J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 3 (4): 429 - 441, 2012

EFFECT OF NITROGEN FERTILIZATION LVELS ON PHOSPHORUS ABSORPTION BY SOME WHEAT VARIETIES IN NORTHERN DELTA REGION

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ABSTRACT

A field experiment was conducted at Sakha Agricultural Research Station farm, Kafr El-Sheikh Governorate, Egypt during 2008/2009 winter season to assess the effect of nitrogen fertilization levels on P absorption by some wheat (*Triticum aestivum* L.) varieties. Split plot design with four replicates was applied, the main plots were assigned by four wheat varieties, Gimiza 9, Sakha 61, Sakha 93 and Giza168. The subplots were assigned by four nitrogen levels of 0, 30, 60 and 90 kg N fed.$^{-1}$ (ha = 2.4 fed.). Eight plant samples were collected during the growth periods to determine the daily increase of dry plant weight, N%, and P% in dry matter, P uptake during the growing periods and P/N ratio during the physiological stages.

The obtained results can be summarized as follow:

- Wheat plant absorbed phosphorus nutrient rabidly than nitrogen in the first stage (0-30) days.
- P% concentration was approximately higher 3.3 folds in the first stage than the second stage and 4.8 folds than the final stage.
- There are a positive relationship between phosphorus absorption and temperature degrees,
- The mean values of P% concentration of the used varieties arranged according to the following order : Giza 168 > Sakha 93 > Sakha 61 > Gimia 9.
- Phosphorus percentage increased highly significant by increasing nitrogen levels up to 90 kg N/ fed.
- P uptake increased highly significant to reach its maximum at fifth stage (61-69) days from sawing (middle of plant age).
- The mean values of P uptake of the used varieties arranged in the following order: Giza 168 > Sakha 61 > Gimiza 9 > Sakha 93
- The mean values of P uptake increased from0.036 mg/plant/day to 0.053, 0.061 and 0.065 mg/plant/day as nitrogen levels increased from N_0, to N_{30}, N_{60} and N_{90} respectively.
- The highest mean value of P/N ratio (0.067) was obtained at the first stage (0-30).
- Increasing nitrogen fertilizer levels from N_0 to N_{30}, N_{60} and N_{90} led to decrease P/N ratio, from 0.056 to .044, 0.041 and 0.040, respectively.
- Increasing wheat yield was associated with decreasing P/N ratio.

Keywords: Wheat varieties, N fertilization levels, P%, P uptake and P/N ratio.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereals used as a food grain in the world. It ranks first in the world cereal production and is a staple food of about one third of the world's population (Abd Allah and El-Gammaal, 2009). There are many factors influencing the yield of wheat. Fertilizers play a pivotal role in increasing yield and improving the quality of crops. Knowledge of wheat nutrients requirements and uptake capacities are

therefore fundamental to the development of improved nutrients management on wheat, just as they are for other crops (Baethgen and Alley, 1989; and Peng and Cassman, 1998).

Results of many researchers that achieved in Egypt revealed that nitrogen fertilizer levels significantly affected most of plant growth traits, yield and its component. The optimum nitrogen fertilizer level for wheat vary widely in amounts ranged between 70 and 120 kg N fed.$^{-1}$ according to environmental conditions (Atta Allah and Mohammed, 2003; Tammam and Tawfils, 2004; Salem, 2005; Mowafy, 2008; and Mansour and Bassiouny, 2009). Application of very high nitrogen rate can reduce grain yield by increasing lodging and disease incidence.

Phosphorus plays a vital role in crop production and is involved in energy transfer in plants. Carbon dioxide fixation by plants would never be possible without phosphorus. Many plant physiological functions such as utilization of sugar, starch, photosynthesis, energy storage and transfer are dependent on phosphorus. It is also a constituent of cell nucleus and is essential for cell division and development of meristematic tissues (Tisdale *et al.*, 1985). Phosphorus has been reported to increase the strength of cereal straw, stimulate root development, promote flowering, fruit production, formation of seed and hasten maturity of the crops (Gupta, 2003). Besides, it improves the quality of certain fruits, vegetables and grain crops and increase their resistance to diseases and adverse conditions. Ali *et al.*, (1997) reported that P application resulted in a significant increase in number of tillers, plant height, number of grains per spickle, 1000 grain weight, and grain yield. Plants need P throughout their life cycle, but especially during early growth stages. Cereals, for example, rely heavily on the P taken up in the first 4 weeks of growth for crop establishment, tillering and final yield. Zahedifar *et al.* (2011).

Phosphorous is relatively immobile (moves very little) in the soil. Thus, it will not leach like nitrogen and sulphur or be carried to plant roots by soil water. Furthermore, P from phosphate fertilizer will readily react with soil minerals making it less plant available. When granular phosphate fertilizer is added to moist soil, it quickly dissolves releasing orthophosphate ions to the soil solution. Over time these ions react with calcium and other ions forming less plant available P compounds (Mashali, *et al.* 1995). P concentration in soil solution is typically very low, making less than 0.01% of total soil P available to plants (Gallaher, 2007; Mengel and Kirkby, 2001). P availability is dependent on several factors, soil texture, calcium carbonate content, soil temperature, soil moisture, soil pH, plant root type, microorganisms and others discharge acids into the soil.

Knowledge about phosphorus demands of wheat plants at different growth stages is important in scheduling the fertilizer application.

The present study aim to investigate the relationships between nitrogen fertilization levels and phosphorus percentage & P uptake during the growth stage periods. The relationships between P/N ratio and grain yield of four wheat varieties were also investigated.

MATERIALS AND METHODS

A field experiment was conducted at Sakha Agricultural Research Station farm during the winter season of 2008/2009 to study the effect of nitrogen fertilization on absorption of phosphorus by some wheat (*Triticum aestivum* L.) varieties at Northern Delta region ($31^{o}05'$ N latitude and $30^{o}56'$ E longitude). Four wheat varieties were used, Gemiza 9, Sakha 61, Sakha 93 and Giza 168. The experimental soil was prepared by suitable plowing and land leveler. The recommended grains weight from each wheat variety (60 kg fed.$^{-1}$) were sown by seed planter 20 cm between the lines on 19th November 2008. Split plot design was used with four replicates. The main plots were randomly assigned by the four wheat varieties and the sub plots were randomly assigned by four nitrogen levels of zero (N_0), 30 kg N fed.$^{-1}$ (N_{30}), 60 kg N fed.$^{-1}$ (N_{60}) and 90 kg N fed.$^{-1}$ (N_{90})(ha.=2.4 fed.). The subplot area was 12 m^2, 3 m in width (15 wheat lines), and 4 m in length. The previous crop was corn. Phosphorus fertilization was added at the rate of 15.5 kg P_2O_5 fed^{-1} in the form of single superphosphate 15.5 % P_2O_5 during the soil preparation (P_2O_5 = 2.29 x P). Potassium fertilization was added at the rate of 24 kg K_2O fed.$^{-1}$ at one dose with the first irrigation in the form of potassium sulphate 48% K_2O (K_2O = 1.2 x K). Nitrogen fertilization was added in two equal doses with the first and second irrigations (24/12/2009 and 21/1/2009) in the form of urea 46.5% N. Composite soil sample was collected from the experimental soil, prepared to determine some soil properties according to Black *et al.* (1965). Some physical and chemical characteristics are presented in Table (1). Eight plant samples (whole plant) were collected from each sub plot during the main stages of growth period i.e, 30, 40, 61, 69, 83, 97 and 111 days from sowing. The samples were constant number of plants from each plot (4 plants). The plant samples were washed thoroughly by the distilled water. After the washing water lost the fresh plant weight was detected. The samples were oven dried at 70^{o}C for 24 hours. The dry plant weight was determined. Crop growth rate (CGR) defined as the dry matter increase with time was noticed according to Radford (1965) using the formula:

$$\mathbf{CGR = (W_2-W_1)/(T_2-T_1)\ g/plant/day}$$

Where, W_1, W_2, refer to total dry weigh (g/plant) at times, T_1, T_2 days, respectively. Plant samples were wet digested using sulphuric and perchloric acids, total nitrogen was determined in the plant samples digestion by the microkjldahel method according to Jackson (1967). Phosphorus was determined using spectrophotometer. Phosphorus uptake was calculated by multiplying the element concentration by the dry matter as follow:

$$\text{Phosphorus uptake (g)} = \frac{\text{phosphorus \% x CGR}}{100}\text{(g)}$$

The obtained results were statistically analyzed using MSTATC computer program. The maximum and optimum daily temperature degrees were calculated and the mean of the growth periods was estimated.

Table 1: Some physical and chemical soil properties of the experimental site.

Particle size distribution			Texture	pH*	EC** dSm^{-1}	O.M. %	Available nutrients mg kg^{-1}		
Sand %	Silt %	Clay %					N	P	K
4.9	33.1	62.0	Clayey	8.0	0.53	1.87	21.0	5.5	200

*** pH in 1:2:5 soil: water suspension**
**** EC in 1:5 soil water extract**

Table 2: The mean temperature degrees of days during growth periods.

Temperature degrees	Temperature degrees during growth periods °C							
	0-30	30-40	40-50	50-61	61-69	69-83	83-97	97-111
Maximum	26.4	18.4	20.4	21.2	21.3	23.3	18.9	23.3
Optimum	6.9	7.5	6.4	7.7	6.9	8.1	6.6	8.5
Mean	15.1	12.9	13.4	14.5	14.1	15.7	12.8	15.9

RESULTS AND DISCUSSION

1**-Phosphorus percentage (P%)**

Data presented in Table (3) and Fig.1 show the P% concentration during the growth stages from (0-30) days to,(30-40), (40-50), (50-61), (61-69), (69-83), (83-97) and (97-111) days. A highly significant effects decrease were obtained from the first stage to the second, increase from the second to the third, decrease from the third to the fourth ,increase from the fourth to fifth and again decrease until the final stages. The mean values of P% decreased from 0.278 % to, 0.085, 0.113, 0.091, 0.094, 0.074, 0.059, 0.058, respectively. The P% concentration in the first stage was approximately 3.3 folds than the second and 4.8 folds than the final stage. With respect to Table 2 the mean values of temperature degrees decreased from 15.1^{o}C at the first stage to 12.9^{o}C at the second stage and again increased to 13.4^{o}C at the third stage.

Data in Table 2 and 3 show that there are a positive relationship between phosphorus absorption and temperature degrees, where phosphorus absorption increased at the final stage (97-111) from 0.052, 0.062 and 0.056 to 0.055, 0.063 and 0.057 when Gimiza 9, Sakha 61and Giza 168 were used respectively. At this time temperature degrees increased from 12.8 to 15.9. Mengel and Kirkby (2001) showed that vigorous growth after tillering causes a dramatic reduction in the mineral concentration of wheat plant due to dilution but it increases significantly at the end of growth stage. It is clear from Table 3 and Fig 1 that the wheat plant was absorbed phosphorus nutrient in the first stage very highly than the other stages. These results reveal to the importance of phosphorus addition at the early time of plant growth due to, at first to effect of time on availability of soil P (Mashali, *et al.* 1995) and at second to effect of temperature degrees (Grant, *et al.*, 2001). The mechanism for growth impairment by early season P deficiency may relate to restrictions in carbon (C) nutrition of the plant. In field-grown corn, P deficiency slows the rate of leaf appearance and leaf

size, particularly in the lower leaves. The effects of reduced leaf growth and solar radiation interception on C nutrition of the plant caused by P deficiency may reduce subsequent nodal root emergence, which would have an additional impact on P uptake capacity (Grant *et al.*, 2001). The mean values of the used varieties can be arranged according to the following order : Giza 168 > Sakha 93 > Sakha 61 > Gimia 9. Similar results were reported by Zahedifar *et al.* (2011). Where they stated that phosphorus concentration was generally at maximum in the early growth stages followed by a significant decrease until ripening stage.

Table 3: Effect of wheat varieties on P% during the growth periods.

Treatments	P% during growth periods (day)								
	0-30	30-40	40-50	50-61	61-69	69-83	83-97	97-111	Mean
Gimiza 9	0.230	0.081	0.110	0.088	0.097	0.080	0.052	0.055	0.099
Sakha 61	0.250	0.099	0.113	0.102	0.096	0.073	0.062	0.063	0.107
Sakha 93	0.300	0.078	0.114	0.084	0.100	0.070	0.064	0.055	0.108
Giza 168	0.330	0.082	0.114	0.089	0.084	0.072	0.056	0.057	0.111
Mean	0.278	0.085	0.113	0.091	0.094	0.074	0.059	0.058	0.106
F. test	**	**	**	**	**	**	**	**	

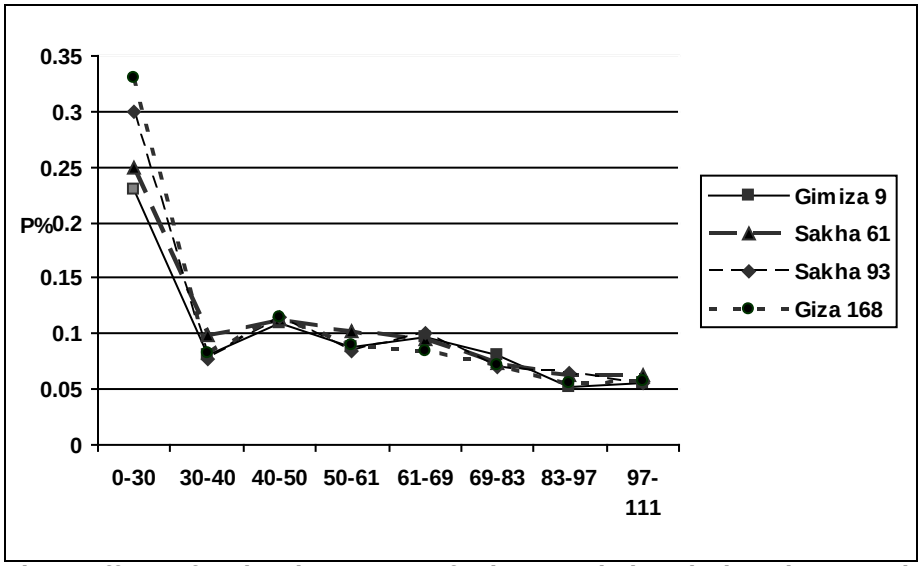

Fig. 1:Effect of N levels on P% of wheat varieties during the growth periods.

Results in Table (4) show that the mean value of P% concentration increased highly significant by increasing nitrogen levels from N_0 to $N_{30,}$ and N_{60} and decreased as N_{90} used. The mean values of P% concentration increased from 0.103 % to 0.108%, 0.108% and decreased to 0.106 % as nitrogen levels increased from N_0 to N_{30}, N_{60} and N_{90} respectively. Holten (2002) indicated that the lower P concentration in control early in the season might be due to a poorly developed root system.

Table 4 P% during the growth periods of wheat varieties.

Treatments	P% during growth periods (day)								
	0-30	30-40	40-50	50-61	61-69	69-83	83-97	97-111	Mean
N_0	0.278	0.075	0.104	0.085	0.094	0.073	0.058	0.059	0.103
N_{30}	0.278	0.093	0.117	0.094	0.094	0.074	0.056	0.060	0.108
N_{60}	0.278	0.087	0.115	0.093	0.089	0.076	0.065	0.058	0.108
N_{90}	0.278	0.086	0.115	0.091	0.100	0.072	0.055	0.053	0.106
Mean	0.278	0.085	0.113	0.091	0.094	0.074	0.059	0.058	0.106
F. test	N. S	**	**	**	**	**	**	**	

Data presented in Table (5) show the interaction between the wheat varieties and N levels which were highly significant in all samples. The mean values of P% concentration of Gimiza 9 decreased from 0.230 % to, 0.081, 0.110, 0.088, 0.097, 0.080, 0.052 and 0.055, respectively during the growth periods from (0-30) days to,(30-40), (40-50), (50-61), (61-69), (69-83), (83-97) and (97-111). The P% concentration in the first stage was approximately 2.8 folds than the second and 4.2 folds than the final stage. The same trend was observed as other varieties (Sakha 61, Sakha 93 and Giza 168) were used. The highest P% value of (0-30) of 0.330 was obtained as Giza 168 was used, but at the second period (30-40) the highest value 0.115 was recorded with Sakha 61. At the third period, the highest value of 0.125 was had as, Giza 16 used. The highest decrease between the first and second stages of 4.2 folds was recorded with Giza 168. These results show that there are a differences between the used varieties along the growth periods. These differences between wheat varieties may be due to the differences in the root volume and the root surface area which encourage the P absorption. Data in Table 5 also show that the highest mean value of 0.112 was obtained Giza 168 as $N_{1,}$ and N_2 was used.

Table 5: Effect of wheat varieties and N levels on P% during the growth periods.

Treatmens		P% during growth periods (day)								
		0-30	**30 -40**	**40-50**	**50-61**	**61-69**	**69-83**	**83-97**	**97-111**	**Mean**
Gimiza 9	N_0	0.230	0.070	0.100	0.080	0.088	0.085	0.049	0.050	0.094
	N_1	0.230	0.090	0.116	0.095	0.098	0.073	0.055	0.055	0.102
	N_2	0.230	0.080	0.113	0.089	0.098	0.085	0.055	0.065	0.102
	N_3	0.230	0.085	0.109	0.088	0.103	0.075	0.048	0.051	0.099
Mean		0.230	0.081	0.110	0.088	0.097	0.080	0.052	0.055	0.099
Sakha61	N_0	0.250	0.088	0.100	0.098	0.101	0.078	0.058	0.070	0.105
	N_1	0.250	0.115	0.118	0.101	0.090	0.063	0.063	0.065	0.108
	N_2	0.250	0.093	0.116	0.100	0.094	0.078	0.073	0.060	0.108
	N_3	0.250	0.100	0.116	0.110	0.100	0.073	0.055	0.058	0.108
Mean		0.250	0.099	0.113	0.102	0.096	0.073	0.062	0.063	0.107
Sakha93	N_0	0.300	0.063	0.111	0.073	0.105	0.064	0.063	0.054	0.104
	N_1	0.300	0.085	0.118	0.085	0.098	0.073	0.056	0.063	0.110
	N_2	0.300	0.080	0.118	0.088	0.085	0.070	0.073	0.051	0.108
	N_3	0.300	0.085	0.110	0.088	0.110	0.073	0.063	0.050	0.110
Mean		0.300	0.078	0.114	0.084	0.100	0.070	0.064	0.055	0.108
Giza 168	N_0	0.330	0.080	0.103	0.088	0.080	0.065	0.063	0.063	0.109
	N_1	0.330	0.080	0.115	0.093	0.088	0.088	0.049	0.055	0.112
	N_2	0.330	0.093	0.113	0.095	0.078	0.070	0.058	0.055	0.112
	N_3	0.330	0.073	0.125	0.078	0.088	0.065	0.055	0.053	0.108
Mean		0.330	0.082	0.114	0.089	0.084	0.072	0.056	0.057	0.111
F. test		**	**	**	**	**	**	**	**	

Data presented in Table (6)and Fig. 2 show the P uptake in plant tissue during growth periods. It is clear from Table (6) and Fig 2 that P uptake increased highly significant to reach its maximum at fifth stage (61-69) days and decreased at the sixth and seventh stages and again increased at the final stage The values increased from 0.019 (mg/plant/day) to 0.039, 0.046, 0.073, and 0.089 (mg/plant/day) and decreased to 0.058 and 0.046 (mg/plant/day) and again increased to 0.060 (mg/plant/day) at (97-111) days. The maximum P uptake obtained at the heading stage (middle of plant age). Table (6) and Fig 2 illustrate that phosphorus nutrition must be at an adequate level in the early stages of plant growth to optimize the yield potential of the wheat crop. There were a highly significant differences in P uptake (mg/plant/day) between the used wheat varieties in the periods of (0-30), (30-40), (40-50), (61-69), (69-83), (83-97) and (97-111). The mean values of P uptake show that the used varieties arranged in the following order: Giza 168 > Sakha 61 > Gimiza 9 > Sakha 93. Giza 168, Sakha 61 and Sakha 93. had the highest P uptake value of 0.117, 0.088 and 0.087 (mg /plant/day) at the period of (61-69) days from sowing. The highest P uptake value 0.077(mg/plant/day) of Gimiza 9 was in the period of (50-61) days.

Table 6: P uptake in the plant tissue during growth periods.

Treatments	P uptake during growth periods ((mg/plant/day)								
	0-30	30-40	40-50	50-61	61-69	69-83	83-97	97-111	Mean
Gimiza 9	0.014	0.043	0.035	0.077	0.063	0.075	0.032	0.076	0.052
Sakha 61	0.017	0.039	0.085	0.066	0.088	0.071	0.044	0.039	0.056
Sakha 93	0.021	0.035	0.040	0.076	0.087	0.028	0.065	0.052	0.051
Giza 168	0.024	0.039	0.025	0.072	0.117	0.059	0.043	0.071	0.056
Mean	0.019	0.039	0.046	0.073	0.089	0.058	0.046	0.060	0.054
F. test	**	**	**	**	**	**	**	**	

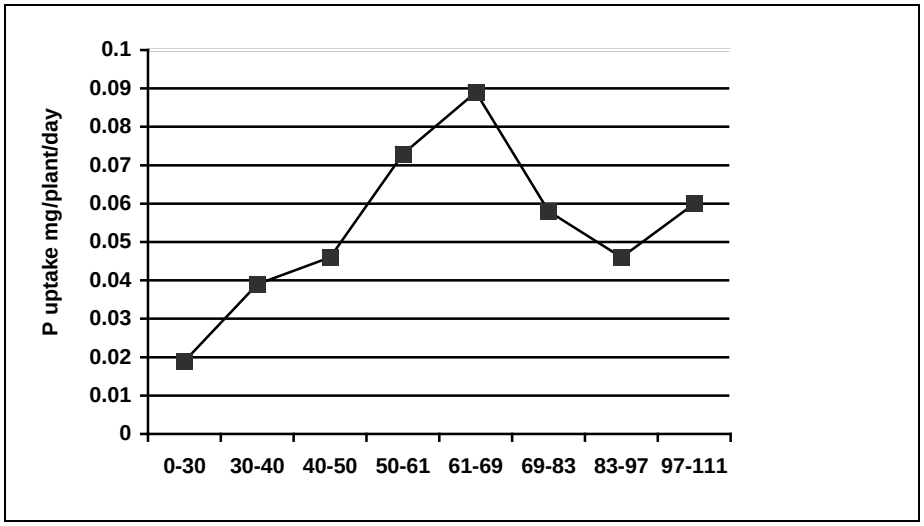

Fig.2: Effect of N levels on P uptake of wheat varieties during the growth periods.

Results in Table (7) show that P uptake of wheat varieties highly significant affected by the nitrogen levels. In most growth periods, P uptake increased as nitrogen levels increased. The mean values increased from0.036 mg/plant/day to 0.053, 0.061 and 0.065 mg/plant/day as nitrogen levels increased from N_0, to N_{30}, N_{60} and N_{90} respectively. It is clear that increase of nitrogen addition enhance P uptake along the growing plant periods. The highest P uptake value (0.089 mg/plant/day) obtained in the period of (61-69) days. This may be due to the increase in vegetative growth

Table 7: P uptake in the plant tissue during growth periods .

Treatments	P uptake during growth periods (mg/plant/day)								
	0-30	30-40	40-50	50-61	61-69	69-83	83-97	97-111	Mean
N_0	0.019	0.026	0.019	0.044	0.069	0.049	0.028	0.033	0.036
N_{30}	0.019	0.040	0.041	0.074	0.086	0.043	0.045	0.078	0.053
N_{60}	0.019	0.043	0.061	0.073	0.093	0.066	0.058	0.072	0.061
N_{90}	0.019	0.047	0.061	0.099	0.107	0.075	0.053	0.056	0.065
Mean	0.019	0.039	0.046	0.073	0.089	0.058	0.046	0.060	0.054
F. test	N.S	**	**	**	**	**	**	**	

Results in Table (8) show the interaction between the wheat varieties and N levels which were highly significant in all the collected samples. The mean values of (0-30), (30-40), (40-50), (50-61), (61-69), (69-83), (83-97) and (97-111) days were 0.014, 0.043, 0.035, 0.077, 0.063, 0.075, 0.032 and 0.076(mg/plant/day), respectively as Gimiza 9 used. The highest value was 0.104 mg/plant/day . It is obtained at the (50-61) days as N_{90} levels used. The mean values of Sakha 61 were 0.017, 0.039, 0.085, 0.066, 0.088, 0.071, 0.044 and 0.039 mg/plant/day, respectively.

Table 8: P uptake in the plant tissue during growth periods.

Treatments		P uptake during growth periods (mg/plant/day)								
		0-30	30 -40	40-50	50-61	61-69	69-83	83-97	97-111	Mean
Gimiza 9	N_0	0.014	0.025	0.014	0.021	0.029	0.071	0.015	0.071	0.032
	N_1	0.014	0.042	0.027	0.094	0.076	0.037	0.029	0.116	0.054
	N_2	0.014	0.049	0.049	0.087	0.083	0.099	0.040	0.070	0.061
	N_3	0.014	0.055	0.051	0.104	0.065	0.093	0.045	0.047	0.059
Mean		0.014	0.043	0.035	0.077	0.063	0.075	0.032	0.076	0.052
Sakha61	N_0	0.017	0.026	0.030	0.068	0.097	0.058	0.024	0.029	0.044
	N_1	0.017	0.043	0.081	0.055	0.079	0.054	0.054	0.035	0.052
	N_2	0.017	0.041	0.106	0.037	0.090	0.081	0.047	0.038	0.057
	N_3	0.017	0.047	0.121	0.103	0.084	0.091	0.050	0.052	0.071
Mean		0.017	0.039	0.085	0.066	0.088	0.071	0.044	0.039	0.056
Sakha93	N_0	0.021	0.023	0.020	0.071	0.043	0.015	0.026	0.006	0.028
	N_1	0.021	0.037	0.040	0.069	0.088	0.023	0.076	0.086	0.055
	N_2	0.021	0.036	0.052	0.070	0.085	0.024	0.096	0.067	0.056
	N_3	0.021	0.043	0.047	0.093	0.131	0.049	0.062	0.048	0.062
Mean		0.021	0.035	0.040	0.076	0.087	0.028	0.065	0.052	0.051
Giza 168	N_0	0.024	0.031	0.010	0.014	0.106	0.052	0.047	0.026	0.039
	N_1	0.024	0.038	0.014	0.078	0.102	0.059	0.021	0.074	0.051
	N_2	0.024	0.046	0.035	0.099	0.112	0.059	0.049	0.111	0.067
	N_3	0.024	0.042	0.039	0.096	0.148	0.065	0.054	0.075	0.068
Mean		0.024	0.039	0.025	0.072	0.117	0.059	0.043	0.071	0.056
Average		0.019	0.039	0.046	0.073	0.089	0.058	0.046	0.060	0.054
F. test		**	**	**	**	**	**	**	**	

The highest value 0.121 mg/plant/day obtained at the (40-50) days as N_{90} levels used. On the hand the highest value of Sakha 93 and Giza 168 (0.131 and 0.148 mg/plant/day) were recorded at (61-69) days. These results reveal that Sakha 61 reached to maximum P uptake early than Gimiza 9 whose reached there maximum P uptake than Sakha93 and Giza 168. The average of results at table 8 show that P uptake reached its maximum values at (61-69) days and decreased to 0.058 and0.046 and again increased to 0.060 mg/plant/day. Antoun *et al.* (2010) stated that increasing the rate of applied nitrogen fertilizer up to 100 Kg/fed. gradually increased the amount of NPK uptake . This might be attributed to the role of nitrogen nutrient in increasing the root surface unit of soil volume and the high capacity of the plant supplied with N in building metabolites, which increase the dry matter content and subsequently increase nutrients uptake by wheat plant.

3- K/N Ratio

Data presented in Table (9) and Fig. 3 show that there were highly significant differences in P/N ratio at long of different growth stages. Where the mean values decreased from 0.067 to.025 and increased to 0.042 and decreased to 0.033 at the stage of (50-61) and so on. The mean of P/N ratio increased at the final stage as shown in Fig. 3.

Table 9: P/N 0ratio in the plant tissue during growth periods.

Varieties	P/N ratio during growth periods (day)									Yield Kg/fed
	0-30	30-40	40-50	50-61	61-69	69-83	83-97	97-111	Mean	
Gimiza 9	0.062	0.024	0.037	0.029	0.050	0.058	0.036	0.053	0.044	1765.1
Sakha 61	0.063	0.027	0.039	0.037	0.049	0.044	0.037	0.054	0.044	1628.6
Sakha 93	0.067	0.025	0.047	0.031	0.051	0.056	0.033	0.052	0.046	1286.3
Giza 168	0.074	0.023	0.044	0.035	0.051	0.060	0.032	0.050	0.046	1596.0
Mean	0.067	0.025	0.042	0.033	0.050	0.055	0.035	0.052	0.045	1569.0
F. test	---	**	**	**	**	**	**	**		
L.S.D. 0.5	---	0.038	0.046	0.060	0.071	0.075	0.057	0.088		

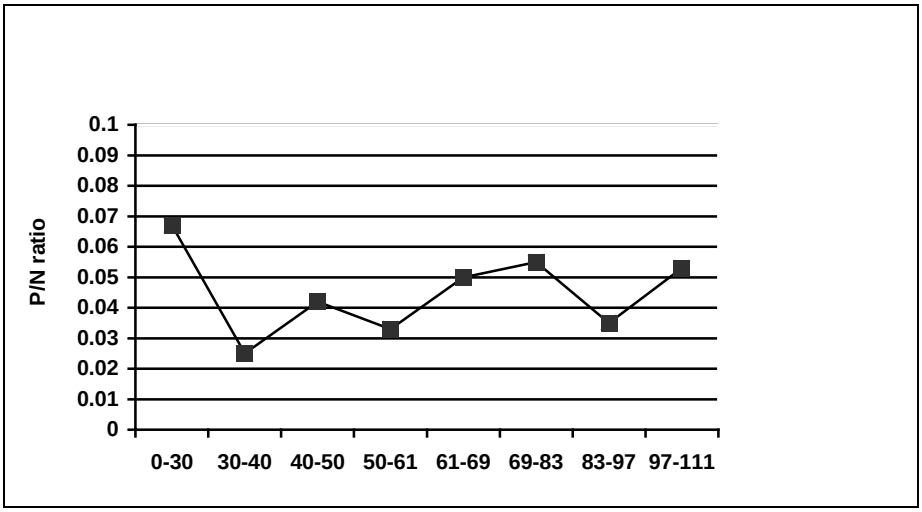

Fig.3: Effect of N levels on P/N ratio of wheat varieties during the growth periods.

As discussed before the P/N ratio reflect the effect of temperature degrees on P absorption. The highest mean value of 0.067 was obtained at the first stage (0-30). This means that wheat plant absorbed phosphorus nutrient rabidly than nitrogen in this stage, but at the second stage the P/N ratio decreased sharply to approximately one third of the first stage. This results may be to 1- the decrease of P% in this stage (Table 3 and Fig. 1), 2- increase the dray matter more than 6.7 folds than the first stage (Knany *et al.* 2011). The mean results of wheat varieties show that there are insignificant differences between Gimiza 9 and Sakha 61 and between Sakha 93 and Giza 168. Table (9) also show that the high yield of 1765.1 and 1628.6 of Gimiza 9 and Sahka 61 was associated with less P/N ratio

Data in Table (10) show that increasing nitrogen fertilizer levels led to decrease P/N ratio, where the mean values decreased from 0.056 to .044, 0.041 and 0.040 as N levels increased from N_0 to N_{30}, N_{60} and $N_{90,}$ respectively. At (0-30) period there were no differences between the N levels. All other periods were highly significant. The highest values were observed with N_0 level at all periods. These results show that increasing N fertilizer levels encouraged the vegetative growth of plant and dilution effect of P was occurred. It can stated that the soil supply with available phosphate ions was lesser than the soil supply with available N ions. Data also show that increasing wheat yield was associated with decreasing P/N ratio. This results may be to dilution effect.

Table 10: P/N Ratio in the plant tissue during growth periods.

Treatme-nts	P/N during growth periods (day)									Yield Kg/fed
	97-111	30-40	40-50	50-61	61-69	69-83	83-97	97-111	Mean	
N_0	0.067	0.025	0.047	0.042	0.076	0.074	0.043	0.070	0.056	911.4
N_{30}	0.067	0.027	0.039	0.030	0.052	0.051	0.033	0.052	0.044	1738.8
N_{60}	0.067	0.024	0.041	0.030	0.037	0.049	0.035	0.041	0.041	1755.6
N_{90}	0.067	0.024	0.042	0.030	0.037	0.045	0.028	0.046	0.040	1870.1
Mean	0.067	0.025	0.042	0.033	0.050	0.055	0.035	0.052	0.045	1569.0
F. test	---	**	**	**	**	**	**	**		
L.S.D. 0.5	---	0.038	0.046	0.060	0.071	0.075	0.057	0.088		

Data presented in Table (11) reveal that the differences between the used wheat varieties in P/N ratio were highly significant in all periods. The maximum mean P/N values of Gimiza 9 (0.062), Sakha 61 (0.063), Sakha 93 (0.067) and Giza 168 (0.074) were at (0-30) period, followed by the values of (0.058, 0.057 and 0.060) as Gimiza 9, Sakha 93 and Giza 168 at (69-83) period. On the other hand the minimum P/N values were had at the second period (30-40)days as all varieties were used . The highest P/N values of Gimiza 9 (0.076), Sakha 61 (0.067), Sakha 93 (0.079) and Giza 168 (0.103) were obtained at (69-83), (97-111), (61-69) and (69-83) periods as N_0 level used. These results show that Giza 168 had the highest P/N ratio followed by Sakha 93, Gimiza 9 and Sakha 61. This means that Giza 168 have high response to the anitrogen fertilization compared to the others varieties.

Table 11: P/N Ratio in the plant tissue during growth periods.

Treatm-ents		K/N ratio during growth perios (day)									Yield Kg/fed.
		0-30	30 -40	40-50	50-61	61-69	69-83	83-97	97-111	Mean	
Gimiz 9	N_0	0.062	0.024	0.040	0.030	0.070	0.076	0.041	0.060	0.050	1117.2
	N_1	0.062	0.027	0.038	0.034	0.050	0.050	0.036	0.060	0.045	1927.8
	N_2	0.062	0.022	0.036	0.025	0.036	0.058	0.034	0.049	0.040	1999.2
	N_3	0.062	0.023	0.035	0.027	0.042	0.047	0.031	0.043	0.039	2016.0
Mean		0.062	0.024	0.037	0.029	0.050	0.058	0.035	0.053	0.044	1765.1
Sakha61	N_0	0.063	0.027	0.038	0.047	0.066	0.053	0.041	0.067	0.050	911.4
	N_1	0.063	0.032	0.037	0.031	0.051	0.043	0.041	0.052	0.044	1881.6
	N_2	0.063	0.024	0.038	0.031	0.041	0.043	0.040	0.043	0.040	1953.0
	N_3	0.063	0.026	0.044	0.037	0.036	0.040	0.026	0.052	0.041	1768.2
Mean		0.063	0.027	0.039	0.037	0.049	0.044	0.037	0.054	0.044	1628.6
Sakha93	N_0	0.067	0.025	0.057	0.037	0.079	0.064	0.043	0.077	0.056	802.2
	N_1	0.067	0.025	0.035	0.027	0.050	0.055	0.028	0.045	0.042	1230.6
	N_2	0.067	0.025	0.050	0.033	0.037	0.056	0.035	0.036	0.042	1289.4
	N_3	0.067	0.024	0.046	0.028	0.039	0.052	0.026	0.051	0.042	1822.8
Mean		0.067	0.025	0.047	0.031	0.051	0.057	0.033	0.052	0.046	1286.3
Giza168	N_0	0.074	0.023	0.051	0.055	0.088	0.103	0.045	0.075	0.064	814.8
	N_1	0.074	0.022	0.044	0.028	0.055	0.055	0.027	0.049	0.044	1915.2
	N_2	0.074	0.024	0.040	0.029	0.033	0.040	0.029	0.037	0.038	1780.8
	N_3	0.074	0.023	0.042	0.027	0.030	0.040	0.027	0.038	0.038	1873.2
Mean		0.074	0.023	0.044	0.035	0.052	0.060	0.032	0.050	0.046	1596.0
Average		0.067	0.025	0.042	0.033	0.050	0.055	0.035	0.052	0.045	1569.0
F. test		**	**	**	**	**	**	**	**		

Conclusion

It could concluded from the results that the highest values of P% and P/N ratio obtained at the first stage (0-30) days and highest P uptake recorded at (61-69) days from sowing.

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تأثير مستويات التسميد النتروجيني علي امتصاص بعض أصناف القمح لعنصر الفوسفور في منطقة شمل الدلتا

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أقيمت تجربة حقلية بمزرعة محطة البحوث الزراعية بسخا ـ محافظة كفرالشيخ ـ مصر خلال الموسم الشتوي لعامي 2008-2009م لدراسة تأثير مستويات التسميد النتروجينيي علي امتصاص بعض أصناف القمح للفوسفور حيث تم تقدير النسبة المئوية لتركيز الفوسفور والكمية الممتصة ونسبة الفوسفور إلي النتروجين خلال فترات النمو المتتالية للنبات. استخدم تصميم القطع المنشقة فى أربع مكررات. شغلت القطع الرئيسية بأربعة أصناف قمح هى: جميزه 9 ، سخا 61 ، سخا 93 وجيزة 168 كما شغلت القطع الشقية بأربعة مستويات نيتروجين هى: صفر ، 30 ، 60 و 90 كجم ن/فدان (هكتار = 2.4 فدان). تم جمع ثمان عينات نباتية خلال فترات النمو المتتالية لتقدير الصفات السابقة

ويمكن تلخيص النتائج المتحصل عليها فيما يلي:

- أوضحت النتائج أن امتصاص القمح لعنصر الفوسفور كان أسرع من عنصر النتروجين في المرحلة الأولي من عمر النبات(صفر-30) يوما من الإنبات.
- أوضحت النتائج أن النسبة المئوية للفوسفور في المرحلة الأولي من عمر النبات كانت حوالي 3.3 مرة قدر المرحلة الثانية و 4.8 مرة قدر المرحلة الأخيرة.
- أوضحت النتائج وجود علاقة معنوية موجبة بين النسبة المئوية للفوسفور ودرجات الحرارة
- يمكن ترتيب متوسطات النسبة المئوية لتركيز الفوسفور لأصناف القمح كما يلي: جيزة 168> سخا 93 > سخا 61 > جميزة 9.
- ازدادت النسبة المئوية للفوسفور بقيمة عالية المعنوية بزيادة مستويات النتروجين حتى 90 كجم/فدان.
- أوضحت النتائج زيادة الفوسفور الممتص بدرجة عالية المعنوية لتصل إلي أقصاها عند المرحلة الخامسة (61-69) يوما من الإنبات
- يمكن ترتيب متوسطات الفوسفور الممتص لأصناف القمح كما يلي: جيزة 168> سخا 61 > جميزة 9 سخا 93.
- ازداد متوسط الفوسفور الممتص من 0.036 ملليجرام/ نبات/ يوم إلي 0.053، 0.061، 0.065 ملليجرام/ نبات/ يوم مع الزيادة في مستويات النتروجين المضاف من صفر إلى 30، 60، 90 كجم ن/ فدان.
- كانت أعلي نسبة بين الفوسفور والنتروجين لأصناف القمح المستخدمة (0.067) خلال الفترة الأولي(صفر-30) يوما من الإنبات.
- أدت الزيادة في مستويات النتروجين المضاف من صفر إلى 30، 60، 90 كجم ن/ فدان إلى نقص النسبة بين االفوسفور والنتروجين من 0.056 إلي 0.044 ، 0.041 ، 0.040 علي التوالي.
- أوضحت النتائج أن زيادة محصول القمح كانت مصاحبة لنقص النسبة بين الفوسفور والنتروجين

قام بتحكيم البحث

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