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Response of Three Bread Wheat to Nitrogen Fertilizer with or Without Ascorbic Acid Grown on a Clay Soil

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ABSTRACT

A field experiment was conducted at Bahtim Agricultural Research Station Farm during 2012/2013 and 2013/2014 seasons. The experimental site is located at lat. 30.80, long 31.16 and 14.00 m above the mean sea level.The objective of this study was to evaluate the effect of nitrogen fertilizer rates (40, 60 and 80 kg N fed^{-1}, with or without foliar application of ascorbic acid) on maximizing wheat yields and its attributes and grain quality of three wheat cultivars as a main-plots. The Egyptian bread wheat cultivars were Misr1, Misr2 and Gemmiza11. The experiment was designed in a split plot design with three replicates. The results indicated that: The highest significant value of spike number m^{-2} was noticed when wheat cultivar Mesr1 was planted compared to other bread wheat cultivars in both seasons. Also, 1000 grain weight and N uptake by wheat were significantly increased by planting Misr2. The number and weight of grain $spike^{-1}$ were significantly increased when wheat cultivar Misr1 or Misr2 were planted compared to Gemmiza11 in the first season and vice versa in the 2nd one. Cultivar of Misr2 gave higher grain, straw, biological yield and harvest index as well as N, P and K uptake in grains than other cultivars in the first season only. Meanwhile, the grain, straw and biological yield as well as N, P and K uptake of wheat straw were significantly improved by planting Misr1 compared to the other cultivars in the second season. Also, data reveal that the planting of Misr1 and Gemmiza11gave the highest increase of N, P and K uptake of grain and biological yield compared to Misr2 in the second season only. Generally, in most cases, application of both nitrogen level (80 or 60 kg $Nfed^{-1}$) with ascorbic acid gave the highest significant values of most yield components, grain, straw, biological yield and harvest index as well as N, P and K uptake of grain, straw, and biological as well as protein % in grain compared with other treatments in both seasons. Over all, the application of 80 or 60 kg N fed^{-1} with ascorbic acid to any bread wheat cultivars gave a significant increase of wheat yield components, grain, straw biological yield and harvest index as well as N, P and K uptake in grains, straw and biological and also protein % of grain in both seasons.

Keywords: wheat, cultivars, nitrogen fertilizer, ascorbic acid.

INTRODUCTION

Wheat is the nationwide staple food for over one-fifth of human populace around the world (FAO, 2014). The food and agriculture organization (FAO), during 2014-2015 growing season, confirmed that 9.4 million tons of wheat was produced and estimated that up to 11 million tons will be produced in 2015-2016 growing season in Egypt. It is perceptibly that the So Egypt Egyptian population increases, as a result the demand for wheat will be augmented annually has to increasing the cultivated area with wheat; according to the economic Affairs sector, Ministry of Agriculture and Land Reclamation in Egypt (FAO, 2015). Selected the high yielding capability cultivars the wheat yield gap in Egypt wants to be filled by rising yield per unit area. Increase in cropping intensity and introduction of high yield of wheat cultivars have caused considerable drain of nitrogen fertilizer and crops showed a encouraging response to nitrogen fertilizer application in the soil (Ali *et al*., 2004).

High wheat yield are the result of ecological, management, technical, capital and input conditions. High wheat yields need increases in application of N fertilizers and the excessive application of this nutrient can contribute to watercourse pollution (Semenov *et al*., 2007). Nitrogen is the majority limiting factor for productivity of wheat that affects the rapid growth of plant and improves grain yield. Many researches showed that N fertilizer application improved wheat grain yield (Gorjanovic and Kraljevic-Balalic, 2008). Asif *et al*. (2012) they stated that the numbers of fertile tiller per unit area, grain number per spike and harvest index were significantly improved by rising N fertilization rates. Also, Zewail (2007) revealed that yield and its components of wheat plant were significantly improved by rising N fertilizer rates up to 120 Kg N feddan-1 Abedi *et al*. (2011) reported that higher grain yield was achieved in treatment receiving 240 kg N ha-1 compared to control. Marino *et al*. (2009) concluded that increasing the N fertilizer rate increased grain yield, number of spike m-2, decreased weight of 1000 grain and in some cases no differences were observed among fertilized treatments for plant height. Iqtidar *et al*. (2006) found that rising the N rate from 50 to 200 kg ha-1 significantly increased the plant height, spike number m-2, spike weight, and grain yield as compared with control treatment. Noureldin *et al*. (2013) reported that rising N fertilizer up to 180 kg ha-1 increased wheat grain yield and its attributes i.e., spike number m-2, spike length, grain weight per spike and weight of 1000 grain. In Egypt, nitrogen is one of the main inputs of the winter wheat crop. its efficient management is fundamental for optimizing its utilization while lessening pollution hazards and operational costs, (Campillo, *et al*., 2010). Seadh and El-Metwally (2015) observed that wheat plants fertilized by 80 kg N fed-1 gave the highest values of wheat yield components, followed by plants fertilized by (64 kg N fed-1) and lastly those fertilized by (48 kg N fed-1) with significant differences among them in two seasons. N is beneficial at persuaded stages of growth for some genotypes of wheat, additional, its application postsilking or throughout grain fill is necessary to exploit grain yields. Yield and its attributes of high yielding varieties generally were increased by increasing nitrogen rate (Behera *et al*., 2000).

Ascorbic acid is an organic compound with antioxidant properties; the molecular formula and weight are C6H8O6 and 176.13, respectively. It dissolves well in water to give mildly acidic solutions. It plays a role in growth of plant and development, cell wall metabolism, cell division and cell expansion, root progress, photosynthesis, shoot apical meristem formation, florescence regulation and regulation of leaf senescence. Also, it is cofactors for enzyme activity, heavy metal evacuation and detoxification as well as stress defense and effects on plant ant oxidation

capacity (Zhang, 2012). Hafez and Gharib (2016) found that the foliar application of ascorbic acid improved wheat yield productivity. Also, Irfan *et al*., (2006) and Zewail (2007) stated that spray of ascorbic acid increased wheat grain yield by influencing many physiological processes i.e., stimulates respiration activates and division of cell as well as activities of many enzymes. Unquestionably is very important to increase productivity of wheat per unit area. Consequently, this study is aiming to evaluate the three new promising cultivars for scooping light on the best cultivars that can be used under the environmental conditions of the study region.

MATERIALS AND METHODS

The field experiment was conducted at Bahtim Agricultural Research Station Farm during 2012/2013 and 2013/2014 growing seasons. The experimental site is located at lat. 30.80, long 31.16 and 14.00 m above the mean sea level. The objective of this study was to find out the effect of nitrogen fertilizer rates with or without foliar application by ascorbic acid on maximizing wheat yields and its attributes and grain quality of wheat cultivars. The Egyptian bread wheat cultivars i.e. Misr1,Misr 2and Gemmiza11 were obtained from Department of Wheat Research, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt and the analysis of the used soil are presented in Table 1.

Table 1. Mechanical and chemical analyses of the used soil.

Characters		2012/2013	2013/2014
Particle size distribution	Coarse sand %	2.6	2.25
	Fine sand %	16.25	8.75
	Silt %	35.75	41
	Clay %	45.4	48
	Textural class	Clay	Clay
pH (1:2.5) in soil suspension		7.61	7.37
$CaCO_3$ (%)		2.34	2.65
EC_e (dSm^{-1}) in soil paste		0.91	1.05
Soluble cations meq l^{-1} (in soil paste extract)	Ca^{+2}	3.48	3.84
	Mg^{+2}	2.62	2.84
	Na^{+}	2.53	2.9
	K^{+}	0.47	0.47
Soluble anions meq l^{-1} (in soil paste extract)	HCO_3^{-}	2.35	2.82
	Cl^{-}	2.63	2.89
	SO_4^{--}	4.12	4.34
Available nutrients ppm	N	38.75	36.44
	P	6.25	8.12
	K	394.45	375.15

The experiment was designed in a split plot design with three replicates. Each experimental unit area was 3 ×3.5 m occupying an area of 10.5 m^2. The main-plots were included the following wheat cultivars:

1- Misr1 2- Misr2 3- Gemmiza11

The sup-plots were devoted to six N fertilizer rates with or without foliar spraying ascorbic acid treatments as follows:

1- 40 kg N fed^{-1}, without spraying ascorbic acid
2- 40 kg N fed^{-1}, with spraying ascorbic acid at the rate of 1g $liter^{-1}$
3- 60 kg N fed^{-1}, without spraying ascorbic acid
4- 60 kg N fed^{-1}, with spraying ascorbic acid at the rate of 1g $liter^{-1}$
5- 80 kg N fed^{-1}, without spraying ascorbic acid
6- 80 kg N fed^{-1}, with spraying ascorbic acid at the rate of 1g $liter^{-1}$

The foliar solution was sprayed at three times after 30, 45 and 60 days from sowing. Nitrogen fertilizer was added in the form of ammonium nitrate (33.5 % N) applied at the aforementioned levels as side – dressing in tow doses prior first and second irrigation. The super phosphate and potassium sulphate were added to all experimental plots by the rates of 15 kg P_2O_5 fed^{-1}, and 24 kg K_2O at preparation time before planting. All cultural practices were carried out according to usual methods being adopted for such crop, except the factors under study.

Grains of wheat cultivars were sown at the rate of 60 kg fed^{-1}, (according to 1000- grain weight of the studied cultivars), during the last week of November by using hand drilling named afeer method in both seasons.

At harvesting, one square meter was randomly selected from each sub – plot to estimate the following characters: number of spikes m^{-2}, number of kernels $spike^{-1}$, kernels weight $spike^{-1}$ (g), thousand – kernels weight (g), grain, straw and biological yield (kg fed^{-1}). It was calculated by harvesting whole plants in each sub-plot and air dried, then threshed and the grains at 13 % moisture were weighed in kg per fed (one faddan =4200 m^2).

Grain samples were dried at 70C, ground and wet digested. Nitrogen was determined using modified kjeldahl method, then the grains protein percentage was calculated by multiplying N % by 5.75. Phosphorus was determined calorimetrically using ammonium molybdate and ammonium metavanadate according to the procedure outlined by Ryan *et al*., (1996). Potassium was determined using the flame spectrophotometer method (Black, 1982).

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split–plot design as published by Gomez and Gomez (1991) by using MSTAT statistical package (MSTAT-C, Crop and Soil Sciences Department, Michigan State University, USA, 1989). Least Significant 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

Wheat yield components

Presented data in Table 2 show that the highest significant value of spike number m^{-2} was noticed when wheat cultivar Mesr1 was planted compared to other bread wheat cultivars in both seasons while the lowest one was recorded when wheat cultivar Gemmiza 11 was planted in both ones. Also, data reveal that the 1000 grain weight was significantly improved significantly by planting Misr2 or Gemmiza11 along with Misr1 in both seasons. Also, the number and weight of grain $spike^{-1}$ were increased significantly when wheat cultivar Misr1 or 2 were planted compared to Gemmiza11 in the first season and vice versa in the 2nd one. The variation among wheat cultivars in such parameters may be due to the genetical difference between them. Similar results were obtained by Abdelkhalek, *et al*., (2015), who concluded that the three wheat cultivars yielded in a different way, and the differences were significant in both seasons. The superiority of Misr1 wheat cultivar over either Misr-2 or Sakha-94 is confirmed. Moreover, Misr1 wheat cultivar out-yielded the other two

wheat cultivars. This was expected since it ranked the top in spike length and 1000 grain weight.

The spike number m^{-2} was significantly increased by adding the highest nitrogen level with or without ascorbic acid compared to the lowest one in the 1st season. But, it increased with application of 40 kg N fed^{-1} with ascorbic acid along with of 80 kg N fed^{-1}, without ascorbic acid in the second season. The application of 40 or 60 kg N fed^{-1}, without ascorbic acid gave the highest value of 1000 grain compared with the other treatments in the first season. Whereas, it significantly improved by application of 60 or 80 kg N fed^{-1}, with or without ascorbic along with lowest nitrogen fertilizer rates with ascorbic acid in the second season. The kernil weight $spike^{-1}$ was significantly increased by raising nitrogen fertilizer rate up to 80 kg N fed^{-1}, with or without ascorbic acid along with other treatments in the 1st season. Also, data reveal that such parameter was improved significantly by adding 60 or 80 kg N fed^{-1}, with ascorbic acid in the 2nd season. The grain number $spike^{-1}$ was significantly improved by application of any nitrogen fertilizer rates with ascorbic acid. On the other hand, the lowest significant values of grain number and weight $spike^{-1}$ were recorded by decreasing nitrogen fertilizer rate to 40 kg N fed^{-1}, without ascorbic acid in both seasons. The increase in abovementioned parameters associated with rising N fertilizer rates may be due to the role of N fertilizer in improving growth of wheat by augmentation activity of meristematic and division of cell which caused raises in internodes length and number of fertile tillers per unit area and also metabolic, photosynthesis processes as well as forming filled grains consequently producing heavier grains. These results are in agreement with those reported by Antoun *et al*. (2010) and Shirazi *et al*. (2014) who stated that the desirable effect of higher N fertilizer rate on yields and quality of grain can be easily ascribed to the N fertilizer which consider as one of the main nutrient for plant nutrition and it increases the vegetative cover for plant and forms strong plants with long spikes. Besides, its encourages plant to uptake other elements, activating, in that way plants growth, as a result ornamental measurements of growth and all wheat yield components.

Table 2. Effect of nitrogen fertilizer rate with or without ascorbic acid on some yield components of three bread wheat cultivars.

TREATMENTS	Spike number m^{-2}				1000 grain weight (g)				Grain number $spike^{-1}$				Grain weight $spike^{-1}$ (g)			
	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean
First season							2012/2013									
40kg N fed^{-1} + without	384	366.7	341.7	364.1	61.42	55.73	49.08	55.41	70.67	76.00	72.67	73.11	4.340	4.237	3.563	4.047
40 kg N fed^{-1} + Ascor	387.3	363.3	354.0	368.2	47.60	52.17	61.27	53.68	79.67	80.67	76.00	78.78	3.790	4.203	4.653	4.216
60kg N fed^{-1} + without	396.0	378.3	366.0	380.1	48.07	59.60	59.60	55.76	85.33	84.00	76.67	82.00	4.100	5.007	4.573	4.560
60 kg N fed^{-1} + Ascor	416.7	376.7	362.0	385.1	47.77	54.67	54.57	52.33	93.00	85.33	85.33	87.89	4.447	4.660	4.657	4.588
80kg N fed^{-1} + without	405.3	380.0	364.7	383.3	48.70	52.50	52.70	51.30	104.3	96.00	78.33	92.89	5.080	5.043	4.127	4.750
80 kg N fed^{-1} + Ascor	404.7	381.3	369.0	385.0	51.37	50.93	52.70	51.67	103.0	101.3	83.00	95.78	5.293	5.163	4.370	4.942
Mean	399.0	374.4	359.6		50.82	54.27	54.99		89.33	87.22	78.67		4.508	4.719	4.324	
LSD																
Cultivars	11.32				1.941				3.656				0.2229			
N rates with or without ascorbic acid	9.312				2.076				2.561				0.2131			
Interaction	16.13				3.595				4.435				0.3691			
Second season							2013/2014									
40kg N fed^{-1} + without	392.7	382.7	340.7	372.0	43.67	59.00	69.67	57.44	79.00	91.67	90.33	87.00	3.440	5.407	6.273	5.040
40 kg N fed^{-1} + Ascor	456.7	397.7	376.0	410.1	41.00	53.00	68.00	54.00	92.33	95.00	93.67	93.67	3.773	5.043	6.360	5.059
60kg N fed^{-1} + without	371.7	371.0	352.3	365.0	44.67	54.33	68.33	55.78	81.67	95.00	93.00	89.89	3.653	5.167	6.333	5.051
60 kg N fed^{-1} + Ascor	421.7	364.3	359.0	381.7	44.33	57.00	66.67	56.00	93.00	95.67	96.00	94.89	4.133	5.450	6.400	5.328
80kg N fed^{-1} + without	370.0	357.7	320.0	349.2	46.33	57.33	68.33	57.33	85.33	93.00	93.67	90.67	3.967	5.533	6.417	5.306
80 kg N fed^{-1} + Ascor	395.0	370.0	335.7	366.9	45.67	63.00	64.33	57.67	97.67	92.33	93.33	94.44	4.453	5.880	6.010	5.448
Mean	401.3	373.9	347.3		44.28	57.28	67.56		88.17	93.78	93.33		3.903	5.413	6.299	
LSD																
Cultivars	12.46				2.714				2.418				0.2634			
N rates with or without ascorbic acid	9.479				3.019				1.635				0.2723			
Interaction	16.42				5.229				2.832				0.4716			

G 11 = Gemiza 11

Moreover, Hafez and Gharib (2016) found that the higher amounts of nitrogen applied in both seasons significantly increased all wheat yield components compared to control treatment.This explanation is in agreement with those of Irfan *et al.* (2006) and Zewail (2007).

Concerning interaction between wheat cultivars and nitrogen fertilizer rates with or without ascorbic acid on the abovementioned parameters. Generally in most cases, results show that the highest significant values of spike number m^{-2} as well as grain number and weight $spike^{-1}$ were recorded by adding 60 or 80 kg N fed^{-1} with ascorbic acid to the cultivar Misr1 or Misr2 compared with application of 40 kg N fed^{-1}, with or without ascorbic acid to Gemmiza11 in the 1st season. But, addition of 40 kg N fed^{-1}, with or without ascorbic acid for any cultivars gave the highest significant value of 1000 grain weight compared to the application of any nitrogen rate with or without ascorbic to Misr1 or lowest nitrogen level for Gemmiza11 in the 1st season. Meanwhile, such parameters were significantly improved when adding any nitrogen rate with or without ascorbic to Gemmiza11 compared to the application of the lowest nitrogen level with or without ascorbic for Misr1 in the second season. In this connection, Trinity, *et al* (2006) suggested that the components of wheat yield exhibit complex characters, which are conditioned by numerous factors genetic and ecological origin, featuring variation between the answers of the genotypes. Also, Freitas *et al* (1995) reported that ecological factors had exerted strong effect on response for genotypes of wheat, with respect to aspects of income, also to the physiological ones. To better understand the

response of cultivars according to N fertilization was held major component analysis. Moreover, Mandic *et al*., (2015) found that the wheat yield components were significantly increased with increasing N level. Also, many authors reported that increasing N level increased weight grain spike^{-1} (Noureldin *et al*., 2013), 1000 grin weight (Ali *et al*., 2011and Abedi *et al*., 2011) and spike number m^{-2} (Abedi *et al*., 2011and Iqbal *et al*., 2012).

Wheat Yield

Data in Table 3 reveal that cultivar of Misr2 gave significant increase in grain, straw, biological yield and harvest index compared to other cultivars in the first season only. The same trend was recorded by planting Misr1 for straw yield in the first season. Meanwhile, the grain, straw and biological yield were improved significantly by sowing cultivar of Misr1 compared to other cultivars in the second one. But harvest index was significantly increased when Misr2 was planted along with other ones. These behaviors may be associated with genetic variation among wheat genotypes. in this association, Atia and Ragab (2013) observed that cultivars of wheat significantly differed in straw and grain yield. Seleem and Abd El – Dayem (2013) found that the wheat winters are different in grain yield.

Application of the highest nitrogen level (80 kg N fed^{-1}) with ascorbic acid gave the significant highest values of grain, biological yield and harvest index compared with other treatments in both seasons. Similar trend was observed for straw yield in the second season only. On the other hand, the lowest ones were noticed by adding 40 kg N fed^{-1} without ascorbic acid in both seasons. The increases in grain yield fed^{-1} due to the increase in N- level is a result of the effect of N which increasing yield components, i. e, number of spikes m^{-2}, number of grains spike^{-1}, weight of grains spike^{-1} and 1000-grain weight. This is clear illustration for the prominent role of nitrogen fertilizer in rising grain yield. These results reported by Sary, *et al*., (2010) who concluded that the addition of 80 and 100 kg N feddan^{-1} resulted in significant increase in grain yield kg feddan^{-1} over the addition of 60 kg N feddan^{-1} by 17.03 and 20.60 %, respectively in one season.

Table 3. Effect of nitrogen fertilizer rate with or without ascorbic acid on grain, straw, biological yield and harvest index of three bread wheat cultivars.

TREATMENTS	Grain yield (kgfed^{-1})				Straw yield (kgfed^{-1})				Biological yield (kgfed^{-1})				Harvest Index %			
	Misr1	Misr2	G11	Mean	Misr1	Misr2	G11	Mean	Misr1	Misr2	G11	Mean	Misr1	Misr2	G 11	Mean
First season							2012/2013									
40 kg N fed^{-1} + without	3000	3322	3000	3107	3761	3871	3811	3815	6762	7193	7111	7022	44.36	46.14	44.06	44.85
40 kg N fed^{-1} + Ascor	3119	3382	3074	3192	3841	3826	3861	3843	6960	7208	6935	7034	44.78	46.95	44.25	45.33
60 kg N fed^{-1} + without	3025	3248	3099	3124	3712	3712	3811	3745	6737	6960	6910	6869	44.95	46.68	44.85	45.49
60 kg N fed^{-1} + Ascor	3159	3432	3238	3276	3702	3776	3796	3758	6861	7208	7034	7034	46.01	47.63	46.05	46.56
80 kg N fed^{-1} + without	3050	3347	3298	3231	4109	3836	3687	3877	7158	7183	6985	7109	42.60	46.60	47.22	45.47
80 kg N fed^{-1} + Ascor	3272	3670	3397	3446	4134	3811	3588	3844	7406	7481	6984	7290	44.18	49.04	48.64	47.29
Mean	3104	3400	3184		3876	3805	3759		6981	7206	6993		44.48	47.17	45.85	
LSD																
Cultivars	149.8				112.5				111.9				1.259			
N rates with or without ascorbic acid	136.4				169.6				236.2				1.686			
Interaction	236.2				293.8				409.1				2.920			
Second season							2013/2014									
40 kg N fed^{-1} + without	3074	2835	2966	2958	3717	2983	3483	3394	6790	5818	6449	6353	45.26	48.73	45.93	46.64
40 kg N fed^{-1} + Ascor	3389	2993	3123	3168	4008	3192	3542	3581	7397	6184	6665	6749	45.81	48.48	46.91	47.07
60 kg N fed^{-1} + without	3780	3416	3578	3591	4008	3542	3833	3794	7788	6958	7411	7386	48.53	49.10	48.31	48.64
60 kg N fed^{-1} + Ascor	3978	3672	3843	3831	4300	3925	4158	4128	8278	7597	8001	7959	48.07	48.33	48.03	48.14
80 kg N fed^{-1} + without	3870	3470	3731	3690	4217	3692	4058	3989	8087	7162	7789	7679	47.86	48.45	47.90	48.07
80 kg N fed^{-1} + Ascor	4086	3740	4046	3957	4288	4267	4450	4335	8375	8006	8496	8292	48.81	46.73	47.62	47.72
Mean	3696	3354	3548		4090	3600	3921		7786	6954	7469		47.39	48.30	47.45	
LSD																
Cultivars	140.5				67.47				199.9				0.8004			
N rates with or without ascorbic acid	110.8				189.3				277.4				0.9103			
Interaction	191.8				327.9				480.5				1.577			

Furthermore, the positive response of wheat plants may be due to that ascorbic acid activates some enzymes which are important in regulation of photosynthetic carbon reduction. Also, this might be attributed to that the soil of this area contained considerable amount of both macro and micronutrients. Additionally, Sary, *et al*., (2010) suggested that a significant result has been observed as a result of spraying ascorbic acid on wheat plants expressed as grain yield kg feddan^{-1}. The application of ascorbic acid at 1000-mgL^{-1} increased grain yield by 15.35 and 15.64 % in the first and second seasons, respectively, when compared to unspray of ascorbic acid.

With regard to the interacted factors under study, generally, the application of 80 kg N fed^{-1} with ascorbic acid to any bread wheat cultivars gave a significant increase of grain, straw and biological yield as well as harvest index in both seasons. Vice versa, in most cases, the lowest ones were noticed when adding 40 kg N fed^{-1} without ascorbic acid to any cultivars in both seasons. This increase in grain, straw and biological of wheat yield might be due to better response of cultivars to application of N fertilizer. This might be because of superior response of wheat varieties to application of nitrogen fertilizer rate that reflected on final stage as well. These results agree with the findings of Salama, *et al*., (2014) who concluded that the interaction between nitrogen fertilizer and wheat cultivars combination treatments had a significant effect on grain yield fed^{-1}, in two seasons..

N, P and K uptake and protein % in grain wheat

Results in Table 4 show that the significant highest values of N, P and K uptake of grain were recorded when Misr2 was planted compared to other cultivars in the first

season only. The same trend was noticed when Gemmiza11 was grown in the first one. Also, data reveal that the planting of Misr1 and Gemmiza11gave the significant highest increase of N, P and K uptake of grain compared to Misr2 in the second season only. Meanwhile, protein % was improved significantly by planting Misr2 and Gemmiza11in the 2nd season only. These behaviors of NPK uptake of grain and protein % may be associated with genetic variation among wheat genotypes. Nitrogen uptake and utilization by wheat plants are determined by genotypic differences and are linked to morphological of varieties and physiological factors, including the length and root system activity, the intensity of nitrate uptake, reductase activity of nitrate, sink of grains, production of carbohydrate and N losses due to soil characteristics and leaching (Shibu *et al*. 2010).

The addition of 80 kg N fed^{-1} with ascorbic acid lead to a significant increase of N, P and K uptake as well as protein % in both seasons. Conversely, the lowest ones were observed by adding 40 kg N fed^{-1}, without ascorbic acid in both seasons. The increase in NPK uptake of wheat grain due to N- application is an indication for the role of N in growth development of plant and production. These results agree with the findings of Antoun *et al*. (2010) who stated that rising inorganic N fertilizer rate from 25 to 50, 75 and 100 kg N fed^{-1}, resulted in significant increases in protein content of wheat grains, also, uptake of NPK in grain and straw were significantly improved. Ascorbic acid showed a positive effect on accumulated soluble proteins which play a vital role in osmotic adjustment and may be associated with absorption of nutrients (Batool *et al*., 2012 and Malik and Ashraf, 2012).

Table 4. Effect of nitrogen fertilizer rate with or without ascorbic acid on N, P and K uptake as well as protein % in grain of three bread wheat cultivars.

TREATMENTS	N uptake of grain ($kgfed^{-1}$)				P uptake of grain ($kgfed^{-1}$)				K uptake of grain ($kgfed^{-1}$)				Protein %			
	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean
First season								2012/2013								
40 kg N fed^{-1} + without	54.90	60.90	55.18	56.99	8.483	8.412	8.092	8.329	11.89	13.98	12.58	12.82	10.52	10.63	10.58	10.58
40 kg N fed^{-1} + Ascor	59.82	65.93	60.24	61.99	9.027	9.467	9.515	9.336	12.70	14.02	13.74	13.49	11.02	11.21	11.27	11.17
60 kg N fed^{-1} + without	56.28	60.96	58.99	58.74	8.645	9.529	9.296	9.157	11.95	12.58	12.66	12.40	10.70	10.79	10.95	10.81
60 kg N fed^{-1} + Ascor	62.87	71.95	67.87	67.56	10.30	10.52	10.58	10.47	14.22	15.44	14.78	14.82	11.44	12.06	11.72	11.74
80 kg N fed^{-1} + without	59.05	65.93	64.85	63.27	9.030	10.04	9.784	9.617	12.86	14.15	13.55	13.52	11.14	11.33	11.31	11.26
80 kg N fed^{-1} + Ascor	71.33	78.90	72.90	74.38	10.79	11.37	10.74	10.97	14.59	17.04	16.19	15.94	12.54	12.36	12.34	12.42
Mean	60.71	67.43	63.34		9.379	9.889	9.668		13.03	14.53	13.92		11.23	11.40	11.36	
LSD																
Cultivars	3.371				0.3450				1.407				0.2304			
N rates with or without ascorbic acid	2.621				0.3390				0.9209				0.1522			
Interaction	4.539				0.5872				1.595				0.2637			
Second season								2013/2014								
40 kg N fed^{-1} + without	56.90	52.39	54.93	54.74	8.511	7.089	8.622	8.074	12.26	11.64	11.76	11.89	10.64	10.71	10.64	10.67
40 kg N fed^{-1} + Ascor	66.51	59.06	61.85	62.47	10.38	8.889	10.23	9.833	14.66	12.85	14.55	14.02	11.30	11.33	11.37	11.33
60 kg N fed^{-1} + without	70.85	64.80	68.76	68.13	10.36	9.939	10.52	10.27	14.79	12.90	14.26	13.98	10.78	10.92	11.05	10.92
60 kg N fed^{-1} + Ascor	81.15	78.87	82.92	80.98	13.89	11.79	13.20	12.96	18.72	17.16	18.17	18.02	11.73	12.37	12.40	12.17
80 kg N fed^{-1} + without	76.08	69.37	74.23	73.23	12.08	10.89	11.72	11.56	16.21	14.64	14.97	15.27	11.30	11.50	11.44	11.41
80 kg N fed^{-1} + Ascor	91.47	82.74	89.34	87.85	14.22	12.36	13.50	13.36	19.38	17.87	19.95	19.07	12.87	12.73	12.67	12.76
Mean	73.83	67.87	72.01		11.57	10.16	11.30		16.00	14.51	15.61		11.44	11.59	11.59	
LSD																
Cultivars	2.957				0.6557				0.9564				0.07169			
N rates with or without ascorbic acid	2.515				0.5927				0.9093				0.1179			
Interaction	4.356				1.027				1.575				0.2042			

With regard to the interacted factors under study, generally, the application of 80 kg N fed^{-1} with ascorbic acid to any cultivars gave a significant increase in N, P and K uptake as well as protein % in both seasons. Vice versa, in most cases, the lowest ones were noticed when adding 40 kg N fed^{-1} without ascorbic acid to any cultivar in both seasons. These results agree with the findings of Antoun *et al*. (2010) and Salama, *et al*., (2014).

N, P and K uptake in straw wheat

Data presented in Table 5 illustrate that the N, P and K uptake of wheat straw were significantly increased by planting wheat cultivars Misr1 compared to other varieties in the second season only. But, the same parameters weren't significantly affected by sowing different cultivars in the first one. The disparity among wheat cultivar in such parameters may be attributed to the genetical difference among them. Similar results were observed by Abdelkhalek, *et al*., (2015).

N, P and K uptake of wheat straw were significantly improved by the addition of 80 kg N fed^{-1} with ascorbic acid in both seasons. Similar trend was observed for P and K uptake when adding 60 kg N fed^{-1} with ascorbic acid in the second season only. Alternatively, the lowest ones were noticed when adding 40 kg N fed^{-1} without ascorbic acid in both seasons. These results may be due to the nitrogen which is considered as one of the most important nutrients for plant nutrition and it improves the vegetative plants growth during encouraging plants to uptake other macro and micronutrients as well as accordingly improving photosynthesis and all yield components. These results agreed with the findings of Hafez and Gharib (2016), who showed that the increase in the N fertilizer rate up to 240 kg N ha^{-1} had a positive effect on grain N content. It can be understood that grain and straw N content in wheat relies on absorption of N from soil prior to heading stage and remobilization of stored vegetative N accumulated before heading. Also, foliar spraying by ascorbic acid gave higher straw N content in relation to control treatment (without spray) in both seasons (Batool *et al*., 2012 and Malik and Ashraf, 2012).

Table 5. Effect of nitrogen fertilizer rate with or without ascorbic acid on N, P and K uptake in straw of three bread wheat cultivars.

TREATMENTS	N uptake of straw (kgfed^{-1})				P uptake of straw (kgfed^{-1})				K uptake of straw (kgfed^{-1})			
	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean
First season						2012/2013						
40 kg N fed^{-1} + without	15.09	13.15	14.61	14.28	6.378	5.913	7.671	6.654	71.05	70.17	73.19	71.47
40 kg N fed^{-1} + Ascor	15.33	14.95	15.07	15.11	8.903	9.503	9.104	9.170	85.96	81.31	78.68	81.98
60 kg N fed^{-1} + without	14.46	16.57	17.40	16.15	8.650	8.968	9.005	8.874	73.10	76.64	77.22	75.65
60 kg N fed^{-1} + Ascor	17.60	18.72	18.12	18.15	9.554	9.095	9.907	9.519	78.74	81.26	81.76	80.59
80 kg N fed^{-1} + without	18.84	18.44	17.54	18.27	9.421	9.373	8.769	9.188	80.92	78.26	77.45	78.88
80 kg N fed^{-1} + Ascor	22.28	20.50	19.07	20.62	10.46	10.25	10.36	10.36	86.53	85.44	84.65	85.54
Mean	17.27	17.05	16.97		8.894	8.851	9.136		79.38	78.85	78.83	
LSD												
Cultivars	0.7913				0.3272				3.676			
N rates with or without ascorbic acid	0.9497				0.5030				3.210			
Interaction	1.645				0.8713				5.560			
Second season						2013/2014						
40 kg N fed^{-1} + without	12.00	9.456	11.46	10.97	5.631	3.933	5.295	4.953	57.42	47.53	56.20	53.72
40 kg N fed^{-1} + Ascor	13.92	10.97	12.03	12.31	7.905	6.435	7.203	7.181	69.84	56.58	60.87	62.43
60 kg N fed^{-1} + without	12.74	12.83	14.03	13.20	7.248	6.822	7.224	7.098	64.22	60.49	63.84	62.85
60 kg N fed^{-1} + Ascor	17.25	15.90	16.74	16.63	9.417	8.151	9.138	8.902	75.03	69.81	73.98	72.94
80 kg N fed^{-1} + without	16.57	14.57	15.02	15.38	7.860	7.221	7.173	7.418	68.37	62.82	66.56	65.92
80 kg N fed^{-1} + Ascor	19.80	19.29	16.74	18.61	9.267	9.648	9.012	9.309	75.39	78.78	72.00	75.39
Mean	15.38 A	13.84	14.34		7.888	7.035	7.507		68.38	62.67	65.58	
LSD												
Cultivars	0.7246				0.3548				1.572			
N rates with or without ascorbic acid	1.046				0.4965				3.528			
Interaction	1.811				0.8600				6.110			

For the interacted factors under study, generally, the highest nitrogen level at 80 kg N fed^{-1} with ascorbic acid applied to any varieties gave a significant increase in N, P and K uptake of wheat straw in both seasons. The same trend was recorded by adding 60 kg N fed^{-1} with ascorbic acid to any variety for P and K uptake in both ones. In contrast, the lowest ones were noticed when adding 40 kg N fed^{-1} without ascorbic acid to any cultivars in both seasons. These results agree with the findings of Salama, *et al*., (2014), Abdelkhalek, *et al*., (2015) and Hafez and Gharib (2016).

N, P and K uptake of biological wheat yield

The results in Table 6 demonstrate that the N uptake of wheat biological was significantly increased with planting both wheat cultivars (Misr2 and Gemmiza11) compared to Misr1 in the first season. Otherwise, N, P and K uptake of wheat biological were significantly improved by sowing both wheat cultivars (Misr1 and Gemmiza11) compared to Misr2 in the 2nd one. Also, data show that the P and K uptake weren't significantly affected by different cultivars in the 1st season. Similar results were obtained by Abdelkhalek, *et al*., (2015), Atia and Ragab (2013) Seleem and Abd El –Dayem (2013).

Table 6. Effect of nitrogen fertilizer rate with or without ascorbic acid on N, P and K uptake in biological yield of three bread wheat cultivars

TREATMENTS	N uptake of biological yield (kgfed-1)				P uptake of biological yield (kgfed-1)				K uptake of biological yield (kgfed-1)			
	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean	Misr1	Misr2	G 11	Mean
First season						2012/2013						
40 kg N fed^{-1} + without	69.99	74.05	69.79	71.28	14.86	14.34	15.60	14.93	82.94	84.15	85.81	84.30
40 kg N fed^{-1} + Ascor	75.14	80.88	75.30	77.11	17.93	18.96	18.62	18.50	92.66	95.33	92.42	93.47
60 kg N fed^{-1} + without	70.74	77.53	76.39	74.89	17.30	18.49	18.30	18.03	85.04	89.22	89.88	88.05
60 kg N fed^{-1} + Ascor	80.47	83.33	85.99	83.26	19.86	19.62	20.48	19.99	92.96	96.36	96.55	95.29
80 kg N fed^{-1} + without	77.89	84.36	82.39	81.55	18.45	19.40	18.55	18.80	93.78	92.41	90.67	92.29
80 kg N fed^{-1} + Ascor	93.61	99.40	91.97	95.00	21.25	18.53	21.11	20.29	101.1	102.5	100.8	101.5
Mean	77.97	83.26	80.30		18.27	18.22	18.78		91.42	93.32	92.69	
LSD												
Cultivars	4.210				1.305				3.767			
N rates with or without ascorbic acid	3.291				1.214				2.078			
Interaction	5.701				2.103				3.599			
Second season						2013/2014						
40 kg N fed^{-1} + without	68.90	61.86	66.39	65.72	14.14	11.02	13.92	13.03	69.68	59.16	68.29	65.71
40 kg N fed^{-1} + Ascor	80.43	70.02	73.89	74.78	18.29	15.32	17.43	17.01	84.50	69.43	75.42	76.45
60 kg N fed^{-1} + without	83.58	77.66	82.79	81.34	17.61	16.76	17.75	17.37	79.01	73.39	78.09	76.83
60 kg N fed^{-1} + Ascor	98.40	94.77	99.65	97.61	23.31	19.94	22.34	21.86	93.75	86.97	92.15	90.96
80 kg N fed^{-1} + without	92.65	83.93	89.25	88.61	19.94	18.11	18.89	18.98	84.58	77.45	81.54	81.19
80 kg N fed^{-1} + Ascor	111.3	102.0	106.1	106.5	23.49	22.01	22.51	22.67	94.76	96.65	91.95	94.45
Mean	89.21	81.71	86.35		19.46	17.19	18.81		84.38	77.18	81.24	
LSD												
Cultivars	3.154				0.9342				1.377			
N rates with or without ascorbic acid	3.036				0.8729				4.010			
Interaction	5.259				1.512				6.945			

Respecting the effect of N fertilizer rates with or without ascorbic acid on N, P and K uptake of wheat biological yield, data show that the parameters were significantly improved by application of 80 kg N fed^{-1} with ascorbic acid in both seasons. The same trend was noticed for P and K uptake when adding 60 kg N fed^{-1} with ascorbic acid in both seasons. Alternatively, the lowest ones were recorded when adding 40 kg N fed^{-1} without

ascorbic acid in both seasons. N, P and K uptake by wheat plants is expected to considerably take place pre heading stage. Thus, more 90% of wheat N, P and K uptake are assimilated in wheat pre heading between root absorption. Similar finding was noticed by Cossani *et al*. (2012) who stated that N, P and K uptake are associated with dry matter production of grains and straw. Also, foliar spraying with ascorbic acid significantly increased grain and straw N, P and K uptake compared to control treatment. The exogenous application of ascorbic acid might increase the absorption and translocation within the leaf in addition to enhancement of the biosynthesis of photosynthetic pigments and improvement the nutritional status of wheat (Batool *et al*., 2012; Malik and Ashraf, 2012).

With respect to the interacted factors under study, generally, the highest nitrogen level at 80 kg N fed^{-1} with ascorbic acid to any cultivars gave a significant increase of abovementioned parameters in both seasons. Similar tendency was record by the application of 60 kg N fed^{-1} with ascorbic acid to any varieties for P and K uptake in both seasons. On the contrary, the lowest ones were noticed when adding 40 kg N fed^{-1} without ascorbic acid to any cultivars in both seasons. This improvement in NPK uptake of wheat biological yield due to rising N fertilizer rates with ascorbic acid may be the reflection of its effective roles in enhancing growth, yield attributes and accumulation of dry matter in whole wheat plant which led to rising the uptake of most macronutrients and enhancing yields and quality of grain. The results achieved are partially compatible with those observed by Seadh and Abido (2014) who suggest that application of nitrogen fertilizer rates enhances the wheat vegetative growth that delays senescence, which ultimately enhance biological yield.

From this results, in most cases, we can concluded that the increases in wheat productivity in Egypt may be due to the ascorbic acids guide to an enhancing three wheat plant cultivars growth and promote its uptake of nutrients as well as improving the nitrogen fertilizer efficiency. Subsequently, under similar conditions we can reduce the recommended dose of nitrogen fertilizer for wheat from 80 to 60 kg N fed^{-1} with foliar spray of ascorbic acids for any bread wheat variety to get the best possible wheat productivity.

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استجابة ثلاثة اصناف من قمح الخبز للتسميد النيتروجينى مع او بدون رش حمض الاسكوربيك فى الاراضى الطينية

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أقيمت تجربة حقلية فى محطة البحوث الزراعية ببهتيم – مركز البحوث الزراعية , مصر خلال موسمين زراعيين متتاليين 2013/2012 و 2014/2013، بهدف دراسة تأثيرمعاملات التسميد النيتروجينى بمعدلات (40 و60 و80 كجم نيتروجين فدان$^{-1}$ مع او بدون رش حمض الاسكوربيك) على ثلاثة اصناف من محصول القمح ومكوناته .وكانت الاصناف القمح المصرية كالاتى: مصر1 ومصر2 و جميزة 11. واستخدم في ذلك تصميم القطع المنشقة مره واحدة في ثلاث مكررات. وكانت أهم النتائج المتحصل عليها كما يلي: سجلت اعلى القيم معنويا لعدد السنابل فى المتر المربع عند زراعة الصنف مصر1 مقارنة بباقى اصناف القمح المنزرعة فى كلا الموسمين. بينما زاد معنويا وزن الالف حبة والنيتروجين الممتص بزراعة الصنف مصر2 مقارنة بالصنف جميزة 11 فى الموسم الاول والعكس بالعكس فى الموسم الثانى. واظهرت النتائج انه بزراعة الصنف مصر2 اعطى اعلى قيم معنويا لمحصول الحبوب والقش والبيولوجى ودليل الحصاد وكذلك الممتص من النيتروجين والفوسفور والبوتاسيوم فى الحبوب مقارنة بباقى اصناف القمح المنزرعة فى الموسم الاول فقط. فى حين زاد معنويا محصول الحبوب والقش والبيولوجى ودليل الحصاد وكذلك الممتص من النيتروجين والفوسفور والبوتاسيوم فى محصول القش بزراعة الصنف مصر1 مقارنة بباقى اصناف القمح المنزرعة فى الموسم الثانى. ايضا تشير النتائج الى انه عند زراعة صنف القمح جميزة 11 اعطى اعلى قيم معنويا من النيتروجين والفوسفور والبوتاسيوم فى الحبوب والبيولوجى مقارنة بزراعة الصنف مصر2 فى الموسم الثانى فقط. وعلى وجه العموم وفى معظم الحالات ، باضافة كلا من 60 او 80 كجم نيتروجين فدان$^{-1}$ مع الرش بحمض الاسكوربيك اعطى اعلى القيم معنويا لمعظم صفات مكونات المحصول ومحصول الحبوب والقش والبيولوجى ودليل الحصاد وكذلك الممتص من النيتروجين والفوسفور والبوتاسيوم فى ومحصول الحبوب والقش والبيولوجى وكذلك نسبة البروتين فى الحبوب مقارنة بباقى المعاملات فى كلا الموسمين. عموما ادى اضافة 60 او 80 كجم نيتروجين فدان$^{-1}$ مع الرش بحمض الاسكوربيك لاى صنف من اصناف قمح الخبز المنزرعة الى زيادة معنوية فى صفات مكونات المحصول ومحصول الحبوب والقش والبيولوجى ودليل الحصاد وكذلك الممتص من النيتروجين والفوسفور والبوتاسيوم فى ومحصول الحبوب والقش والبيولوجى وكذلك نسبة البروتين فى الحبوب فى كلا الموسمين.