + potassium ore/fed without significant differences among them in both seasons more than plants which did not receive any fertilization in both seasons. The positive effect of such fertilizers (N, P and K) on spikes number might be attributed to their roles in increasing the amount of metabolites synthesized, which promoted the numbers of tillers. Similar trend were obtained by Attia and Abd El Salam (2016) and Al-Amin *et al*. (2017).

Significant differences in number of grains/spike were recorded among the tested fertilization systems in the two seasons as shown in Table (3). The highest significant numbers were recorded from plants fertilized with 50% mineral N + 50% organic N/fed followed by 100% mineral N/fed with significant between them in both seasons. However, the lowest grain numbers were obtained when plants did not receive any fertilizers. The positive effects of mineral and organic fertilizers on number of grains /spike were previously reported by Mandic *et al*. (2015), Adnan *et al*. (2016) and Attia and Abd El Salam (2016).

Application of all organic and mineral fertilizers either separately or mixed tended to significantly increase 1000-grain weight and spike weight as compared with unfertilized plants in both seasons. The heaviest 1000- grain weight and spike yield were recorded by 50% organic N + phosphate ore + potassium ore/fed and 50% mineral N + 50% organic N/fed in both seasons. However, the unfertilized plants with any organic and mineral fertilizers produced the lightest grain weight and spike yield in the two seasons. In this context, Mengel and Kirkby (2001) stated that translocation of photoassimilate from the vegetative tissues to grains was much affected by plant nutrition status, which leads to promote cells division and buildup of storage capacity. The increments in 1000-grain weight and spike weight by application of different fertilizers were previously reported by Khaled (2007), Noureldin *et al*. (2013) and Mandic *et al*. (2015).

Grain yield/fed was significantly and positively responded to application of all fertilization systems compared to unfertilized plants (Table 3). It is worthy to mention that the application of 50% mineral N + 50% organic N/fed followed by 100% mineral N/fed caused greater increases in seed yield /fed amounted to 31.34 and 27.71% more than unfertilized plants, respectively as an average of the two seasons. However, 50% organic N + phosphate ore + potassium ore/fed and 100% organic N/fed treatments ranked as a second in this respect. Therefore, a sustainable use of these organic and nature resources is of prime importance. The increases in grain yield/fed resulting from application of the tested fertilization systems may be consequent to increases in number of spikes/ m^2 and spike yield.

Table 3. Effect of fertilization systems on yield and its components during 2015/2016 and 2016/2017 seasons.

Fertilization systems	Number of spikes/ m^2	Number of grains/ spike	1000-grain weight (g.)	Spike weight (g.)	Grain yield (ton/fed)	Straw yield (ton/fed)	Biological yield (ton/fed)	Harvest index (%)
2015/2016 season								
Without fertilization (control)	350.73	51.33	45.73	2.54	2.422	3.187	5.609	43.18
100% Mineral N/fed	409.87	56.41	47.83	2.75	3.148	3.857	7.005	44.94
100% Organic N/fed	396.93	54.27	47.18	2.63	2.925	3.989	6.914	42.31
50% Mineral N + 50% organic N/fed	417.60	58.66	47.96	2.76	3.243	4.010	7.253	44.71
50% Organic N + phosphate ore/fed	375.33	54.83	47.04	2.70	2.809	3.865	6.674	42.09
50% Organic N + potassium ore/fed	381.22	54.59	47.68	2.66	2.983	3.883	6.866	43.45
50% Organic N + phosphate ore + potassium ore/fed	403.87	55.41	48.06	2.80	3.087	4.088	7.175	43.02
LSD 0.05	20.45	2.12	0.36	0.07	0.121	0.095	0.219	0.44
2016/2017 season								
Without fertilization (control)	364.53	53.35	44.90	2.57	2.738	3.209	5.947	46.04
100% Mineral N/fed	423.73	59.05	46.83	2.78	3.442	3.951	7.393	46.56
100% Organic N/fed	390.20	56.88	46.00	2.72	3.323	3.865	7.188	46.23
50% Mineral N + 50% organic N/fed	434.13	60.83	47.05	2.80	3.534	4.068	7.602	46.49
50% Organic N + phosphate ore/fed	399.53	57.49	46.27	2.72	3.208	3.854	7.062	45.43
50% Organic N + potassium ore/fed	388.27	58.64	46.49	2.75	3.244	3.819	7.063	45.93
50% Organic N + phosphate ore + potassium ore/fed	415.20	58.83	47.67	2.84	3.308	4.222	7.530	43.93
LSD 0.05	22.67	1.71	0.76	0.08	0.151	0.203	0.166	0.30

may be attributed to the reduction in leaching losses and enhancement nutrients uptake and biological activity (Agamy *et al*., 2012). In this respect, other researchers found that grain yield of wheat was increased by application of 50% chemical fertilizer + 50% poultry manure (Al-Amin *et al*., 2017), 80 kg organic N + 40 kg mineral N/fed (Shaaban, 2006) and 75 kg mineral nitrogen (Noureldin *et al*., 2013 and El-Seidy *et al.,* 2017).

With regard to straw and biological yields/fed, data in Table (3) showed that the both traits were significantly affected by all fertilization systems in comparison with unfertilized plants. The plants which received 50% mineral N + 50% organic N/fed and 50% organic N + phosphate ore + potassium ore/fed recorded increases in straw yield amounted to 26.30 and 29.92% and in biological yield amounted to 28.55 and 27.25%, more than those of unfertilized plants, respectively. This increase in biological yield might be ascribe to the increase in grain yield as well as number of tillers and plant height. These results are in agreement with those obtained by EL-Guibali (2016).

With respect to the variation in harvest index gained from application of fertilization systems, the data in Table (3) indicate that adding 100% mineral N/fed and 50% mineral N + 50% organic N/fed resulted significant means higher than those obtained from other fertilization systems. On the other hand, the lowest mean values were produced by adding 50% organic N + phosphate ore/fed and 100% organic N/fed in first season and by adding 50% organic N + phosphate ore + potassium ore/fed in the second season. These results are in harmony with those obtained by Al-Amin *et al*. (2017) who mentioned that integrated organic manure (50%) with chemical fertilizers (50%) was effective treatment for produced the highest harvest index.

A-II. Effect of varietal differences

Number of spikes/m^2 showed positive response to varietal differences in both seasons as shown in Table (4). Giza 171 followed by Gemmeiza 11 surpassed the other varieties in number of spikes/ m^2, while Misr 1 variety gave the lowest number. As an average of the two seasons, Giza 171 and Gemmeiza 11 varieties produced spikes number amounted to 18.26 and 15.42% more than Misr 1, respectively. Similar results were obtained by Noureldin *et al.* (2013), Dawood *et al.* (2014) and El-Seidy *et al.* (2017).

The results in same table clear that Gemmeiza 11 and Giza 171 varieties having higher number of grains/spike and heavier 1000- grain weight, consequently they were significantly having heavier spike weight. However, Misr 1 variety recorded the last rank. The superiority of such varieties might be attribute to their greater amount of assimilates, which contributed to dry matter accumulation and in turn increase the number of grains /spike and grain weight. In this respect, Abd El-Kreem and Ahmed (2013) and Osman and Nor Eldein (2017) found widely differences among wheat varieties in number of grains/spike, 1000-grain weight and/or spike weight.

Grain yield/fed was remarkably influenced by varieties variation in both seasons. Grain yield /fed ranged between 2.620 to 3.231 ton in the first season and from 2.958 to 3.516 ton in the second season. It is worth noting that Giza 171 variety significantly surpassed other varieties in grain yield/fed followed by Gemmeiza 11 without significant between them in the second season. However, Misr 1 produced the lowest grain yield/fed. It can be notice that Giza 171, Gemmeiza 11, Gemmeiza 12 and Sids 13 varieties excelled Misr 1 variety in grain

Table 4. Yield and its components of some wheat varieties during 2015/2016 and 2016/2017 seasons.

Varieties	Number of spikes/ m^2	Number of grains/spike	1000-grain weight (g.)	Spike weight (g.)	Grain yield (ton/fed)	Straw yield (ton/fed)	Biological yield (ton/fed)	Harvest index (%)
2015/2016 season								
Gemmeiza 11	413.48	56.57	48.89	2.85	3.087	3.857	6.944	44.46
Gemmeiza 12	404.62	53.79	48.63	2.65	2.901	3.796	6.697	43.32
Misr 1	346.24	53.46	44.33	2.56	2.620	3.856	6.476	40.45
Giza 171	423.30	56.17	48.96	2.80	3.231	3.976	7.207	44.83
Sids 13	366.33	55.37	45.95	2.60	2.888	3.713	6.601	43.75
LSD 0.05	16.13	1.49	0.30	0.13	0.110	0.085	0.137	0.31
2016/2017 season								
Gemmeiza 11	420.14	60.04	47.72	2.90	3.449	3.998	7.447	46.31
Gemmeiza 12	399.43	56.23	46.86	2.79	3.198	3.886	7.084	45.14
Misr 1	376.00	55.31	44.37	2.54	2.958	3.722	6.680	44.28
Giza 171	430.81	59.45	47.69	2.87	3.516	4.036	7.552	46.56
Sids 13	384.76	58.30	45.66	2.59	3.147	3.635	6.782	46.30
LSD 0.05	21.67	1.58	0.78	0.09	0.124	0.134	0.151	0.22

respectively as an average of the two seasons. The superiority of Giza 171 variety might be attributed to its superiority in yield components, i.e. number of spikes/m^2, number of grains/spike and 1000-grain weight. In this respect, other researchers found significant variation among wheat varieties in grain yield in favor of Gemmeiza 10 (Noureldin *et al.,* 2013), Sids 12 (Dawood *et al.,* 2014) and Gemmeiza 11 (Khaled and Hammad, 2014 and El-Seidy *et al.,* 2017).

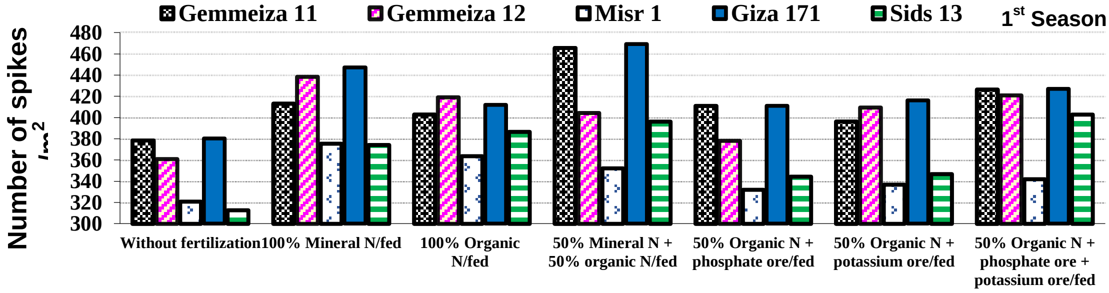
Significant differences could be detected among the tested varieties with regard to straw and biological yields /fed in both seasons. It is obvious that Giza 171 gave the highest values followed by Gemmeiza 11 in both seasons without significant between them in the second season. Sids 13 produced the lowest straw yield/fed, while Misr 1 variety recorded the lowest biological yield in both seasons. The variation in straw yield might be attributed mainly to the increases in number of tillers and plant height. Varietal differences in straw and biological yields were previously reported by Abdelkhalek *et al.* (2015) and Osman and Nor Eldein (2017).

Results in Table (4) indicate that Giza 171 variety had significantly higher value of harvest index than the other varieties. Meanwhile, Gemmeiza 11, Sids 13 and Gemmeiza 12 varieties ranked the second in a descending order. On the other hand, Misr 1 variety recorded the lowest mean value in both seasons. This was true in both seasons. It means that Giza 171 has a higher ability of photoassimilate transport to sinks (grains) than the other tested varieties. These results are in harmony with those obtained by El-Seidy *et al.* (2017).

A-III. Effect of the interaction

Number of spikes/ m^2, number of grains / spike, 1000-grain weight, spike yield, grain yield /fed and straw and biological yields/fed as affected by the significant interaction between fertilization systems and varieties are shown in Figures (1-7). However, harvest index showed insignificant response to this interaction during both seasons, therefore the data were excluded.

It is clear from Figure (1) that Giza 171 variety followed by Gemmeiza 11 had the highest number of spikes/m^2 (469.33 and 465.67) in the first season and (466.67 and 456.00) in second season, respectively when the plants were fertilized with the mixture of mineral and organic fertilizers (50% mineral N + 50% organic N/fed). Moreover, it is obvious that Sids 13 and Misr 1 varieties exhibited the lowest values (312.67 and 321.00) in the first season and (348.00 and 341.33) in second season, respectively when their plants were unfertilized with any mineral and /or organic fertilizers.



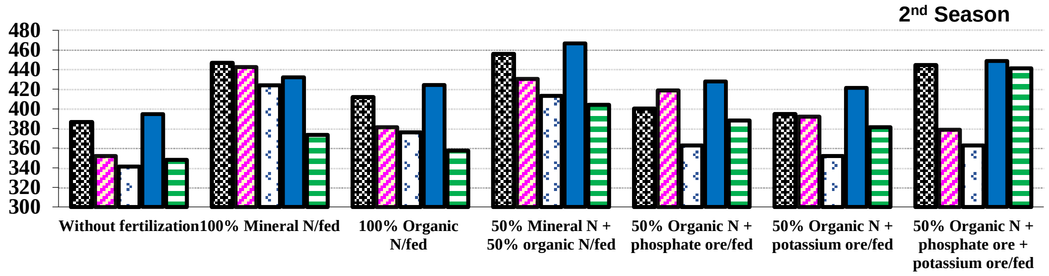
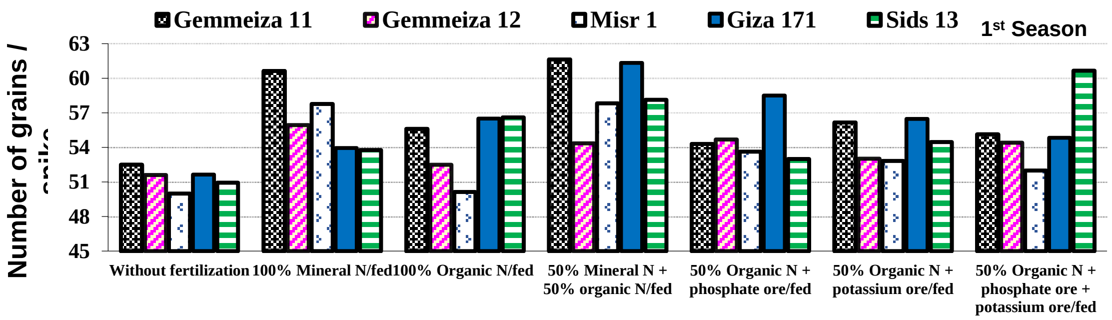


Fig. 1. Effect of interaction between fertilization and varieties on number of spikes /m^2.

With regard to number of grains/spike, significant differences were recorded among the tested fertilization systems and wheat varieties in both seasons (Figure 2). Gemmeiza 11 and Giza 171 varieties were the most superior ones, where recorded the values of 61.63 and 61.33 in the first season and 63.80 and 62.87 in the second season, respectively when fertilized with 50% mineral N + 50% organic N/fed. However, Misr 1 and Gemmeiza 12 varieties were the inferior ones when their plants unfertilized in both seasons. The superiority of Gemmeiza 11 or Giza 171 grown under 50% mineral N + 50% organic N/fed in number of grains /spike could be attributed to a greater amount of assimilates which contributed to dry matter accumulation during vegetative period and this in turn increase the number of grains /spike.

It is evident from data illustrated in Figure (3) that there was a considerable amount of variation among the combination treatments in both seasons for 1000-grain weight. Gemmeiza 11 variety had the heaviest grain especially when plants fertilized with 50% organic N + phosphate ore + potassium ore/fed and 50% mineral N + 50% organic N/fed in both seasons, while Giza 171 exposed its heaviest grain when fertilized with 50% mineral N + 50% organic N/fed in both seasons without significant among them. On the other hand, unfertilized plants of Misr 1 was the lighter one in both seasons.

Data in Figure (4) indicated that Gemmeiza 11 variety had the heaviest spike weight when fertilized with 50% organic N + phosphate ore + potassium ore/fed and 50% mineral N + 50% organic N/fed in both seasons, while Giza 171 exposed its heaviest spike weight when fertilized with 50% mineral N + 50% organic N/fed in both seasons without significant among them. On the other hand, unfertilized plants of Misr 1 variety recorded the lowest values (2.39 and 2.27 g.) in first and second seasons, respectively.



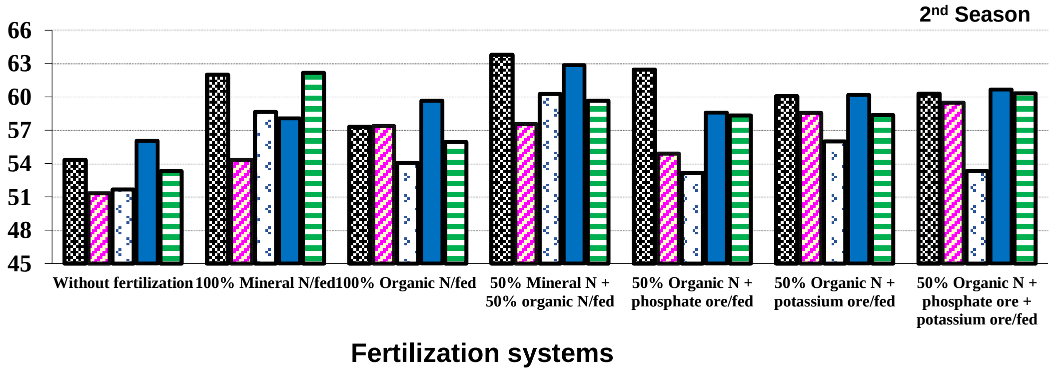


Fig. 2. Effect of interaction between fertilization and varieties on number of grains /spike.

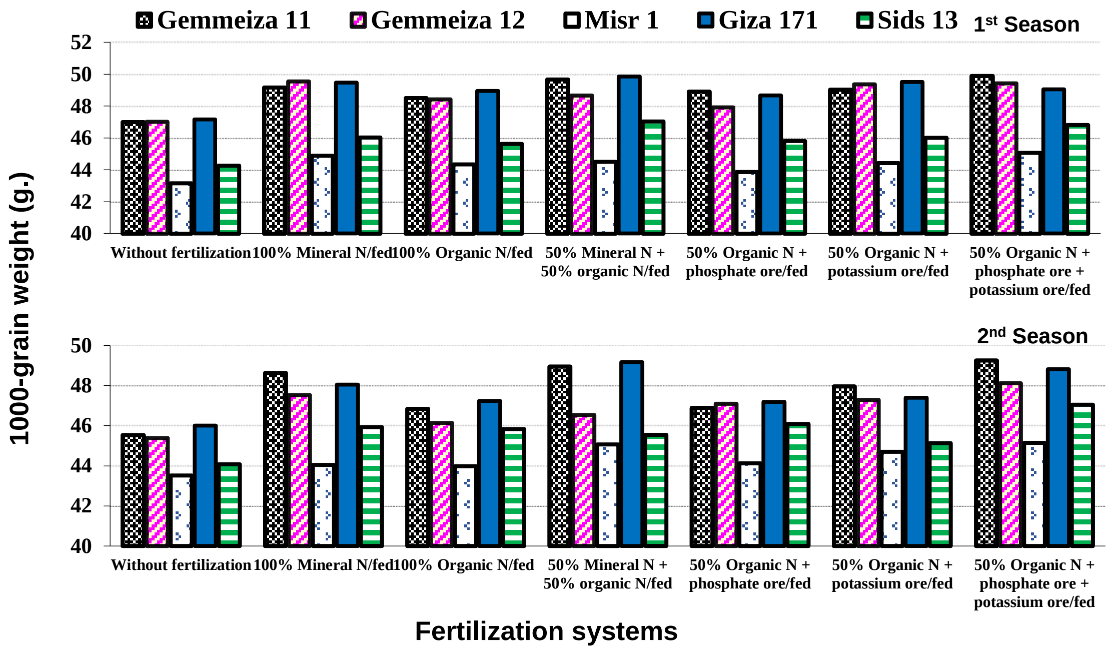
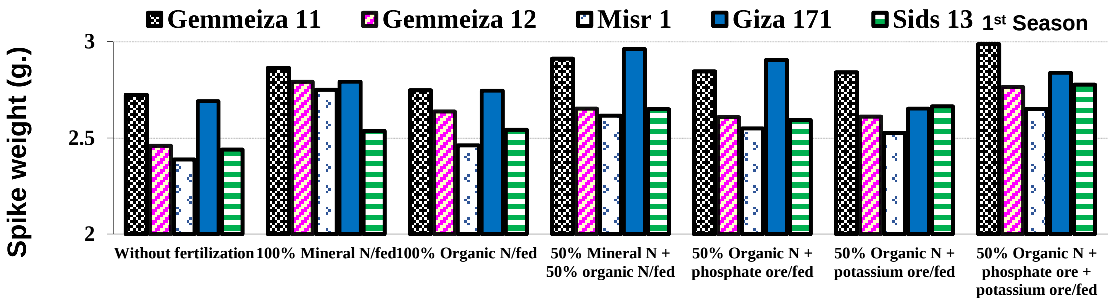


Fig. 3. Effect of interaction between fertilization and varieties on 1000-grain weight.



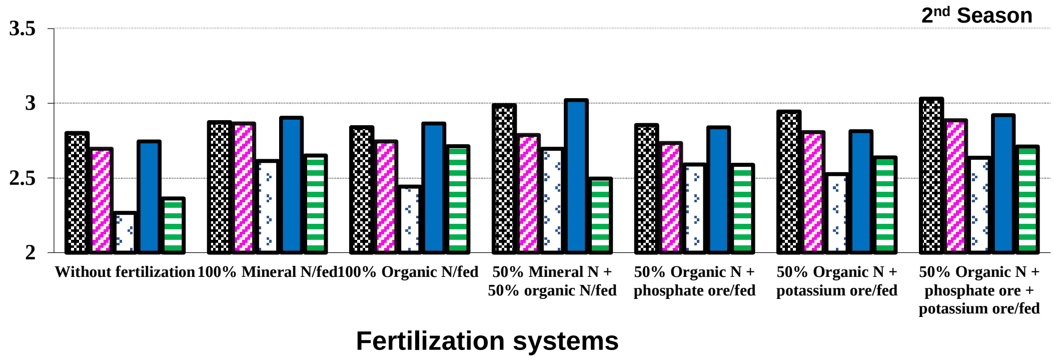


Fig. 4. Effect of interaction between fertilization and varieties on spike weight.

It can be noticed from data illustrated in Figure (5) that the tested varieties showed different responses to various fertilization systems from variety to another for grain yield/fed. It is interesting to note that the most pronounced interaction for increasing grain yield /fed was happened when the plants of Giza 171 were fertilized with 50% mineral N + 50% organic N/fed where recorded the highest values (3.869 and 3.906 ton) in the first and second seasons, respectively. Moreover, Gemmeiza 11 variety took the second rank when its plants received the same mixture of mineral and organic fertilizers. It can be noticed that fertilized Giza 171 with 50% mineral N + 50% organic N/fed caused increases in grain yield/fed which amounted to 36.94, 54.91, 59.91 and 66.06 % more than the unfertilized Gemmeiza 11, Gemmeiza 12, Sids 13 and Misr 1, respectively as an average of both seasons. However, unfertilized plants had the lowest values in the five tested varieties. These results are in harmony with those obtained by Abdelkhalek *et al.* (2015), Mandic *et al.* (2015) and El-Seidy *et al.* (2017).

It is clear from the data illustrated in Figure (6) that fertilized Gemmeiza 11 plants with 50% organic N + phosphate ore + potassium ore/fed and Giza 171 with 50% mineral N + 50% organic N/fed were the more effective treatments in increasing straw yield/fed in the two seasons, where such treatments produced the highest values (4.447 and 4.372 ton/fed, respectively) as an average of the two seasons than the other combination treatments. On the other hand, unfertilized plants had the lowest values in the five tested varieties. Similar results were obtained by Khaled and Hammad (2014).

It is evident from Figure (7) that Giza 171 variety was superior to the other varieties especially when its plants were fertilized with 50% mineral N + 50% organic N/fed where recorded the highest values of biological yield /fed (8.157 and 8.362 ton) in the first and second seasons, respectively. Concerning the different responses of other varieties to various fertilization systems, we noticed that Gemmeiza 11 and Sids 13 exposed their highest biological yields (7.870 and 7.247 ton/fed, respectively as an average of the two seasons) when fertilized with 50% organic N + phosphate ore + potassium ore/fed, while Gemmeiza 12 and Misr 1 varieties produced their highest biological yields (7.416 and 7.243 ton/fed, respectively as an average of the two seasons) when fertilized with 100% mineral N/fed. These results are in harmony with those obtained by Abd El-Kreem and Ahmed (2013) and Mansour *et al.* (2016).

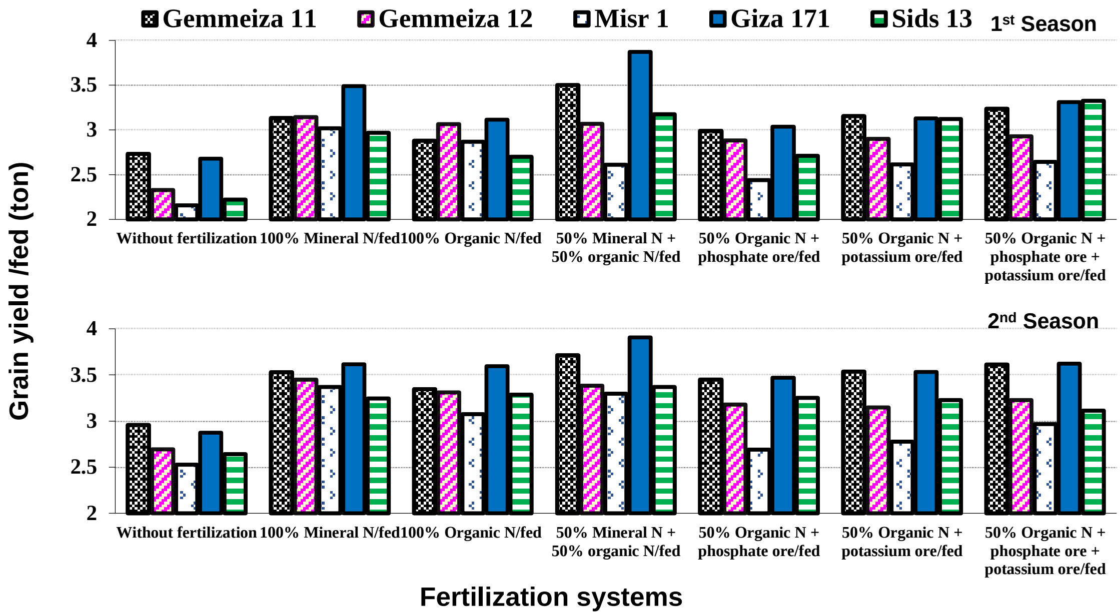


Fig. 5. Effect of interaction between fertilization and varieties on grain yield/fed (ton).

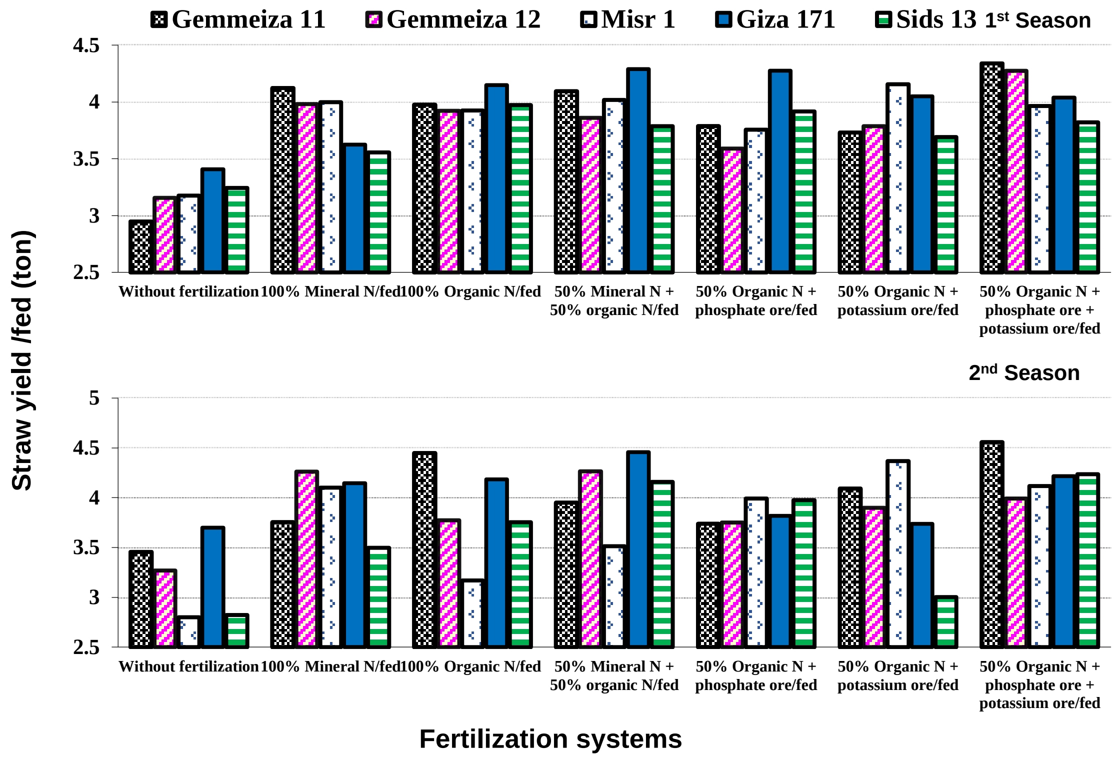


Fig. 6. Effect of interaction between fertilization and varieties on straw yield/fed (ton).

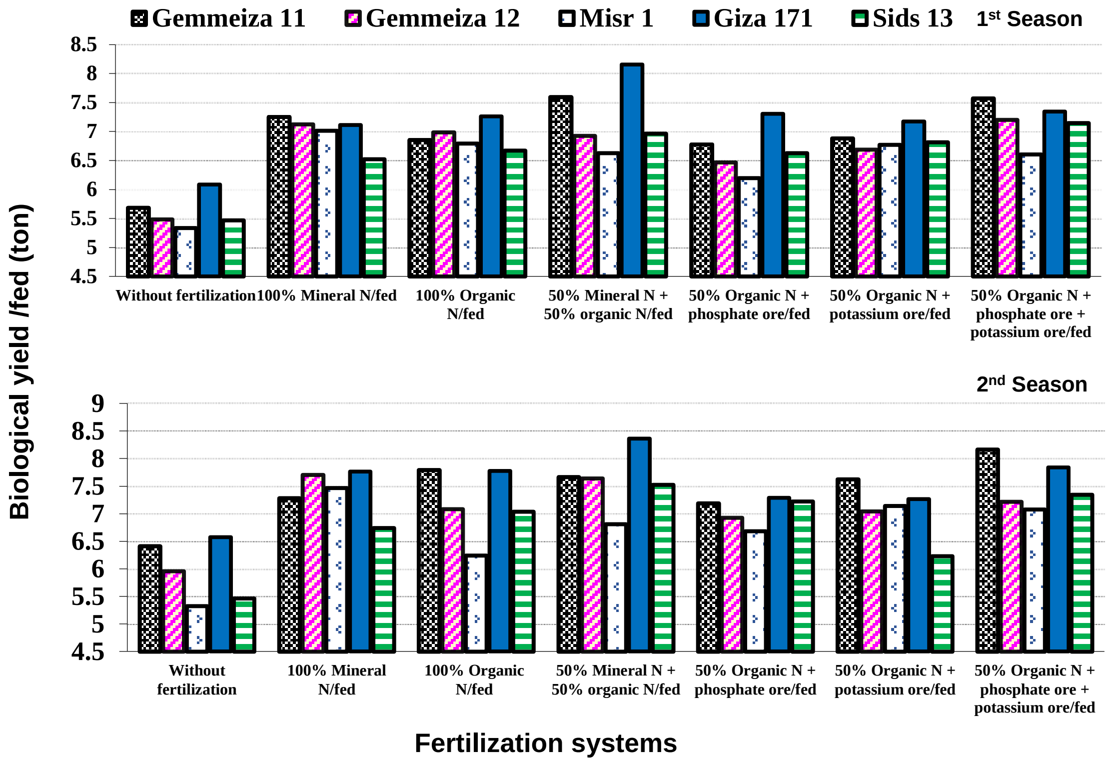


Fig. 7. Effect of interaction between fertilization and varieties on biological yield/fed (ton).

B- Technological properties

B.I. Effect of fertilization systems

Results in Table (5) showed that the effect of fertilization systems on chemical composition of whole meal, i.e. moisture content, protein, carbohydrates, ash, fats and crude fiber. Moisture content of wheat grains were not significantly affected by application of fertilization systems. With regard protein %, it can be noticed that application of 50% mineral N + 50% organic N/fed, 100% mineral N/fed and 100% organic N/fed seemed to be the most effective treatments for increasing protein percentage, while unfertilized plants took the last rank. Adequate amount of nitrogen in the rhizosphere encourages the absorption of nitrogen in the plant, and this might be a reason of the increase protein %. The simulative effect of nitrogen on protein percentage might be due its role as a constituent of all amino acids molecules and hence protein synthesis. Moreover, it can be noticed that application of 50% organic N + phosphate ore + potassium ore/fed and 50% organic N + potassium ore/fed produced the highest significant means of carbohydrates %, indicating the importance of K element on translocation of sugar and carbohydrates from leaves to the reproductive organs. These results are in accordance with those reported by Khaled (2007) and EL-Guibali (2016).

Fertilized plants with 50% organic N + phosphate ore + potassium ore/fed and 50% organic N + potassium ore/fed exhibited higher ash percentage compared to the other tested fertilizers. On the other hand, unfertilized plants recorded the lowest one. Mean values of fats were insignificantly affected by application of any tested fertilizers compared to unfertilized plants. However, fertilized plants with 50% mineral N + 50% organic N/fed and 100% organic

N/fed produced the highest crude fiber content than obtained from rest treatments.

With regard gluten, data in the same table shows that mean values of wet and dry gluten percentages were significantly influenced with application of fertilization systems. In similarity with protein %, application of 50% mineral N + 50% organic N/fed had significant increase in wet and dry gluten % followed by 100% mineral N/fed and 50% organic N + phosphate ore + potassium ore/fed. Meanwhile, unfertilized plants produced the lowest wet and dry gluten %. In this context, Duska *et al.* (2001) mentioned that flour quality was determined according to its protein and gluten content. Gluten is rich in gliadins and glutenins. It has been generally associated with total protein content (Ibrahim *et al*., 2011). Similar results were recorded by Gerba *et al*. (2013).

B-II. Effect of varietal differences

Data in Table (6) shows chemical composition of whole meal of wheat varieties. Differences among wheat varieties were not significant for mean values of moisture content. Moisture content of wheat varieties were ranged between 10.87 to 11.45%. Significant increase in protein % was detected among various varieties. Gemmeiza 11 and Giza 171 surpassed other varieties especially Gemmeiza 12 which ranked the last in this respect. Significant differences were recorded among the tested varieties in carbohydrates. Gemmeiza 12 variety was the superior one and Sids 13 variety was the inferior one. With regard ash percentage, it is obvious that Sids 13 gave the highest value followed by Gemmeiza 12 and Giza 171 varieties, while Gemmeiza 11 produced the lowest value of ash %. Concerning fats and crude fiber %, data showed that there are insignificant differences among varieties in both traits. Fats and fiber percentages of all tested wheat varieties were found quite close to each other. These findings are in harmony with those obtained by Hussein *et al.* (2010) and Dawood *et al.* (2014).

Table 5

Table 6. Chemical composition and gluten content of some wheat grain varieties.

Varieties	Moisture %	Protein %	Carbohydrates %	Ash %	Fats %	Fiber %	Wet gluten %	Dry gluten %
Gemmeiza 11	10.90	11.59	72.04	1.57	1.91	1.99	28.17	9.85
Gemmeiza 12	11.07	10.13	73.23	1.70	1.88	1.99	24.72	8.52
Misr 1	11.31	10.89	72.40	1.64	1.87	1.89	26.82	9.13
Giza 171	10.87	11.38	72.31	1.68	1.85	1.91	28.20	9.87
Sids 13	11.45	11.31	71.72	1.75	1.86	1.91	27.74	9.53
LSD 0.05	NS	0.24	0.38	0.09	NS	NS	0.36	0.28

Concerning gluten, data in the same table clear that Giza 171 and Gemmeiza 11 were characterized by their higher contents of wet and dry gluten, which reached 28.20 and 9.87% for Giza 171 and 28.17 and 9.85% for Gemmeiza 11, respectively. Both varieties were statistically equal in having a higher

gluten%. On the contrary, Gemmeiza 12 recorded the lowest content of wet and dry gluten (24.72 and 8.52%, respectively). In this concern, Salleh (2015) mentioned that wheat varieties quality depends on many traits, among which the most important include, e.g. protein content, composition of high-molecular glutenin subunits. Similar results were obtained by Ibrahim *et al.* (2011).

B-III. Effect of the interaction

The interactions between fertilization systems and wheat varieties were found to be significant, as an average of the both seasons, for protein, carbohydrates, wet gluten and dry gluten percentages (Figure 8). On the contrary, the interactions between the two factors were not significant for moisture content, ash, fats and fiber percentages.

It is evident from Figure (8) that protein % ranged from 9.68 to 12.23%. Fertilized Gemmeiza 11 or Giza 171 plants with 50% mineral N + 50% organic N/fed had the maximum values (12.23 and 12.15%, respectively) without significant between them. However, the lowest one (9.68%) was obtained especially when Misr 1 plants were unfertilized. Moreover, it can be observed that the increment percentage of protein caused by the best treatments amounted to 26.34 and 25.52%, respectively more than the lowest one.

The interaction effect on carbohydrates % illustrated in the same figure shows that the highest values were obtained by fertilized Gemmeiza 12 variety with 50% organic N + phosphate ore + potassium ore/fed (74.25%), 50% organic N + potassium ore/fed (74.00%) or 50% organic N + phosphate ore/fed (73.78%). However, the lowest values (71.01 and 71.25%) were obtained by Sids 13 when unfertilized and fertilized with 100% mineral N/fed, respectively.

Concerning data of wet and dry gluten (Figure 8) indicate that fertilized Giza 171 or Gemmeiza 11 plants with 50% mineral N + 50% organic N/fed had the maximum values (30.97 and 30.22%, respectively) for wet gluten and (11.02 and 10.75%, respectively) for dry gluten without significant between them for both traits. However, the lowest significant values were obtained especially when Gemmeiza 12 and Misr 1 plants were unfertilized with any mineral and/or organic fertilizers. These increases in wet

and dry gluten observed herein by such interaction treatments were logical resultant of the increases in protein percentage as previously reported.

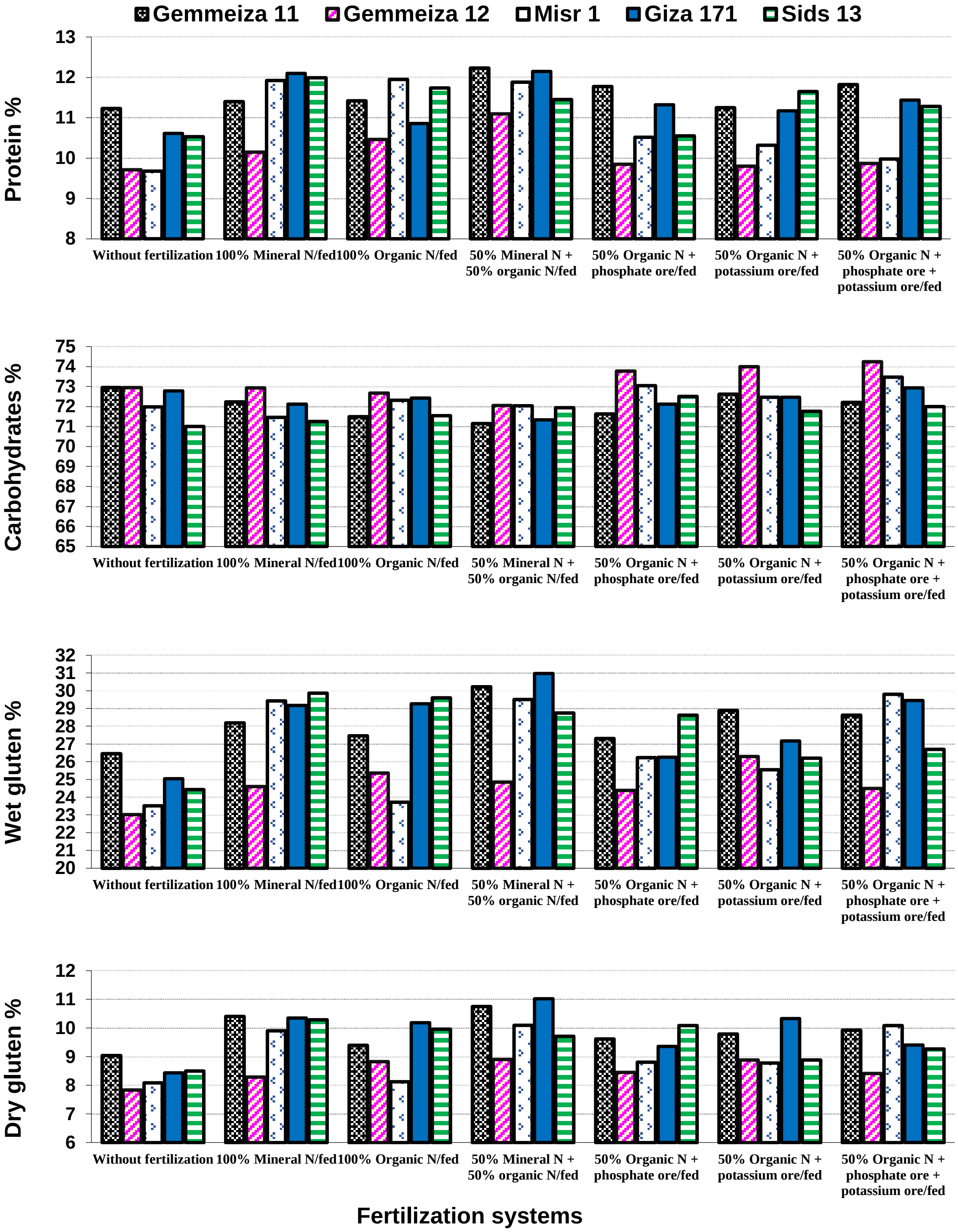


Fig. 8. Effect of interaction between fertilization and varieties on technological properties.

Conclusions

From the abovementioned results, it can be conclude that application of organic fertilizers had important effects on yield and quality of wheat. Significant increases in grain yield and most effective characters of quality were obtained by Giza 171 variety when fertilized with 50% mineral N + 50% organic N/fed which is found to be the best combined treatment for maximize wheat grain productivity (3.869 and 3.906 ton /fed in the first and second seasons, respectively) under environmental conditions of Menoufia governorate.

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تأثير الأسمدة المعدنية والعضوية على الصفات المحصولية والتكنولوجية لبعض أصناف قمح الخبز

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الملخص العربى

أجريت تجربتان حقليتان بالمزرعة البحثية لكلية الزراعة جامعة المنوفية بشبين الكوم بمصر خلال موسمي ٢٠١٥/٢٠١٦، ٢٠١٦/٢٠١٧م لدراسة تأثير توليفات مختلفة من الأسمدة المعدنية والعضوية (نيتروجين معدنى ، نيتروجين عضوى ، خام الفوسفات ، خام البوتاسيوم) بالأضافة الي معاملة الكنترول (بدون تسميد) وذلك علي صفات المحصول ومكوناته والصفات التكنولوجية لبعض أصناف قمح الخبز (جميزة ١١ ، جميزة ١٢ ، مصر ١ ، جيزة ١٧١ ، سدس ١٣). ويمكن تلخيص أهم النتائج التي تم الحصول عليها على النحو التالي :

أدت اضافة نظم التسميد المختلفة (أسمدة معدنية أو عضوية أو كليهما) إلى احداث زيادة فى معظم الصفات المحصولية والتكنولوجية المدروسة حيث تفوق معدل التسميد ٥٠% نيتروجين معدنى + ٥٠% نيتروجين عضوى / فدان فى زيادة قيم معظم الصفات المحصولية (عدد السنابل /م٢ ، عدد حبوب السنبلة ، محصول الحبوب للفدان ، محصول القش والبيولوجى للفدان) والصفات التكنولوجية (النسب المئوية للبروتين والألياف الخام وكذلك الجلوتين الرطب والجاف) وذلك مقارنة ببقية أنظمة التسميد الأخرى خاصة النباتات غير المسمدة والتى سجلت أقل القيم لمعظم الصفات. وعلى الجانب الآخر سُجلت أعلى قيم لوزن ١٠٠٠ حبة ، وزن السنبلة ، النسبة المئوية للكربوهيدرات والرماد عند التسميد بمعدل ٥٠% نيتروجين عضوى + خام الفوسفات + خام البوتاسيوم/ فدان.

أوضحت البيانات تفوق صنفى القمح جيزة ١٧١ ، جميزة ١١ علي بقية الأصناف المختبرة الأخري في معظم صفات المحصول ومكوناته (عدد السنابل /م٢ ، عدد حبوب السنبلة ، وزن ١٠٠٠ حبة ، وزن حبوب السنبلة، محصول الحبوب للفدان ، محصول القش والبيولوجى للفدان) والصفات التكنولوجية (النسب المئوية للبروتين والجلوتين الرطب والجاف) بأفضلية لصنف القمح جيزة ١٧١ لمعظم الصفات الهامة بينما حقق صنفى جميزة ١٢ ، سدس ١٣ أعلى قيم للنسب المئوية للكربوهيدرات والرماد على الترتيب . هذا وقد سجل صنف مصر ١ أقل القيم لمعظم الصفات المدروسة.

أظهرت النتائج معنوية التفاعل بين نظم التسميد والأصناف المختبرة لمعظم الصفات المدروسة حيث تحققت زيادات معنوية في الصفات المحصولية والجودة الهامة عند زراعة صنف جيزة ١٧١ مع تسميده بمعدل ٥٠% نيتروجين معدنى

+ ٥٠% نيتروجين عضوى/ فدان مما يدل إلى أن هذه المعاملة أفضل توليفة لزيادة إنتاجية محصول الحبوب (٣,٨٦٩ و ٣,٩٠٦ طن / فدان في الموسم الأول والثانى على الترتيب) وذلك تحت الظروف البيئية لمحافظة المنوفية.

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