

## EFFECT OF NITROGEN AND PHOSPHOROUS FERTILIZATION ON SOME WHEAT CULTIVARS PRODUCTIVITY

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**ABSTRACT:** Two field experiments were carried out at Sidi Salem Directorate, Kafr El-Sheikh Governorate, Egypt, during the two successive winter seasons of 2011/2012 and 2012/2013 to study the effect of four nitrogen fertilization rates (0, 37.5, 75 and 112.5 kg N/fed) and three phosphorous fertilization rates (0, 15 and 30 kg P<sub>2</sub>O<sub>5</sub>/fed) on the growth characters, yield, its component and some chemical properties of three bread wheat cultivars (Gemmeiza 9, Sakha 93 and Giza 168). The experimental design was split split plot design in four replications. The obvious results of this investigation can be summarized as follows:

All traits of wheat under study, i.e. No. of tillers/m<sup>2</sup>, No. of spike/m<sup>2</sup>, plant height, spike length, No. of kernels/spike, 1000-kernel weight, kernels weight/spike, straw yield/fed, grain yield/fed, biological yield/fed, harvest index, kernels nitrogen content (%) and grain protein yield/fed showed significantly increased by increasing nitrogen fertilizer rates, except kernels phosphorous content (%). Application of 112.5 kg N /fed significantly gave the maximum values of all traits. Increasing phosphorous fertilizer rates up to 30 Kg P<sub>2</sub>O<sub>5</sub>/fed significantly increased No. of tillers/m<sup>2</sup>, No. of spike/m<sup>2</sup>, plant height, spike length, straw yield/fed, grain yield/fed, biological yield/fed and kernels phosphorous content (%) in the two seasons. While, No. of kernels/spike, 1000-kernel weight, kernels weight/spike, harvest index, kernels nitrogen content % and grain protein yield/fed were not affected by increasing phosphorous fertilizer rates. The results showed that wheat cultivars were significantly differed in all traits studied under study in the both seasons, except biological yield kg/fed, kernels nitrogen content (%) and kernels phosphorous content (%). Gemmeiza 9 cultivar significantly surpassed Sakha 93 and Giza 168 cultivars in plant height, spike length, 1000-kernel weight, kernels weight/spike, grain yield/fed, harvest index and kernels protein yield/fed in the both seasons, while, Sakha 93 recorded the highest values of No. of kernels/spike. Moreover, Giza 168 surpassed the other two cultivars in No. of tillers/m<sup>2</sup>, No. of spike/m<sup>2</sup> and straw yield/fed. The first order interactions between (112.5 kg N/fed X 30 Kg P<sub>2</sub>O<sub>5</sub>/fed), (112.5 kg N/fed X Gemmeiza 9) and (30 Kg P<sub>2</sub>O<sub>5</sub>/fed X Gemmeiza 9) as well as the second order interaction between 112.5 kg N/fed X 30 Kg P<sub>2</sub>O<sub>5</sub>/fed X Gemmeiza 9 were significantly recorded the greatest grain yield/fed as compared with the others interactions in the both seasons. It could be summarized that sown wheat Gemmeiza 9 cultivar and fertilization by 30 Kg P<sub>2</sub>O<sub>5</sub> + 112.5 kg N/fed maximized grain yield per unit area.

**Key words:** Wheat cultivars, phosphorous fertilization and nitrogen fertilization.

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### INTRODUCTION

Bread wheat (*Triticum aestivum*, L.) is the most important cereal crops in Egypt as well as over the world and covers more of the earth's surface, used in human food and animal feed. It is a staple food for more than one third of the world population. In Egypt, wheat provides 37 % of the total calories for

the people and 40 % of the protein in the Egyptian diet (Min. Agric. Statistic Year Book, 2000). The total production of wheat was 9.61 million tons in 2015 produced from an area of 3,468,864 faddans, (Bull. Agric. Stat., 2016), with an average yield of 2880 kg/fad. The total consumption of wheat nearly from 16.26 million tons, thus the local

production covers more than 59.09 % of the local consumption. Consequently, increasing wheat production during the last period became one of the most important goals of the Egyptian government to fulfill the food security for the people. This target can be achieved through expanding wheat area in the delta and along the valley as well as in the new reclaimed lands and rainfed areas, or by means of raising the yield through growing high yielding cultivars and applying the optimum cultural practices.

Determination the required rate of nitrogen fertilization of wheat is of the main important practices of great contribution for the highest production of better quality, as well as nitrogen is a key element for wheat productivity as well as in many other field cereal crops. Several investigations reported that increasing nitrogen fertilization rates caused significant increase in growth, yield, its components and chemical properties traits of wheat. Shafshak *et al.*, 2003; Allam 2005; Abd El-Maaboud *et al.*, 2006; Al-Afandy *et al.*, 2007; Khan *et al.*, 2008; Benin *et al.*, 2012; Gomaa *et al.*, 2012; Hafez *et al.*, 2012; Zaki *et al.*, 2012; Ashmawy *et al.*, 2013; Noureldin *et al.*, 2013; Sultana *et al.*, 2013; Khalid *et al.*, 2014; El-Hosary *et al.*, 2015, Jelic *et al.*, 2015 and Mehasen *et al.*, 2015 showed that increases in No. of tillers/m<sup>2</sup>, No. of spike/m<sup>2</sup>, plant height, spike length, No. of kernels/spike, 1000-kernel weight, kernels weight/spike, straw yield/fed, grain yield/fed, biological yield/fed, harvest index, kernels nitrogen content % and grain protein yield/fed with increasing nitrogen fertilization rates.

Phosphorous is the second major nutrient that produces significant increment in wheat growth and productivity if added in appreciated dosage as a fertilizer. It is very important for most of the physiological processes of plant growth and metabolism. Abdul Galil *et al.*, 2003; Shafshak *et al.*, 2003; Abd El-Maaboud *et al.*, 2006; Al-Afandy *et al.*, 2007 Khan *et al.*, 2008; and

Jelic *et al.*, 2015 indicated that application of phosphorous fertilization at the perfect time and quantity increased significantly wheat traits including No. of tillers/m<sup>2</sup>, No. of spike/m<sup>2</sup>, plant height, spike length, straw yield/fed, grain yield/fed, biological yield/fed and kernels phosphorous content %.

Several investigators showed that wheat cultivars differed in growth, yield, its components and some chemical properties (Abdul Galil *et al.*, 2003; Abd El-Maaboud *et al.*, 2006; Benin *et al.*, 2012; Gomaa *et al.*, 2012; Hafez *et al.*, 2012; Zaki *et al.*, 2012; Ashmawy *et al.*, 2013; Noureldin *et al.*, 2013; Sultana *et al.*, 2013; Khalid *et al.*, 2014; El-Hosary *et al.*, 2015, Jelic *et al.*, 2015 and Mehasen *et al.*, 2015).

The aim of this investigation was designed to study the effect of four nitrogen and three phosphorous fertilization rates on growth, yield, yield components and chemical composition in three wheat cultivars.

## **MATERIALS AND METHODS**

Two field experiments were carried out at Sidi Salem Directorate, Kafr El-Sheikh Governorate, Egypt, during the two successive winter seasons of 2011/2012 and 2012/2013. The aim of this study was to investigate the effect of four nitrogen and three phosphorous fertilization levels on the growth traits, yield, its components and some chemical properties of three bread wheat cultivars. Soil texture of the experimental site was clay and salty of pH nearly of 8.00. The physical and chemical properties of the experimental soil were determined according to the standard procedures described by Black, 1965) and represented in Table, 1 in each of the two growing seasons.

Each experiment included 36 treatments which were the combination of four nitrogen fertilizer rates, three phosphorous fertilizer rates and three bread wheat cultivars.

**Table 1: Physical and chemical properties of the experimental soil units of the two growing seasons (2011/2012 and 2012/2013).**

Properties	Seasons	
	2011/2012	2012/2013
Chemical analysis		
E.C.	4.85	5.02
pH (1 :2.5)	7.84	8.12
N (ppm) (available)	32	39
P (ppm) (available)	7.83	8.15
Soluble cations and anions ( ppm )		
Na <sup>+</sup>	30.4	31
Ca <sup>2+</sup>	10.60	10.60
Mg <sup>2+</sup>	6.70	7.78
K <sup>+</sup>	0.80	0.90
HCO <sub>3</sub> <sup>-</sup>	3.50	4.50
Cl <sup>-</sup>	23.25	26.58
SO <sub>4</sub> <sup>2-</sup>	21.75	19.20
Particle size distribution ( mechanical analysis )		
Course sand %	4. 98	5. 32
Find sand %	15. 76	16. 18
Silt %	24. 61	26. 29
Clay %	54. 65	52. 21
Texture grade	Clay	Clay

**Factors under study were as follows:**

- 1- Four nitrogen fertilization rates, i.e. 0, 37.5, 75 and 112.5 kg N/fed, nitrogen fertilizer was applied in form of urea (46 % N), and divided into two equal parts and applied before the first and second irrigations in each season.
- 2- Three phosphorous fertilization rates, i.e. 0, 15 and 30 kg P<sub>2</sub>O<sub>5</sub>/fad, phosphorous fertilizer was applied in form of calcium super phosphate (12.5 % P<sub>2</sub>O<sub>5</sub>), and applied during soil preparation in the two seasons.
- 3- Three bread wheat cultivars namely, Gemmeiza 9, Sakha 93 and Giza 168. Seeds of the three wheat cultivars were

secured every two seasons from Field Crop Institute, Sakha Agriculture Research Station, Agricultural Research Center (ARC).

The experimental design was split split plot design (Gomez and Gomez, 1984) in four replications. The four nitrogen fertilizer rates were random distributed in the main plots, whereas the three phosphorous fertilizer rates were arranged at random in sub plots and the three cultivars of wheat were assigned in random in sub sub plots. The preceding summer crop in the two seasons was rice. The sub sub plot size was 10.5 m<sup>2</sup> of 3.0 X 3.5 m including 15 rows 20 cm apart and 3.5 meter length. Seeding rate

for the three wheat cultivars was 60 kg seeds/fed. Experiments were planted on November 16<sup>th</sup> and 20<sup>th</sup> of in the first season (2011/2012) and the second season (2012/2013), respectively. The other recommended agronomic practices of growing wheat were applied in the manner prevailing in the region were practiced.

### **Studied parameters:**

#### **The following growth characters, yield and yield attributes were recorded:**

At harvest, all plants in one square meter from each sub sub plot were harvested to determine No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup> and 1000-kernel weight (g). Then, ten fertile tillers from the previous one square meter were chosen randomly to estimate the plant height (cm), spike length (cm), No. of kernels/spike and kernels weight/spike (g). While, biological, grain and straw yields (kg/fed) and harvest index % were estimated from the whole sub sub plot yield.

### **Chemical analysis**

Wheat grain samples were taken after harvest at random from kernels of ten spikes to determine kernels nitrogen content (%) according to the modified micro Kjeldahl method as described by A. O. A. C., 1980, kernels phosphorous content (%) was determined by Spectrophotometer as reported by (Jackson 1973). While, protein yield/fed was calculated by multiplying kernels nitrogen content X 5.7 X grain yield kg/fed.

### **Statistical analysis:**

The analysis of variance was carried out according to the procedure described by Gomez and Gomez (1984). Data were statistically analyzed according to using the MSTAT-C Statistical Software Package (Michigan State University, 1983). Where the F-test showed significant differences among means L. S. D. test at 0.05 level was used to compare between means.

## **RESULTS AND DISCUSSION**

### **Effect of nitrogen fertilization:**

Results in Tables 2 and 3 showed that growth, yield, its attributes and chemical properties of wheat, i.e. No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup>, plant height (cm), spike length (cm), No. of kernels/spike, kernels weight/spike (g), 1000-kernel weight (g), biological yield (kg/fed), grain yield (kg/fed), straw yield (kg/fed), harvest index (%), kernels nitrogen content % and kernels protein yield (kg/fed) were significantly increased by increasing nitrogen fertilizer rates up to 112.5 kg N/fed in 2011/2012 and 2012/2013 seasons. While, kernels phosphorous content % was not significant. In general, the higher nitrogen rate (112.5 kg N/fed) was more effective in increasing values of all studied traits, also, produced the maximum grain yield/fed and proved significantly superior to other nitrogen rates. The nitrogen treatments of 37.5, 75 and 112.5 kg N/fed significantly increased grain yield/fed of wheat by 44.68, 69.29 and 84.26 % in the first season, respectively, and by 43.08, 67.99 and 80.89 % in the second season, respectively when compared to without nitrogen added. The present results clearly indicate that nitrogen application induced increases in growth, yield and yield components traits of wheat showing the major role of this vital nutritive element. The increase in nitrogen application encourages photosynthesis activities and the metabolic efficiency as well as promoting the cell division, vegetative growth and encouraging the juvenility and active persistence of meristematic tissues which contributes in enhancing the accumulation of the produced metabolites of wheat. Many investigators came out with similar results as Shafshak *et al.*, 2003; Allam 2005; Abd El-Maaboud *et al.*, 2006; Al-Afandy *et al.*, 2007; Khan *et al.*, 2008; Benin *et al.*, 2012; Gomaa *et al.*, 2012; Hafez *et al.*, 2012; Zaki *et al.*, 2012; Ashmawy *et al.*, 2013; Noureldin *et al.*, 2013; Sultana *et al.*, 2013; Khalid *et al.*, 2014; El-Hosary *et al.*, 2015, Jelic *et al.*, 2015 and Mehasen *et al.*, 2015.

Table 2: Effect of nitrogen, phosphorous, cultivars and their interactions on No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup>, plant height, spike length, No. of kernels/spike, 1000-kernel weight and kernels weight/spike of wheat during 2011/2012 and 2012/2013 seasons.

Treatments	Trsits	No. of tillers/m <sup>2</sup>		No. of spikes/m <sup>2</sup>		Plant height (cm)		Spike length (cm)		No. of kernels/spike		1000-kernel weight (g)		Kernels weight/spike (g)	
		2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
Nitrogen fertilization kg N/fed	0	486.44	508.14	338.89	357.00	93.28	98.78	12.05	12.36	57.03	59.42	39.39	40.26	2.270	2.387
	37.5	526.00	543.69	381.67	397.32	106.78	107.72	13.08	13.16	63.69	66.31	42.82	44.01	2.719	2.900
	75	553.47	568.14	400.89	427.42	113.11	114.61	13.74	13.96	67.03	69.86	44.41	45.95	2.987	3.211
L.S.D. at 5%	112.5	577.06	584.17	422.61	459.53	119.06	121.56	14.10	14.47	69.00	72.97	45.82	47.04	3.167	3.404
	0	25.12	20.16	23.16	19.17	4.51	5.12	0.15	0.19	2.51	3.26	1.42	1.21	0.221	0.242
	15	519.46	537.46	373.92	394.46	103.85	106.84	12.87	13.05	62.56	65.46	42.17	43.37	2.648	2.838
Phosphorous fertilization kg P <sub>2</sub> O <sub>5</sub> /fed	30	540.54	554.42	387.79	413.20	108.88	111.58	13.28	13.59	64.19	67.19	43.29	44.31	2.814	2.998
	L.S.D. at 5%	547.23	561.23	396.33	423.29	111.44	113.58	13.57	13.82	65.81	68.77	43.88	45.26	2.895	3.091
Wheat cultivars	Gemmeiza 9	9.51	10.12	7.32	8.76	3.25	2.99	0.16	0.17	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	Sakha 93	467.92	488.17	350.15	373.52	114.79	117.21	14.43	14.61	66.56	69.60	46.27	47.93	3.113	3.327
	Giza 168	514.10	523.63	378.54	390.41	109.06	111.52	13.59	13.89	68.73	70.96	43.85	44.75	2.988	3.176
L.S.D. at 5%	33.15	625.21	641.31	429.35	467.02	100.31	103.28	11.70	11.97	57.27	60.85	39.22	40.25	2.256	2.424
	NP	30.15	28.77	30.15	6.31	6.55	0.22	0.25	2.98	3.15	1.87	1.76	0.342	0.351	
	NV	**	**	**	**	**	**	N.S.	N.S.	**	**	**	**	**	**
F test Prob.	PV	**	**	**	**	**	**	**	**	**	**	**	**	**	**
	NPV	**	**	**	**	**	**	**	**	**	**	**	**	**	**
	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

\* and \*\* significant at 0.05 and 0.01 levels of probability respectively

Table 3: Effect of nitrogen, phosphorous, cultivars and their interactions on straw yield kg/fed, grain yield kg/fed, biological yield kg/fed, harvest index %, kernels nitrogen content % and grain protein yield kg/fed of wheat during 2011/2012 and 2012/2013 seasons.

Treatments	Traits	Straw yield (kg/fed)		Grain yield (kg/fed)		Biological yield (kg/fed)		Harvest index %		Kernels nitrogen content %		Protein yield (kg/fed)		Kernels phosphorous content %	
		2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
Nitrogen fertilization kg N/fed	Seasons	2443.33	2707.78	1383.89	1541.11	3827.22	4248.89	36.16	36.27	1.887	1.902	148.85	167.08	0.359	0.357
	0	3219.44	3570.00	2002.22	2205.00	5221.66	5775.00	38.34	38.18	1.994	2.009	227.57	252.50	0.374	0.374
	37.5	3624.44	4040.00	2342.78	2588.89	5967.22	6628.89	39.26	39.05	2.044	2.052	272.95	302.81	0.384	0.383
	75	4128.89	4402.22	2550.00	2787.78	6678.89	7190.00	38.18	38.77	2.073	2.083	301.31	331.00	0.388	0.387
Phosphorous fertilization kg P <sub>2</sub> O <sub>5</sub> /fed	L.S.D. at 5%	252.12	273.51	261.12	283.15	356.45	396.72	1.12	1.15	0.061	0.052	12.44	14.37	N.S.	N.S.
	0	3224.17	3540.83	1920.83	2117.92	5145.00	5658.75	37.33	37.43	1.974	1.986	216.13	239.75	0.341	0.338
	15	3364.58	3699.17	2103.75	2293.75	5468.33	5992.92	38.47	38.27	2.003	2.016	240.19	263.58	0.379	0.379
	30	3473.33	3800.00	2184.58	2430.42	5657.91	6230.42	38.61	39.01	2.022	2.033	251.78	281.64	0.409	0.408
Wheat cultivar	L.S.D. at 5%	51.76	69.46	46.25	55.91	123.15	142.52	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.061	0.053
	Gemmeiza 8	3164.17	3465.00	2362.50	2523.33	5526.67	5988.33	42.75	42.14	1.973	1.979	265.69	284.64	0.359	0.365
	Sakha 93	3310.83	3597.50	2108.33	2304.17	5419.16	5901.67	38.91	39.04	1.991	2.005	239.27	263.33	0.356	0.361
	Giza 168	3587.08	3977.50	1738.33	2014.58	5325.41	5992.08	32.64	33.62	2.035	2.050	201.64	235.40	0.414	0.400
F test Prob.	L.S.D. at 5%	196.52	234.94	167.52	183.28	N.S.	N.S.	2.51	2.63	N.S.	N.S.	8.50	8.76	N.S.	N.S.
	NP	**	**	**	**	**	**	N.S.	N.S.	N.S.	N.S.	**	**	N.S.	N.S.
	NV	**	**	**	**	**	**	**	**	N.S.	N.S.	**	**	N.S.	N.S.
	PV	**	**	**	**	**	**	**	**	N.S.	N.S.	**	**	N.S.	N.S.
NPV	**	**	**	**	**	**	**	N.S.	N.S.	N.S.	**	**	N.S.	N.S.	

\* and \*\* significant at 0.05 and 0.01 levels of probability respectively

**Effect of phosphorous fertilization:**

Results of the effect of phosphorous application on yield of wheat and its related characters are shown in Tables 2 and 3. The results indicate that increasing P fertilizer rates from 0 to 30 kg P<sub>2</sub>O<sub>5</sub>/fed increased significantly No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup>, plant height (cm), spike length (cm), biological yield (kg/fed), grain yield (kg/fed), straw yield (kg/fed) and kernels phosphorous content % in the both seasons. In general, the higher phosphorous fertilizer rate (30 kg P<sub>2</sub>O<sub>5</sub>/fed) was more effective in increasing values of all studied traits, also, produced the greatest grain yield/fed and proved significantly superior to other phosphorous fertilizer rates. The phosphorous fertilizer treatments of 15 and 30 kg P<sub>2</sub>O<sub>5</sub>/fed significantly increased grain yield/fed of wheat by 9.52 and 13.73 % in the first season, respectively, and by 8.30 and 14.76 % in the second season, respectively when compared to without phosphorous fertilizer added. These results showed the importance of P as an important nutritive element for wheat. Similar results were also obtained by Abdul Galil *et al.*, 2003; Shafshak *et al.*, 2003; Abd El-Maaboud *et al.*, 2006; Al-Afandy *et al.*, 2007 Khan *et al.*, 2008; and Jelic *et al.*, 2015. The results in Table 2 and 3 also show that No. of kernels/spike, kernels weight/spike (g), 1000-kernel weight (g), harvest index (%), kernels nitrogen content % and kernels protein yield (kg/fed) showed no significant change.

**Effect of wheat cultivars:**

Results presented in Tables 2 and 3 revealed that the differences between the studied three cultivars, i.e. Gemmeiza 9, Sakha 93 and Giza 168 in all growth traits, yield, its components and chemical properties in the both seasons were significant except, biological yield kg/fed, kernels nitrogen content % and kernels phosphorous content % were not significant. These results revealed that Gemmeiza 9 cultivar recorded the greatest values of plant

height (114.79 and 117.21 cm), spike length (14.43 and 14.61 cm), 1000-kernel weight (46.27 and 47.93 g), kernels weight/spike (3.113 and 3.327), grain yield (2362.50 and 2523.33 kg /fed), harvest index (42.75 and 42.14 %) and kernels protein yield (265.69 and 284.64 kg /fed) in the first and second seasons, respectively. The three tested cultivars could be arranged in a descending order with regard to the previous traits as follows, Gemmeiza 9, Sakha 93 and Giza 168. However, results may reveal the superiority of Sakha 93 cultivar in No. of kernels/spike (68.73 and 70.96 kernels) in the first and second seasons, respectively. Moreover, Giza 168 cultivar gave the highest values of No. of tillers/m<sup>2</sup> (625.21 and 641.31 tillers), No. of spikes/m<sup>2</sup> (429.35 and 467.02 spikes) and straw yield (3587.08 and 3977.50 kg/fed) in the first and second seasons, respectively. These differences may be due to the genetic differences between the three cultivars. Also, the differences in 1000-kernel weight might be attributed to the variation in translocation rate of photosynthetic from leaves to the storing organs, i.e. the grain. The superiority of Gemmeiza 9 cultivar in grain yield over the other wheat cultivars might be due to the increase in growth and yield components, namely, plant height, spike length, kernels weight/spike, 1000-kernel weight. These results are in harmony with those reported by Abdul Galil *et al.*, 2003; Abd El-Maaboud *et al.*, 2006; Benin *et al.*, 2012; Gomaa *et al.*, 2012; Hafez *et al.*, 2012; Zaki *et al.*, 2012; Ashmawy *et al.*, 2013; Nouredin *et al.*, 2013; Sultana *et al.*, 2013; Khalid *et al.*, 2014; El-Hosary *et al.*, 2015, Jelic *et al.*, 2015 and Mehasen *et al.*, 2015.

**Interactions effect:**

**The interaction effect between nitrogen and phosphorous fertilization rates:**

Data in Tables, 2 and 3 showed that the interaction between nitrogen and phosphorous fertilization rates were significant on No. of tillers/m<sup>2</sup>, No. of

spikes/m<sup>2</sup>, plant height (cm), No. of kernels/spike, kernels weight/spike (g), 1000-kernel weight (g), biological yield (kg/fed), grain yield (kg/fed), straw yield (kg/fed) and kernels protein yield (kg/fed). The results illustrated in Table, 4 showed that the highest values of biological yield (6873.33 and 7390.00 kg/fed), straw yield (4253.33 and 4516.67 kg/fed), grain yield (2620.00 and 2873.33 kg/fed) and kernels protein yield (311.08 and 343.12 kg/fed) were recorded from wheat plants which fertilized by 112.5 kg N and 30 kg P<sub>2</sub>O<sub>5</sub>/fed. Such results are in accordance with those obtained by Shafshak *et al.*, 2003; Abd El-Maaboud *et al.*, 2006; Al-Afandy *et al.*, 2007 Khan *et al.*, 2008; and Jelic *et al.*, 2015.

#### **The interaction effect between nitrogen fertilizer rates and wheat cultivars:**

Significant effect of the interaction between nitrogen fertilizer rates and wheat cultivars obtained for almost growth, yield and yield components of wheat namely, No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup>, plant height (cm), spike length (cm), No. of kernels/spike, kernels weight/spike (g), 1000-kernel weight (g), biological yield (kg/fed), grain yield (kg/fed), straw yield (kg/fed), harvest index (%) and kernels protein yield (kg/fed) (Tables, 2 and 3). The results in Table, 4 showed that Gemmeiza 9 which fertilized by 112.5 kg N/fed recorded significantly the highest values of biological yield (6816.66 and 7216.66 kg/fed), grain yield (2863.33 and 3013.33 kg/fed) and kernels protein yield (335.72 and 353.83 kg/fed) in the first and second seasons, respectively, Whereas, Giza 168 under the same nitrogen fertilizer rate gave the greatest straw yield (4360.00 and 4683.33 kg/fed) in the first and second seasons, respectively. Similar results were also reported by Allam 2005; Abd El-Maaboud *et al.*, 2006; Benin *et al.*, 2012; Gomaa *et al.*, 2012; Hafez *et al.*, 2012; Zaki *et al.*, 2012; Ashmawy *et al.*, 2013; Nouredin *et al.*, 2013; Sultana *et al.*, 2013; Khalid *et al.*, 2014; El-Hosary *et al.*, 2015, Jelic *et al.*, 2015 and Mehasen *et al.*, 2015.

#### **The interaction effect between phosphorous fertilizer rates and wheat cultivars:**

The interaction effect between phosphorous fertilizer rates and wheat cultivars were significant on No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup>, plant height (cm), biological yield (kg/fed), grain yield (kg/fed), straw yield (kg/fed) and kernels protein yield (kg/fed) (Tables, 2 and 3). The results in Table, 4 showed that Gemmeiza 9 which fertilized by 30 kg P<sub>2</sub>O<sub>5</sub>/fed recorded significantly the greatest values of biological yield (5760.00 and 6247.50 kg/fed), grain yield (2477.50 and 2672.50 kg/fed) and kernels protein yield (282.44 and 305.27 kg/fed) in the first and second seasons, respectively, Whereas, Giza 168 under the same phosphorous fertilizer rate gave the maximum straw yield (3687.50 and 4112.50 kg/fed) in the first and second seasons, respectively. Similar results were also reported by Abdul Galil *et al.*, 2003; Abd El-Maaboud *et al.*, 2006 and Jelic *et al.*, 2015.

#### **The interaction effect between nitrogen, phosphorous and wheat cultivars:**

Significant effect of the interaction between nitrogen and phosphorous fertilizer rates as well as wheat cultivars obtained for some growth, yield and yield components of wheat namely, No. of tillers/m<sup>2</sup>, No. of spikes/m<sup>2</sup>, plant height (cm), biological yield (kg/fed), grain yield (kg/fed), straw yield (kg/fed) and kernels protein yield (kg/fed) in the both seasons (Tables, 2 and 3). The results illustrated in Table, 5 indicated that planting Gemmeiza 9 wheat cultivar which fertilized by 112.5 kg N and 30 kg P<sub>2</sub>O<sub>5</sub>/fed recorded the maximum values of biological yield (6970.00 and 7450.00 kg/fed), grain yield (2920.00 and 3150.00 kg/fed) and kernels protein yield (343.70 and 372.57 kg/fed). Whereas, Giza 168 under the same nitrogen and phosphorous fertilizer rates gave the highest straw yield (4480.00 and 4850.00 kg/fed) in the first and second seasons, respectively. Such results are in accordance with those obtained by Abd El-Maaboud *et al.*, 2006 and Jelic *et al.*, 2015.



**Effect of nitrogen and phosphorous fertilization on some wheat .....**

**Table, 4: Effect of the interaction between (nitrogen X phosphorous), (nitrogen X cultivars) and (phosphorous X cultivars) on straw yield kg/fed, grain yield kg/fed, biological yield kg/fed and kernels protein yield kg/fed of wheat during 2011/2012 and 2012/2013 seasons.**

Treatments		Straw yield kg/fed		Grain yield kg/fed		Biological yield kg/fed		Protein yield kg/fed	
		2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
N	P	The interaction effect between nitrogen and phosphorous fertilization							
0	0	2326.67	2566.67	1153.33	1325.00	3480.00	3891.67	121.68	141.31
	15	2436.67	2743.33	1446.67	1556.67	3883.34	4300.00	155.68	168.41
	30	2566.67	2813.33	1551.67	1741.67	4118.34	4555.00	169.99	192.40
37.5	0	3070.00	3406.67	1843.33	1993.33	4913.33	5400.00	205.10	223.60
	15	3241.67	3583.33	2040.00	2208.33	5281.67	5791.66	233.03	254.90
	30	3346.67	3720.00	2123.33	2413.33	5470.00	6133.33	245.09	279.52
75	0	3516.67	3916.67	2226.67	2456.67	5743.34	6373.34	257.52	285.10
	15	3630.00	4053.33	2358.33	2616.67	5988.33	6670.00	274.90	306.50
	30	3726.67	4150.00	2443.33	2693.33	6170.00	6843.33	286.62	316.86
112.5	0	3983.33	4273.33	2460.00	2696.67	6443.33	6970.00	289.13	317.87
	15	4150.00	4416.67	2570.00	2793.33	6720.00	7210.00	303.97	331.97
	30	4253.33	4516.67	2620.00	2873.33	6873.33	7390.00	311.08	343.12
L.S.D. at 5%		103.52	138.92	92.50	111.82	246.30	285.04	17.55	20.08
N	V	The interaction effect between nitrogen fertilization and wheat cultivars							
0	Gemmeiza 9	2240.00	2483.33	1600.00	1745.00	3840.00	4228.33	166.90	183.41
	Sakha 93	2416.67	2660.00	1490.00	1556.67	3906.67	4216.67	160.09	168.76
	Giza 168	2673.33	2980.00	1061.67	1321.67	3735.00	4301.67	117.70	147.81
37.5	Gemmeiza 9	2993.33	3346.67	2300.00	2491.67	5293.33	5838.34	259.84	282.49
	Sakha 93	3203.33	3486.67	2056.67	2183.33	5260.00	5670.00	231.88	248.65
	Giza 168	3461.67	3876.67	1650.00	1940.00	5111.67	5816.67	190.08	225.47
75	Gemmeiza 9	3470.00	3826.67	2686.67	2843.33	6156.67	6670.00	309.65	328.03
	Sakha 93	3550.00	3923.33	2360.00	2616.67	5910.00	6540.00	274.02	305.46
	Giza 168	3853.33	4370.00	1981.67	2306.67	5835.00	6676.67	234.16	273.87
112.5	Gemmeiza 9	3953.33	4203.33	2863.33	3013.33	6816.66	7216.66	335.72	353.83
	Sakha 93	4073.33	4320.00	2526.67	2860.00	6600.00	7180.00	297.26	337.61
	Giza 168	4360.00	4683.33	2260.00	2490.00	6620.00	7173.33	270.52	300.32
L.S.D. at 5%		393.04	469.88	335.04	366.56	472.30	535.02	17.00	17.52
P	V	The interaction effect between phosphorous fertilization and wheat cultivars							
0	Gemmeiza 9	3022.50	3347.50	2202.50	2351.25	5225.00	5698.75	244.31	261.61
	Sakha 93	3167.50	3462.50	1962.50	2132.50	5130.00	5595.00	219.92	240.80
	Giza 168	3482.50	3812.50	1597.50	1870.00	5080.00	5682.50	182.93	215.84
15	Gemmeiza 9	3187.50	3472.50	2407.50	2546.25	5595.00	6018.75	270.61	287.66
	Sakha 93	3315.00	3617.50	2140.00	2310.00	5455.00	5927.50	243.72	264.66
	Giza 168	3591.25	4007.50	1763.75	2025.00	5355.00	6032.50	205.09	237.20
30	Gemmeiza 9	3282.50	3575.00	2477.50	2672.50	5760.00	6247.50	282.44	305.27
	Sakha 93	3450.00	3712.50	2222.50	2470.00	5672.50	6182.50	254.63	284.96
	Giza 168	3687.50	4112.50	1853.75	2148.75	5541.25	6261.25	217.24	253.53
L.S.D. at 5%		340.38	406.93	290.15	317.45	409.02	463.34	14.72	15.18

**Table, 5: Effect of the interaction between nitrogen, phosphorous and cultivars on straw yield kg/fed, grain yield kg/fed, biological yield kg/fed and kernels protein yield kg/fed of wheat during 2011/2012 and 2012/2013 seasons.**

Treatments			Straw yield kg/fed		Grain yield kg/fed		Biological yield kg/fed		Protein yield kg/fed	
N	P	V	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
0	0	Gemmeiza 9	2090.00	2400.00	1360.00	1525.00	3450.00	3925.00	138.22	156.73
		Sakha 93	2280.00	2490.00	1250.00	1300.00	3530.00	3790.00	132.88	138.94
		Giza 168	2610.00	2810.00	850.00	1150.00	3460.00	3960.00	92.30	126.84
	15	Gemmeiza 9	2280.00	2490.00	1690.00	1800.00	3970.00	4290.00	175.61	188.07
		Sakha 93	2400.00	2710.00	1530.00	1550.00	3930.00	4260.00	164.39	167.42
		Giza 168	2630.00	3030.00	1120.00	1320.00	3750.00	4350.00	124.81	147.85
	30	Gemmeiza 9	2350.00	2560.00	1750.00	1910.00	4100.00	4470.00	188.03	206.31
		Sakha 93	2570.00	2780.00	1690.00	1820.00	4260.00	4600.00	183.51	200.74
		Giza 168	2780.00	3100.00	1215.00	1495.00	3995.00	4595.00	136.78	169.15
37.5	0	Gemmeiza 9	2800.00	3160.00	2100.00	2270.00	4900.00	5430.00	232.82	252.96
		Sakha 93	3090.00	3330.00	1890.00	1990.00	4980.00	5320.00	207.38	221.76
		Giza 168	3320.00	3730.00	1540.00	1720.00	4860.00	5450.00	174.24	195.59
	15	Gemmeiza 9	3030.00	3340.00	2350.00	2505.00	5380.00	5845.00	267.23	286.28
		Sakha 93	3220.00	3510.00	2100.00	2170.00	5320.00	5680.00	238.80	249.24
		Giza 168	3475.00	3900.00	1670.00	1950.00	5145.00	5850.00	192.57	228.52
	30	Gemmeiza 9	3150.00	3540.00	2450.00	2700.00	5600.00	6240.00	280.00	308.88
		Sakha 93	3300.00	3620.00	2180.00	2390.00	5480.00	6010.00	250.38	275.87
		Giza 168	3590.00	4000.00	1740.00	2150.00	5330.00	6150.00	203.81	253.07
75	0	Gemmeiza 9	3350.00	3730.00	2550.00	2710.00	5900.00	6440.00	291.57	310.33
		Sakha 93	3410.00	3820.00	2280.00	2450.00	5690.00	6270.00	262.00	283.63
		Giza 168	3790.00	4200.00	1850.00	2210.00	5640.00	6410.00	217.86	260.63
	15	Gemmeiza 9	3480.00	3850.00	2720.00	2890.00	6200.00	6740.00	312.41	333.58
		Sakha 93	3540.00	3900.00	2380.00	2640.00	5920.00	6540.00	277.42	309.24
		Giza 168	3870.00	4410.00	1975.00	2320.00	5845.00	6730.00	233.59	275.72
	30	Gemmeiza 9	3580.00	3900.00	2790.00	2930.00	6370.00	6830.00	325.22	340.53
		Sakha 93	3700.00	4050.00	2420.00	2760.00	6120.00	6810.00	282.91	323.92
		Giza 168	3900.00	4500.00	2120.00	2390.00	6020.00	6890.00	250.98	285.40
112.5	0	Gemmeiza 9	3850.00	4100.00	2800.00	2900.00	6650.00	7000.00	327.34	337.38
		Sakha 93	3890.00	4210.00	2430.00	2790.00	6320.00	7000.00	284.92	328.08
		Giza 168	4210.00	4510.00	2150.00	2400.00	6360.00	6910.00	254.78	287.14
	15	Gemmeiza 9	3960.00	4210.00	2870.00	2990.00	6830.00	7200.00	336.18	351.94
		Sakha 93	4100.00	4350.00	2550.00	2880.00	6650.00	7230.00	300.15	340.63
		Giza 168	4390.00	4690.00	2290.00	2510.00	6680.00	7200.00	274.77	302.59
	30	Gemmeiza 9	4050.00	4300.00	2920.00	3150.00	6970.00	7450.00	343.70	372.57
		Sakha 93	4230.00	4400.00	2600.00	2910.00	6830.00	7310.00	306.63	344.35
		Giza 168	4480.00	4850.00	2340.00	2560.00	6820.00	7410.00	282.10	311.54
L.S.D. at 5 %			680.76	813.86	580.31	634.90	818.05	926.68	29.44	30.35

## **CONCLUSION**

From the obtained results of this study it could be concluded that planting wheat Gemmeiza 9 cultivar with fertilizing by 30 kg P<sub>2</sub>O<sub>5</sub> with 112.5 kg N/fed in order to maximizing its productivity.

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## تأثير السماد النيتروجيني والفوسفاتي على إنتاجية بعض أصناف القمح

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### الملخص العربي

أجريت تجربتان حقليتان في مركز سيدي سالم . محافظة كفر الشيخ . جمهورية مصر العربية، خلال الموسمين الشتويين المتعاقبين 2012/2011 و 2013/2012 لدراسة تأثير أربع معدلات من السماد النيتروجيني (0 - 37,5 - 75 و 112,5 كجم/ن/فدان) و ثلاثة معدلات من السماد الفوسفاتي (0 - 15 و 30 كجم فوراً/5) على صفات النمو والمحصول ومكوناته وبعض الصفات الكيميائية لثلاثة أصناف من القمح ( جميزة 9 - سخا 93 و جيزة 168). وكان التصميم التجريبي المستخدم هو قطع منشقة مرتان في أربع مكررات.

وتتلخص أهم النتائج على النحو التالي:-

لقد زادت كل الصفات المدروسة (عدد الأشرطة/م<sup>2</sup>، عدد السنابل/م<sup>2</sup>، إرتفاع النبات (سم)، طول السنبل (سم)، عدد حبوب السنبل، وزن 1000 حبة (جم) ووزن حبوب السنبل (جم)، المحصول البيولوجي كجم/فدان، محصول الحبوب كجم/فدان، محصول القش كجم/فدان، دليل الحصاد (%، محتوى الحبوب من النيتروجين (% و محصول البروتين كجم/فدان في كلا الموسمين) معنوياً بزيادة معدلات السماد النيتروجيني ما عدا محتوى الحبوب من الفوسفور لم تتأثر معنوياً. إضافة السماد النيتروجيني بمعدل 112,5 كجم نيتروجين /فدان أعطى أفضل قيم في الصفات السابقة.

زيادة معدلات السماد الفوسفاتي إلى 30 كجم فوراً/5 أحدثت زيادة معنوية في عدد الأشرطة/م<sup>2</sup>، عدد السنابل/م<sup>2</sup>، إرتفاع النبات، طول السنبل، المحصول البيولوجي/فدان، محصول الحبوب/فدان، محصول القش/فدان و محتوى الحبوب من الفوسفور في كلا الموسمين، بينما عدد حبوب السنبل، وزن 1000 حبة، وزن حبوب السنبل، دليل الحصاد، محتوى الحبوب من النيتروجين و محصول البروتين/فدان لم تتأثر معنوياً بزيادة السماد الفوسفاتي.

أوضحت النتائج أن الإختلافات بين الأصناف كانت معنوية في جميع الصفات المدروسة خلال موسمي الزراعة ما عدا المصلوب البيولوجي/فدان، محتوى الحبوب من النيتروجين و محتوى الحبوب من الفوسفور. تفوق الصنف جميزة 9 على الصنفان سخا 93 و جيزة 168 في قيم صفات إرتفاع النبات، طول السنبل، وزن 1000 حبة، وزن حبوب السنبل، محصول الحبوب/فدان، دليل الحصاد و محصول البروتين/فدان في كلا الموسمين. بينما سجل الصنف سخا 93 أعلى القيم في صفة عدد حبوب السنبل. أما الصنف جيزة 168 تفوق في صفات عدد الأشرطة/م<sup>2</sup>، عدد السنابل/م<sup>2</sup> و محصول القش/فدان.

المعاملات (112,5 كجم ن/فدان X 30 كجم فوراً/5 فدان)، (112,5 كجم ن/فدان X جميزة 9) (30 كجم فوراً/5 فدان X جميزة 9) و (112,5 كجم ن/فدان X 30 كجم فوراً/5 فدان X جميزة 9) حققت معنوياً أعلى محصول حبوب مقارنة بالمعاملات الأخرى في كلا الموسمين.

توصي النتائج بزراعة الصنف جميزة 9 والتسميد بالسماد الفوسفاتي بمعدل 30 كجم فوراً/5 فدان و 112,5 كجم ن/فدان حيث عظمت إنتاجية محصول الحبوب بوحدة المساحة.