

Effect of organic and mineral fertilization on productivity of some wheat cultivars

Salama, A. M. A.*; E. M.Said* ;E.E.E.Khafagy and A.K.E. Seadh****

*Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt .

**Soil Fertility and Plant Nutrition Research Department, Soils, Water and Environment Research Institute, Agricultural Research Center, Giza, Egypt.

ABSTRACT

Two field experiments were conducted at the Experimental Research Station in El-Serw, Agricultural Research Center during 2010/2011 and 2011/2012 seasons to study the effect of nitrogen and compost combination treatments and potassium fertilizer levels on growth, yield and its components as well as grain quality of some wheat cultivars. The experiments were carried out in a strip-split plot design with three replicates. The vertical plots were assigned to wheat cultivars (Sakha 93, Gemmiza 9 and Gemmiza 10). The Horizontal plots were devoted to nitrogen and compost combination treatments as follows: 1) 100 % mineral nitrogen (90 kg/fed). 2) 75 % mineral nitrogen (67.5 kg/fed) + 25 % organic nitrogen "compost" (22.5 kg/fed). 3) 50 % mineral nitrogen (45.0 kg/fed) + 50 % organic nitrogen "compost" (45.0 kg/fed). 4) 25 % mineral nitrogen (22.5 kg/fed) + 75 % organic nitrogen "compost" (67.5 kg/fed). 5) 100 % organic nitrogen "compost" (90 kg/fed). While, the sub – plots were allocated to potassium fertilizer levels (0 and 48 kg K₂O/fed).

Results showed that Gemmiza 10 cultivar surpassed other studied cultivars in number of days to heading, flag leaf area, plant height, number of spikes/m², number of spikelets/spike, number of grains/spike, grains weight/spike, grain and straw yields/fed, potassium content in grains in both seasons. However, Gemmiza 9 cultivar produced 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.

Application of 100 % mineral nitrogen fertilizer alone produced the highest values of all studied characters. Application of 75 % mineral nitrogen (67.5 kg/fed) + 25 % organic nitrogen "compost" (22.5 kg/fed) came in the second rank after application of 100 % mineral nitrogen alone without significant differences between them in some studied characters in both seasons.

All studied characters of wheat plants gradually increased as a result of increasing potassium fertilizer levels from 0 to 48 kg K₂O/fed in both seasons. Generally, maximum means of all studied characters were produced from fertilizing wheat plants with 48 kg K₂O/fed in both seasons.

It could be recommended that fertilizing Gemmiza 10 cultivar plants with mineral nitrogen (67.5 kg N/fed) + compost (22.5 kg N/fed) + 48 kg K₂O/fed to enhance wheat productivity and also to reduce sources of environmental pollution and maintain human health.

Keywords: Wheat, Organic fertilizer, Compost, nitrogen fertilizer, potassium fertilizer, cultivars, varieties.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important nutritional cereal crops in Egypt and all over the world. Wheat is the staple food crop of the urban areas; moreover it is used widely in blending with maize flour in rural areas 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 achieve suitable agronomic practices for obtaining maximum productivity of different wheat varieties with optimum quality properties.

Chosen the high yielding ability cultivars undoubtedly is very important to raise wheat productivity per unit area. For this reason, this study is aiming to evaluate the new promising cultivars with the old traditional ones for scooping light on the best cultivars that can be used under the environmental conditions of study region. 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/m², 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/m², weight of grains/spike, number of grains/spike, 1000-grain weight and grain yield/fed. Atia and Ragab (2013) found that wheat cultivars significantly differed in grain and straw yields as well as protein and potassium contents in grains. 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.

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. Positive effects of compost on soil structure, aggregate stability and water-holding capacity were reported (Odlare *et al.*, 2008). Moreover, the combination of compost with nitrogen fertilizer further enhanced the biomass and grain yield of wheat crop in this regard, Mahmoud *et al.* (2006) found that grain and straw yields of wheat and N, P and K uptake in grains and straw as well as crude protein content were increased by application of 75% of N as ammonium sulfate with 25% composting rice straw. Abedi *et al.* (2010) evaluated the effects of different levels of inorganic (0, 80, 160 and 240 kg N/ha) and organic (0, 30

and 60 Mg municipal waste compost ha⁻¹) fertilizers on wheat grain yield and protein content. They reported that the highest wheat grain yield was achieved when the plants were fertilized with 160 kg N/ha and 30 Mg compost/ha. The highest amount of seed protein was obtained with 60 Mg compost/ha at all levels of nitrogen. Antoun, Linda *et al.* (2010) found that the interaction between compost and mineral nitrogen level had significant effects on 1000-grain weight, grain yield/ha 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/ha with adding 10 tons compost/ha.

Potassium is important for the function of the stomata, pore-like openings of the plant leaves, through which transpiration of water and uptake of gaseous carbon dioxide occurs. Adequate potassium nutrition of the plant is necessary to ensure the integrity of the water economy within the plant. Thus, many experiments have shown that potassium fertilizer has apparently increased wheat grain yield. In this concern, Slaton *et al.* (2007) concluded that the potential benefits of providing sufficient potassium for wheat often include promoting early plant maturity, resistance to diseases and other pests, stalk strength, tillering, vigorous growth, and improved yield. Tahir *et al.* (2008) revealed that heading date, flag leaf area, plant height, number of spikes/m², spike length, grains weight/spike, 1000-grain weight and grain yield were significantly increased by increasing potassium levels. Fertilized wheat plants with 90 kg K/ha gave significantly higher yield, but on the basis of economic analysis it is recommended that fertilized wheat plants with 60 kg K/ha gave better results. Rahimi (2012) showed that effect of potassium on grain yield was highly significant. Increasing the level of potassium to 100 kg K₂O/ha, increased grain yield to 4985.3 kg/ha. Tababtabaei and Ranjbar (2012) indicated that the highest grain and straw yields were obtained by application of 90 kg K₂O/ha. Using different amount of potassium had no any effect on grain protein.

Therefore, this investigation was established to determine the effect of nitrogen and compost combination treatments and potassium fertilizer levels 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 El-Serw district, Damietta Governorate.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Research Station in El-Serw, Agricultural Research Center (ARC) during the two successive winter seasons of 2010/2011 and 2011/2012. The objective of these experiments was to improve some wheat cultivars productivity under organic and minerals fertilization.

The experiments were carried out in a strip-split plot design with three replicates. The vertical plots were assigned to three wheat cultivars (Sakha 93, Gemmiza 9 and Gemmiza 10).

The Horizontal plots were devoted to five nitrogen and compost combination treatments as follows:

1. 100 % mineral nitrogen (90 kg/fed).
2. 75 % mineral nitrogen (67.5 kg/fed) + 25 % organic nitrogen "compost" (22.5 kg/fed).
3. 50 % mineral nitrogen (45.0 kg/fed) + 50 % organic nitrogen "compost" (45.0 kg/fed).
4. 25 % mineral nitrogen (22.5 kg/fed) + 75 % organic nitrogen "compost" (67.5 kg/fed).
5. 100 % organic nitrogen "compost" (90 kg/fed).

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.

While, the sub – plots were allocated to two potassium fertilizer levels (0 and 48 kg K₂O/fed).

The potassium fertilizer in the form of potassium sulphate (48 % K₂O) at formerly mentioned rates was applied broadcasting in one dose before the first irrigation.

Each experimental unit was 3 X 3.5 m occupying an area of 10.5 m² (i.e. 1/400 feddan). The preceding summer crop was rice (*Oryza sativa*, L.) in both seasons.

The experiments were carried out in a clay loam soil with medium fertility.

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

Soil samples were taken at random from the experimental field area at a depth of 0 and 30 cm from soil surface before soil preparation to measure the physical and chemical soil properties as shown in Table 2. Calcium super phosphate (15.5 % P₂O₅) was applied during soil preparation at the rate of 150 kg/fed.

Sowing took place on November 15th and 18th in the first and second seasons, respectively. Wheat grains at the rate of 75 kg/fed 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, one square meter was randomly chosen from each sub – plot to estimate the following characters:

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

Soil analysis		2010/2011	2011/2012
A: Mechanical analysis			
Clay (%)		65.95	66.10
Silt (%)		22.26	21.67
Fine sand (%)		10.35	11.23
Coarse sand (%)		1.44	1.09
Texture class		Clayey	Clayey
B: Chemical analysis			
pH		8.00	8.01
E.C. (mho/cm at 25 °C)		2.41	2.32
Organic matter (%)		0.86	0.75
C.E.C. (meq/100 g soil)		42.30	44.10
CaCO ₃ (%)		1.34	1.41
Total nitrogen (%)		0.033	0.031
Available P (ppm)		7.94	8.01
Available K (ppm)		479.0	483.0
Cations (meq./100 g soil)	Ca ⁺⁺	3.11	2.95
	Mg ⁺⁺	2.69	2.81
	Na ⁺	11.40	11.21
	K ⁺	0.28	0.27
Anions (meq./100 g soil)	HCO ₃ ⁻	1.70	1.59
	Cl ⁻	12.21	12.02
	SO ₄ ⁻⁻	3.68	3.63

2- Flag leaf area (cm²). It was calculated by the following formula:

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

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, 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 (ardab/fed). | 11- Straw yield (t/fed). |

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), modified by distilling the ammonia into saturated boric solution and titration in standard acid. Crude protein percentage was calculated by multiplying the total nitrogen values in wheat flour by 5.75.
- 13- Potassium (%) was determined using a flame photometer according to Black (1965).

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. Cultivars performance:

Significant differences among the three studied wheat cultivars *i.e.* Sakha 93, Gemmiza 9 and Gemmiza 10 were detected in flag leaf area (in the first season), plant height, number of spikes/m², spike length, number of spikelets/spike, number of grains/spike, grains weight/spike, 1000-grain weight, grain and straw yields/fed, protein and potassium percentages in grains during the two growing seasons as shown from data in Tables 3 and 4. Gemmiza 10 cultivar surpassed other studied cultivars (Gemmiza 9 and Sakha 93) in number of days to heading, flag leaf area, plant height, number of spikes/m², number of spikelets/spike, number of grains/spike, grains weight/spike, grain and straw yields/fed, potassium content in grains, which recorded the highest values of these characters in the two growing seasons. However, Gemmiza 9 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 El-Metwally *et al.* (2012), Harb *et al.* (2012) and Seleem and Abd El –Dayem (2013).

2. Effect of nitrogen and compost combination treatments:

From obtained results in Tables 3 and 4, combined application of mineral nitrogen fertilizer and organic manure as compost treatments showed

significant effect on all studied characters in both growing seasons. Application of 100 % mineral nitrogen fertilizer alone significantly increased growth characters, yield and yield components as well as crude protein percentages in grains in both seasons. Application of 75 % mineral nitrogen (67.5 kg/fed) + 25 % organic nitrogen "compost" (22.5 kg/fed) came in the second rank after application of 100 % mineral nitrogen alone without significant differences between them in some studied characters, except potassium percentages in grains in both seasons. This treatment may be recommended when taking into consideration the economic costs and also environmental pollution with nitrite and nitrate. Application of 50 % mineral nitrogen (45.0 kg/fed) + 50 % organic nitrogen "compost" (45.0 kg/fed) came in the third rank followed by application of 25 % mineral nitrogen (22.5 kg/fed) + 75 % organic nitrogen "compost" (67.5 kg/fed) with respect to all studied characters, except for potassium percentages in grains in both seasons. On the other hand, application of 100 % organic manure as compost alone gave the lowest values of all studied characters, except for potassium percentages in grains which was the highest with the application of 100 % organic manure followed by 75 %, 50 % and 25 % in a descending order. 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. It was worthy to mention 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 Mahmoud *et al.* (2006), Abedi *et al.* (2010), Antoun, Linda *et al.* (2010) and El-Hamdi *et al.* (2012).

3. Effect of potassium fertilizer levels:

The effect of potassium fertilizer levels, it was significant for all studied characters in the two seasons, except number of grains/spike it was not significant and grains weight/spike it was significant in the second season only (Tables 3 and 4). All studied characters of wheat plants gradually increased as a result of increasing potassium fertilizer levels from 0 to 48 kg K₂O/fed in both seasons. Generally, maximum means of all studied characters resulted from fertilizing wheat plants with 48 kg K₂O/fed in both seasons. On the contrary, the lowest values of these characters were obtained from plots did not receive potassium fertilizer (control treatment). The increase in all studied characters as a result to increasing potassium fertilizer levels can be easily ascribed to the potential benefits of potassium for wheat which include promoting early plant maturity, resistance to diseases and other pests increasing, stalk strength, tillering, growth, and finally grain and straw yields (Slaton *et al.*, 2007). These results are in agreement with those reported by many workers including Tahir *et al.* (2008), Rahimi (2012) and Tababtabaei and Ranjbar (2012).

t1

t2

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 (Tables 5-8).

Table 5: Grain yield (ardab/fed) as affected by the interaction between cultivars and nitrogen and compost combination treatments during 2010/2011 and 2011/2012 seasons.

Cultivars	Nitrogen and compost combination treatments				
	100 % N	75 % N + 25 % C	50 % N + 50 % C	25 % N + 75 % C	100 % C
2010/2011 season					
Sakha 93	15.52	15.13	14.40	12.66	11.45
Gemmiza 9	17.11	16.26	15.67	12.74	11.54
Gemmiza 10	17.53	16.95	15.57	14.06	11.64
F. test	*				
LSD at 5 %	0.37				
2011/2012 season					
Sakha 93	16.65	16.41	15.65	12.83	11.63
Gemmiza 9	17.25	16.54	16.01	12.92	11.75
Gemmiza 10	17.67	17.06	15.92	13.61	11.80
F. test	*				
LSD at 5 %	0.44				

The interaction between cultivars and nitrogen combination treatments had a significant effect on grain yield/fed in both seasons. Data presented in Table 5 show that, the highest values of grain yield/fed (17.53 and 17.67 ardab/fed) were obtained when Gemmiza 10 cultivar received 90 kg N/fed in the first and second seasons, respectively. Gemmiza 9 cultivar with 90 kg N/fed ranked after the aforementioned interaction treatment without significant differences between them in the second season.

Grain yield/fed was significantly affected by the interaction between cultivars and potassium fertilizer levels in both seasons. From data listed in Table 6 the highest values of grain yield/fed (15.12 and 15.33 ardab/fed) were obtained as a result of fertilizing Gemmiza 10 cultivar with the highest level of potassium fertilizer (48 kg K₂O/fed) in the first and second seasons, respectively. This treatment followed by fertilizing Gemmiza 9 cultivar with 48 kg K₂O/fed without significant differences in the second season.

Table 6: Grain yield (ardab/fed) as affected by the interaction between cultivars and potassium fertilizer levels during 2010/2011 and 2011/2012 seasons.

Cultivars	Potassium fertilizer levels	
	0 kg K ₂ O/fed	48 kg K ₂ O/fed
2010/2011 season		
Sakha 93	13.73	13.96
Gemmiza 9	14.73	15.01
Gemmiza 10	14.74	15.12
F. test	*	
LSD at 5 %	0.09	
2011/2012 season		
Sakha 93	14.42	14.84
Gemmiza 9	14.80	15.25
Gemmiza 10	14.83	15.33
F. test	*	
LSD at 5 %	0.11	

Table 7: Grain yield (ardab/fed) as affected by the interaction between nitrogen and compost combination treatments and potassium levels during 2010/2011 and 2011/2012 seasons.

Nitrogen and compost combination treatments	Potassium fertilizer levels	
	0 kg K ₂ O/fed	48 kg K ₂ O/fed
2010/2011 season		
100 % N	16.55	16.88
75 % N + 25 % C	16.01	16.22
50 % N + 50 % C	15.08	15.35
25 % N + 75 % C	13.00	13.31
100 % C	11.37	11.72
F. test	*	
LSD at 5 %	0.12	
2011/2012 season		
100 % N	17.03	17.35
75 % N + 25 % C	16.48	16.85
50 % N + 50 % C	15.60	16.12
25 % N + 75 % C	12.81	13.43
100 % C	11.48	11.97
F. test	*	
LSD at 5 %	0.15	

The interaction between nitrogen and compost combination treatments and potassium fertilizer levels significantly affected grain yield per feddan in both seasons. Fertilizing wheat plants with 90 kg N + 48 kg K₂O/fed produced the highest values of grain yield (16.88 and 17.35 ardab/fed) in the first and second seasons, respectively (Table 7). This treatment followed by

fertilizing wheat plants with mineral nitrogen (67.5 kg N/fed) + compost (22.5 kg N/fed) + 48 kg K₂O/fed in both seasons.

The interaction among cultivars, nitrogen and compost combination treatments and potassium fertilizer levels exerted significant effect on grain yield/fed in both seasons. The highest values of grain yield/fed (17.64 and 17.88 ardab/fed) were obtained from fertilizing Gemmiza 10 cultivar plants with 90 kg N + 48 kg K₂O/fed in the first and second seasons, respectively (Table 8). This interaction treatment followed by fertilizing Gemmiza 9 cultivar plants with 90 kg N + 48 kg K₂O/fed in both seasons.

Table 8: Grain yield (ardab/fed) as affected by the interaction among cultivars, nitrogen and compost combination treatments and potassium levels during 2010/2011 and 2011/2012 seasons.

Cultivars	Nitrogen and compost combination treatments	Potassium fertilizer levels	
		0 kg K ₂ O/fed	48 kg K ₂ O/fed
2010/2011 season			
Sakha 93	100 % N	15.31	15.73
	75 % N + 25 % C	15.11	15.15
	50 % N + 50 % C	14.28	14.51
	25 % N + 75 % C	12.60	12.88
	100 % C	11.30	11.60
Gemmiza 9	100 % N	16.93	17.28
	75 % N + 25 % C	16.06	16.46
	50 % N + 50 % C	15.51	15.84
	25 % N + 75 % C	13.88	14.24
	100 % C	11.32	11.77
Gemmiza 10	100 % N	17.42	17.64
	75 % N + 25 % C	16.82	17.08
	50 % N + 50 % C	15.44	15.71
	25 % N + 75 % C	12.51	12.82
	100 % C	11.48	11.80
F. test		*	
LSD at 5 %		0.19	
2011/2012 season			
Sakha 93	100 % N	16.51	16.80
	75 % N + 25 % C	16.22	16.60
	50 % N + 50 % C	15.40	15.91
	25 % N + 75 % C	12.57	13.08
	100 % C	11.42	11.84
Gemmiza 9	100 % N	17.13	17.37
	75 % N + 25 % C	16.40	16.68
	50 % N + 50 % C	15.80	16.22
	25 % N + 75 % C	13.22	14.00
	100 % C	11.44	12.00
Gemmiza 10	100 % N	17.46	17.88
	75 % N + 25 % C	16.84	17.28
	50 % N + 50 % C	15.60	16.24
	25 % N + 75 % C	12.65	13.20
	100 % C	11.60	12.06
F. test		*	
LSD at 5 %		0.26	

It could be recommended that fertilizing Gemmiza 10 cultivar plants with mineral nitrogen (67.5 kg N/fed) + compost (22.5 kg N/fed) + 48 kg K₂O/fed to enhance wheat productivity and also to reduce sources of environmental pollution and maintain human health.

REFERENCES

- A.O.A.C. (1990). Official Methods of Analysis. 15th Ed. Association of Official Analytical Chemists, Inc., Virginia, USA, pp: 770-771.
- Abedi, T. ; A. Alemzadeh and S.A. Kazemeini (2010). Effect of organic and inorganic fertilizers on grain yield and protein banding pattern of wheat. *Australian J. of Crop Sci.*, 4(6): 384-389.
- Antoun, Linda W. ; Sahar M. Zakaria and Hanaa H. Rafla (2010). Influence of compost, N-mineral and humic acid on yield and chemical composition of wheat plants. *J. Soil Sci. and Agric. Engi., Mansoura Univ.*, 1(11): 1131- 1143.
- Atia, R.H. and Kh.E. Ragab (2013). Response of some wheat varieties to nitrogen fertilization. *J. Soil Sci. and Agric. Eng., Mansoura Univ.*, 4(3): 309 – 319.
- Black, C.A. (1965). Methods of soil analysis. Part I- Physical and mineralogical properties. A.S.A. Madison, Wisc., USA.
- El-Hamdi, Kh. H. ; A. R. Ahmed and N. E. S. El-Azzony (2012). Effect of compost, nitrogen and micronutrient compounds on nitrogen uptake, yield and yield components of wheat. *J. Soil Sci. and Agric. Eng., Mansoura Univ.*, 3(11): 1043 – 1056.
- El-Metwally, A.El-M. ; N.A. Khalil ; M.M. El-Fouly and M.F. El-Dahshouri (2012). Growth, nutrients uptake and grain yield of some wheat cultivars as affected by zinc application under sandy soil conditions. *J. Plant Production, Mansoura Univ.*, 3(5): 773 – 783.
- Gardner, F.P. ; R.B. Pearce and R.L. Michell (1985). Physiology of crop plant. Iowa State Univ. Press Ames. Iowa. USA pp. 58-75 (C.F. Computer Search).
- Gomez, K.N. and A.A. Gomez (1984). Statistical procedures for agricultural research. John Wiley and Sons, New York, 2nd Ed., 68 P.
- Harb, O.M.S. ; G.H. Abd El-Hay ; M.A. Hager ; M.K. Hassanien and M.M. Abou El-Enin (2012) Effect of water irrigation quantity and compost rates on some wheat varieties under sandy soil conditions of West Delta region conditions. *J. Plant Production, Mansoura Univ.*, 3(5): 847 – 855.
- Mahmoud, M. M. ; Gehan H. Youssef and Wafaa M. A. Saddik (2006). Partial replacement of N-mineral requirements by N-organic source as related to both sesame-wheat yields and their components. *Egypt. J. Appl. Sci.*, 21(6B) 12 - 21.
- Odlare, M. ; M. Pell and K. Svensson (2008). Changes in soil chemical and microbiological properties during 4 years of application of various organic residues. *Waste Manag.*, 28: 1246-1253.

- Rahimi, A. (2012). Effect of potassium and nitrogen on yield and yield components of dry land wheat in Boyerahmad Region of Iran. *Annals of Biol. Res.*, 3 (7): 3274-3277.
- Seleem, S.A. and S.M. Abd El-Dayem (2013). Response of some wheat cultivars to nitrogen fertilizer levels. *J. Plant Production, Mansoura Univ.*, 4(5): 721 – 731.
- Slaton, N.A. ; R.E. DeLong ; M. Mozaffari ; S. Clark ; C. Allen and R. Thompson (2007). Wheat grain yield response to phosphorus and potassium fertilizer rate. *AAES Research Series*, 558: 69-71.
- Snedecor, G.W. and W.G. Cochran (1980). "Statistical Methods" 7th Ed. The Iowa State Univ. Press, Iowa, USA.
- Tababtabaei, S.A. and G.H. Ranjbar (2012). Effect of different levels of nitrogen and potassium on grain yield and protein of wheat. *Intl. Res. J. Appl. Basic. Sci.*, 3(2): 390-393.
- Tahir, M. ; A. Tanveer ; A. Ali ; M. Ashraf and A. Wasaya (2008). Growth and yield response of two wheat (*Triticum aestivum* L.) varieties to different potassium levels. *Pakistan J. Life Soc. Sci.*, 6(2): 92-95.

تأثير التسميد العضوي والمعدني على إنتاجية بعض أصناف القمح
عادل محمد سلامة* ، العربي مسعد محمد سعيد* ، الحسيني المرسي السيد خفاجي**
وعلى كمال سعده**
* قسم المحاصيل - كلية الزراعة- جامعة المنصورة.
** قسم بحوث تغذية النبات ، معهد بحوث الأراضي والمياه والبيئة ، مركز البحوث الزراعية.

أجريت تجربتان حقليتان خلال موسمي ٢٠١١/٢٠١٠ و ٢٠١٢/٢٠١١ بمحطة التجارب والبحوث الزراعية بالسرو (محافظة دمياط) - مركز البحوث الزراعية لدراسة تأثير بعض العمليات الزراعية التي تساهم في زيادة إنتاجية وجودة حبوب بعض أصناف القمح مثل معاملات التسميد النيتروجيني والمعدني والعضوي وأيضاً مستويات السماد البوتاسي. نفذت كل تجربة في تصميم الشرائح المتعامدة المنشقة في ثلاث مكررات. حيث اشتملت الشرائح الرأسية على أصناف القمح وهي؛ سخا ٩٣ ، جميزة ٩ وجميزة ١٠. بينما الشرائح الأفقية فقد احتوت على خمسة معاملات للتسميد النيتروجيني والمعدني والعضوي كالتالي؛ (١)- ١٠٠ % نيتروجين معدني (٩٠ كجم/فدان) ، (٢)- ٧٥ % نيتروجين معدني (٦٧.٥ كجم/فدان) + ٢٥ % نيتروجين عضوي من الكمبوست (٢٢.٥ كجم/فدان) ، (٣)- ٥٠ % نيتروجين معدني (٤٥.٠ كجم/فدان) + ٥٠ % نيتروجين عضوي من الكمبوست (٤٥.٠ كجم/فدان) ، (٤)- ٢٥ % نيتروجين معدني (٢٢.٥ كجم/فدان) + ٧٥ % نيتروجين عضوي من الكمبوست (٦٧.٥ كجم/فدان) ، (٥)- ١٠٠ % نيتروجين عضوي (٩٠ كجم/فدان). بينما احتوت القطع الشقية على مستويين من السماد البوتاسي هما؛ صفر و ٤٨ كجم K_2O /فدان. تشير النتائج المتحصل عليها إلى تفوق الصنف جميزة ١٠ على الأصناف الأخرى المدروسة (جميزة ٩ وسخا ٩٣) في عدد الأيام من الزراعة حتى طرد الداليات ، مساحة ورقة العلم، ارتفاع النبات، عدد السنابل/م^٢ ، عدد السنابل / السنبل ، عدد الحبوب / سنبل ، وزن الحبوب / سنبل ، محصول الحبوب والقش / فدان، ومحتوى البوتاسيوم في الحبوب. في حين سجل الصنف جميزة ٩ أطول السنابل وأعلى نسبة مئوية للبروتين في الحبوب في كلا الموسمين. أما الصنف سخا ٩٣ فقد سجل أعلى القيم من وزن ١٠٠٠ حبة في كلا الموسمين. نتجت أعلى القيم لجميع الصفات تحت الدراسة عند التسميد المعدني بـ ٩٠ كجم نيتروجين/فدان في كلا الموسمين. وجاء استخدام ٧٥ % نيتروجين معدني (٦٧.٥ كجم / فدان) + ٢٥ % نيتروجين عضوي " الكمبوست " (٢٢.٥ كجم / فدان) في المرتبة الثانية بعد استخدام ١٠٠ % نيتروجين معدني دون فروق معنوية بينهما في بعض الصفات المدروسة. أظهرت النتائج المتحصل عليها أن معاملة التسميد البوتاسي بـ ٤٨ كجم K_2O /فدان قد تفوقت على معاملة المقارنة (بدون تسميد بوتاسي) وأنتجت أعلى القيم لجميع الصفات المدروسة في الموسمين الأول والثاني.

توصى الدراسة بتسميد القمح صنف جميزة ١٠ بـ ٦٧.٥ كجم نيتروجين معدنى / فدان + ٢٢.٥ كجم نيتروجين عضوى فى صورة سماد الكميوست/ فدان + ٤٨ كجم K_2O /فدان لتحسين إنتاجية القمح وأيضاً للحد من مصادر التلوث البيئى والحفاظ على صحة الإنسان تحت ظروف محافظة دمياط.

قام بتحكيم البحث

كلية الزراعة – جامعة المنصورة
كلية الزراعة – جامعة القاهرة

أ.د / محمود سليمان سلطان
أ.د / السيد عبد العزيز محمود

Table 3: Number of days to heading, flag leaf area, plant height, number of spikes/m², spike length, number of spikelets/spike and number of grains/spike as affected by cultivars, nitrogen and compost combination treatments and potassium fertilizer levels as well as their interactions during 2010/2011 and 2011/2012 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		Number of grains/spike	
	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012
A- Cultivars:														
Sakha 93	90.63	90.83	37.38	36.39	87.06	88.23	250.4	249.8	9.22	9.37	17.93	17.10	50.26	49.70
Gemmiza 9	90.73	91.30	38.87	36.62	95.73	92.06	255.7	256.5	10.22	10.06	18.46	18.20	50.66	49.80
Gemmiza 10	91.06	91.40	39.60	37.03	103.83	95.83	256.1	259.6	9.52	9.40	19.36	18.80	52.50	51.93
F. test	NS	NS	*	NS	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	-	-	2.00	-	5.94	4.63	3.7	3.5	0.19	0.16	1.12	0.97	1.16	1.44
B- Nitrogen and compost combination treatments:														
100 % N	94.00	94.22	43.60	43.83	102.44	103.00	289.8	289.5	11.18	11.12	22.22	21.55	59.88	58.94
75 % N + 25 % C	93.22	93.55	42.75	42.75	98.83	99.50	279.3	278.3	10.55	10.64	21.38	20.77	56.72	57.05
50 % N + 50 % C	91.33	92.55	41.95	41.47	95.33	95.72	263.1	260.1	9.80	9.78	19.55	19.50	53.83	54.27
25 % N + 75 % C	88.61	88.88	35.94	31.40	94.44	85.11	227.2	234.3	8.73	8.67	16.44	15.66	45.77	43.88
100 % C	86.88	86.66	28.84	23.94	86.66	76.88	211.0	214.2	7.98	7.83	13.33	12.66	39.50	38.22
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.91	0.78	2.79	1.38	4.92	3.65	4.9	4.5	0.23	0.21	1.28	0.84	2.00	1.83
C- Potassium fertilizer levels:														
0 kg K ₂ O/fed	90.22	90.42	37.29	33.93	90.08	90.22	250.8	251.3	9.52	9.43	18.08	17.28	50.82	50.20
48 kg K ₂ O/fed	91.40	91.93	39.94	39.42	101.00	93.86	257.4	259.2	9.78	9.78	19.08	18.77	51.46	50.75
F. test	*	*	*	*	*	*	*	*	*	*	*	*	NS	NS
D- Interactions:														
A × B	*	NS	*	NS	NS	*	NS	*	*	*	NS	NS	NS	*
A × C	NS	NS	NS	*	NS	*	NS	NS	NS	NS	NS	NS	*	*
B × C	NS	NS	*	NS	NS	NS	NS	*	*	*	*	*	NS	NS
A × B × C	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	*	NS	NS

Table 4: Grains weight/spike, 1000 – grain weight, grain and straw yields/fed as well as protein and potassium percentages as affected by cultivars, nitrogen and compost combination treatments and potassium fertilizer levels as well as their interactions during 2010/2011 and 2011/2012 seasons.

Characters Seasons Treatments	Grains weight/spike (g)		1000 – grain weight (g)		Grain yield (ardab/fed)		Straw yield (t/fed)		Protein (%)		Potassium (%)	
	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012	2010 /2011	2011 /2012
A- Cultivars:												
Sakha 93	1.805	1.799	47.91	48.80	13.85	14.63	1.932	1.945	9.97	9.98	1.414	1.415
Gemmiza 9	1.828	1.801	46.39	47.28	14.87	15.04	2.062	2.010	10.45	10.33	1.429	1.418
Gemmiza 10	1.835	1.809	47.48	48.51	14.93	15.07	2.087	2.083	10.35	10.30	1.520	1.509
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.010	0.007	0.37	0.44	0.13	0.20	0.051	0.092	0.28	0.21	0.052	0.050
B- Nitrogen and compost combination treatments:												
100 % N	1.838	1.842	49.46	49.95	16.72	17.19	2.444	2.345	11.12	11.18	1.343	1.329
75 % N + 25 % C	1.828	1.798	48.92	49.67	16.11	16.67	2.230	2.220	10.83	10.84	1.398	1.387
50 % N + 50 % C	1.823	1.793	48.09	49.20	15.21	15.86	2.076	2.146	10.57	10.48	1.438	1.439
25 % N + 75 % C	1.816	1.792	46.23	47.14	13.15	13.12	1.789	1.777	9.77	9.70	1.494	1.494
100 % C	1.809	1.791	43.59	45.01	11.54	11.73	1.596	1.576	9.00	8.81	1.599	1.588
F. test	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.011	0.014	0.80	0.50	0.20	0.32	0.052	0.59	0.19	0.25	0.028	0.033
C- Potassium fertilizer levels:												
0 kg K ₂ O/fed	1.821	1.792	45.93	46.93	14.40	14.68	1.992	2.002	10.18	10.08	1.287	1.276
48 kg K ₂ O/fed	1.825	1.814	48.59	49.46	14.70	15.14	2.061	2.023	10.34	10.32	1.622	1.618
F. test	NS	*	*	*	*	*	*	*	*	*	*	*
D- Interactions:												
A × B	NS	NS	NS	*	*	*	*	*	NS	NS	NS	*
A × C	NS	NS	*	*	*	*	*	*	NS	*	*	*
B × C	NS	NS	*	*	*	*	*	*	*	NS	*	*
A × B × C	NS	NS	*	*	*	*	NS	NS	NS	NS	NS	NS