Zagazig J.Agric. Res., Vol .31 No.(6) 2004 **2795 - 2811**

THE INFLUENCE OF N&P FERTILIZATION ON YIELD AND MINERAL COMPOSITION OF WHEAT PLANTS UNDER FOLIAR APPLICATION WITH ZINC AND ASCORBIC ACID

Abd El-Hameed, A.M.
Plant Nutrition Dept., Soil, Water&Env. Agric. Res. Cent., Giza, Egypt

Accepted 7 / 10 / 2004

ABSTRACT: **Two successive field experiments were carried out during 2001/2002 and 2002/2003 seasons at Meet El-Nahall Dekirnis, Dakahlia Governorate to study the influence of N&P fertilization under foliar application of zinc, ascorbic acid and its combination on yield and mineral composition of wheat plants.**

The results revealed that:

1- **The total uptake of N and P increased with the 50 kg N fed^{-1} + 13.20 kg P fed^{-1} under zinc + ascorbic acid treatment, whereas the total uptake of K was increased with the 70 kg N fed^{-1} + 13.20 kg P fed^{-1} under the same previous treatment.**

2- **The total uptake of Fe increased with the 70 kg N fed^{-1} + 6.60 kg P fed^{-1} under zinc + ascorbic acid treatment, meanwhile the total uptake of Mn was increased with the 50 kg N fed^{-1} + 6.60 kg P fed^{-1} levels under ascorbic acid treatment, as well as the total uptake of Zn was increased with the 50 kg N fed^{-1} + 13.20 kg P fed^{-1} under zinc + ascorbic acid treatment.**

3- **N-recovery percentage was increased about 25.92% with the treatment of N_2= 50 kg N fed^{-1} while the P-recovery percentage equal 38.48% with the P_1= 6.60 kg P fed^{-1}.**

4- **The superiority was the treatment of 50 kg N fed^{-1} +13.20 kg P fed^{-1} combined with zinc + ascorbic acid treatment where it gave the highest mean values for grains yield (3.37 ton fed^{-1}) and straw yield (5.68 ton fed^{-1})**

5- N, P and K-uptake increased over control by about 44.28, 39.62 and 46.27%, respectively in grains, while in straw they were 45.59, 69.23 and 39.03% with the zinc + ascorbic acid treatment, respectively.

6- Fertilizing with the 50 kg N fed^{-1} + 13.20 kg P fed^{-1} by zinc + ascorbic acid treatment saving about 40% from nitrogen and phosphatic fertilizer, hence, saving the environment from pollution, and avoided excessive N application.

INTRODUCTION

Wheat is considered a very important crop for many countries in the world, which is regarded as the most important cereal crop in Egypt. The amount needed of such crop is greater than that locally produced. Therefore, increasing its productivity as well as the cultivated areas are highly recommended.

Phosphorus is considered as an essential macronutrient, i.e. needs in relatively large amounts and occurs in most plants and soil solutions in concentrations of 10 and 0.001 to 0.01 kg/ha, respectively (Paul and clark, 1996). Unlike the available forms of nitrogen (NH_4^+ and NO_3^-), $H_2PO_4^-$ is chemically unstable and will quickly react with other cation species in the soil solution (fixation & transformation and precipitation processes) to form phosphorus compound less available for plant uptake (Foth, 1984).

Under Egyptian conditions many researchers studied the effect of different levels of soluble nitrogen fertilizers on wheat and corn production and protein content as well as mineral composition, they found that increasing nitrogen levels up to 90, 100, 70 and 40 or 50 kg N fed^{-1} increased most parameters of wheat plants (El-Leithi *et al.*, 1996 and El-Naggar, 1999). It is still fertilized by using soluble mineral fertilizers such as NH_4NO_3. Excess nitrogenous fertilization occurs due to lack of soil monitoring to rationalize the fertilizer dosages and because the flood irrigation system, used with frequency and rates applied accelerates NO_3^- leaching. The results of Deiz *et al.* (1994) showed that, the conventional agricultural practices are one of the main causes of NO_3^- aquifer pollution.

Foliar application is a technique as a practical way to supply trace elements in rapid microelements absorption. Othman (1989) found that foliar application of zinc under higher levels of phosphatic fertilization, significantly reduced dry matter stems and leaves at flowering stage. Ascorbic acid is known as a growth regulator that influence many physiological processes such as the synthesis of enzymes, nucleic acids, proteins and act as co-enzyme (Reda *et al.*, 1977; Abdel-Halim, 1995; Traffa *et al.*, 1999 and El-Greadly, Nadia, 2002 in different plants.

Abd El-Hameed *et al.* (2003) reported that, a high significant was found in grain and straw yields, also, N, P, K, Fe, Mn, Zn and Cu absorption with high levels of phosphorus and zinc foliar application, at the rates of 25 kg P_2O_5 fed^{-1} + 1 kg zinc fed.

The objective of the present study was to investigate the interactions of N & P fertilization with foliar application of zinc, ascorbic acid and its combination on yield and macro-micronutrients uptake of wheat crop.

MATERIALS AND METHODS

Two field experiments were established to fulfill the objectives of present work as follows:

Location: At Meet El-Nahall, Dekirnis, Dakahlia Governorate.

Soil: Representative surface soil samples (0-30 cm) performance of the experiment where some characteristics of the soil samples. The routine soil analysis was determined according to Black (1965) and Page (1982) as indicated in Table 1.

Studied crop: Wheat (*Triticum aestivum*, L.) "Gemmaza 9" was obtained from Agric. Res. Center. The planting dates were 25th and 29th of November in the two seasons 2001/2002 and 2002/2003, respectively.

Experimental plot: 4 x 3 m =12 m^2

Experimental treatments: The experiment was designed in a split-split plot involving 13 treatments. Each treatment was replicated three times, so the total treatments equal 39 plots. The detailed experimental treatments were as follows, 3 treatments, the main A of foliar application (Zn 1kg as zinc sulphate fed^{-1}, ascorbic acid (1500 ppm) and combined of Zn + ascorbic acid) with two different levels of phosphorus and nitrogen.

Table 1: Particle size distribution (%) and chemical properties of the soil in the experimental site.

Soil physical properties (%)		Soil chemical properties			Available nutrients (mg kg^{-1})	
			pH (1) value	8.2		
			EC dsm^{-1} (2)	0.86		
Sand	32.0	Soluble cations meq/100 g soil	Ca^{++}	1.10	N (3)	34.0
			Mg^{++}	2.10		
			Na^{++}	5.10	P (4)	13.0
			K^{+}	0.50		
Silt	24.0	Soluble anions meq/100 g soil	CO^{-}_3	0.00	K (5)	311.0
			HCO^{-}_3	1.40		
			CL-	5.10	Zn(6)	0.72
			SO^{-}_4	2.30		
Clay	44.0					
O.M	1.81					
$CaCO_3$	2.86					
Soil texture	Clayey	SAR	1.85			
		ESP	3.74			

1- 1 : 2.5 suspension 2- 1 : 5 Extract 3- Extracted by 1% K_2SO_4
4- Extracted by 1M sodium by carbonate 5- Extracted by 1M ammonium acetate
6- Extracted by DTPA.

Phosphorus fertilization (the submain B), P_1= 6.60 & P_2 = 13.20 kg P fed^{-1} as calcium superphosphate 15.5 % P_2O_5, and nitrogen fertilization (the sub sub-main C), N_1 = 70 & N_2 = 50 kg N fed^{-1} as Ammonium nitrate (33.3 % N). In addition to the control (N_1= 70 kg N fed^{-1}, P_1= 6.60 kg P fed^{-1} and without foliar application treatment.

Foliar applications were done after 45 days from sowing, the foliary replicated 5 times with 15 days intervals.

Calcium super phosphate was added during the soil tillage certain treatments before sowing, while ammonium nitrate was added at two equal doses before the 1st and 2nd irrigation, respectively.

Wheat plants were harvested after 6 months from sowing. The samples were collected from 1 m^2 in plot and calculated as 1 feddan for grains and straw yields. Plant samples were oven dried at 70 °C till a constant weight and the dry weight was recorded.

The plant materials were ground and a sub-samples of 0.4 (g) were

wet-digested using $H_2SO_4 - HClO_4$ mixture according to Peterbugsiki (1968).

The macronutrient and micronutrient contents (N, P, K, Fe, Mn and Zn), respectively, were determined in grains and straw yields according to Black (1965). N and P recovery percentage was calculated according to Mikkelsen (1987).

$$\text{N or P recovery \% (grain + straw)} = \frac{\text{N or P uptake (fertilized plants)} - \text{N or P uptake (control)}}{\text{Applied N or P rate}} \times 100$$

A combined analysis of collected data for both seasons was done using the analysis of variance technique according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

A. Effect of different N&P levels and foliar application on nutrient uptake:

From the combination effect of foliar applications (zinc, ascorbic acid and its combination) and different N, P levels on N, P and K uptake (kg fed^{-1}) in grains and straw at harvest stage are illustrated in Table 2, where the statistical analysis are significant at all parameters under investigation where 50 kg N fed^{-1} + 13.20 kg P fed^{-1} involved in zinc + ascorbic acid gave the highest values for N-uptake in grains, but 50 kg N fed^{-1} + 6.60 kg P fed^{-1} of zinc + ascorbic acid gave the highest values for N-uptake in straw viz, 41.70 and 23.76, respectively for two seasons. While P-uptake in grains have the highest values with the 50 kg N fed^{-1} + 13.20 kg P fed^{-1} of zinc treatment. However, straw having the highest values with the 70 kg N fed^{-1} + 6.60 kg P fed^{-1} of zinc + ascorbic acid treatment, viz, 7.27 and 8.75, respectively for two seasons. On the other hand, the K-uptake gave the highest values with the 70 kg N fed^{-1} + 13.20 kg P fed^{-1} combined with zinc + ascorbic acid treatments in grains while in straw was N_1= 70 kg N fed^{-1} + P_1= 6.60 kg P combined with zinc + ascorbic acid treatments, gave 11.09 and 58.22, respectively, for the two seasons. Generally, the results referred to the total uptake for N and P-uptake increments with 30 kg 50 kg N fed^{-1} + 13.20 kg P fed^{-1} of zinc + ascorbic acid treatments while the total of K-uptake was increased with the 70 kg N fed^{-1} + 13.20 kg P fed^{-1} for the previous treatment. The work of Sarhan (2004), confirmed these results.

Table 3 revealed that, the combination effect of foliar

Table 2: Combination effect of foliar application and different N, P levels on N, P and K uptake (kg fed^{-1}) in grains and straw of wheat plants at harvest stage.

Treatments			N-uptake			P-uptake			K-uptake		
			Grains	Straw	Total	Grains	Straw	Total	Grains	Straw	Total
Control (Without foliar application)			27.6	14.96	42.56	4.82	4.68	9.50	5.90	39.84	45.74
Zinc	P_1	N_1	31.23	16.73	47.96	6.78	4.33	11.11	7.16	46.93	54.09
		N_2	28.79	19.32	48.11	5.91	4.49	10.40	8.01	49.85	57.86
	P_2	N_1	36.41	18.14	54.55	6.96	5.62	12.58	8.30	44.02	52.32
		N_2	32.09	18.36	50.45	7.27	6.65	13.92	8.42	50.69	59.11
Ascorbic acid	P_1	N_1	27.62	16.83	44.45	5.65	7.14	12.79	7.07	56.61	63.68
		N_2	32.21	20.79	53.00	5.56	7.11	12.67	8.04	56.07	64.11
	P_2	N_1	29.42	16.87	46.29	4.37	7.71	12.08	6.78	48.20	54.90
		N_2	32.49	16.08	48.57	3.83	5.73	9.56	10.79	45.83	56.62
Zinc + ascorbic acid	P_1	N_1	38.39	20.45	58.84	4.63	8.75	13.38	7.62	58.22	66.13
		N_2	39.84	23.76	63.60	5.56	6.64	12.20	7.90	53.88	61.50
	P_2	N_1	39.33	17.76	57.09	4.81	8.16	12.97	11.09	50.40	85.30
		N_2	41.70	23.26	64.96	6.56	8.12	14.68	5.90	57.51	68.60
LSD 5 % for foliar			0.07	0.59		0.06	0.22		0.22	0.16	
P			**	**		NS	**		**	**	
N			**	**		**	**		**	**	
Interactions			0.76	0.42		0.61	0.27		0.16	0.57	

N_1 = 70 kg N fed^{-1}, N_2 = 50 kg N fed^{-1}, P_1= 6.60 kg P fed^{-1} and P_2 = 13.20 kg P fed^{-1}

Table 3: Combination effect of foliar application and different N, P levels on Fe, Mn and Zn uptake (g fed^{-1}) in grains and straw of wheat plants at harvest stage.

Treatments			Fe-uptake			Mn-uptake			Zn-uptake		
			Grains	Straw	Total	Grains	Straw	Total	Grains	Straw	Total
Control (without foliar application)			127.3	12.05	139.3	77.10	44.05	121.1	155.2	314.4	469.6
Zinc	P_1	N_1	151.4	21.45	172.9	87.14	47.20	134.3	163.5	421.5	585.0
		N_2	148.3	21.60	169.9	99.26	96.60	195.8	182.8	519.3	702.1
	P_2	N_1	160.6	16.07	176.6	105.5	64.80	170.3	195.0	348.8	543.8
		N_2	166.5	44.60	211.1	103.4	89.30	192.7	194.0	638.2	832.3
Ascorbic acid	P_1	N_1	148.5	31.90	180.4	87.62	63.80	151.4	179.5	541.9	721.4
		N_2	231.5	41.10	272.6	108.9	113.1	222.0	179.9	749.4	929.3
	P_2	N_1	203.0	15.10	218.1	99.05	78.30	177.3	190.5	465.2	655.7
		N_2	189.2	24.30	213.5	99.60	65.05	164.6	190.6	506.1	696.7
Zinc + Ascorbic acid	P_1	N_1	273.8	21.30	295.1	91.36	71.00	162.3	208.4	487.1	695.5
		N_2	232.8	59.40	292.2	121.4	71.80	203.1	199.5	473.7	673.2
	P_2	N_1	204.3	18.00	222.3	97.03	66.00	163.0	225.1	404.4	629.5
		N_2	257.6	33.80	291.4	112.5	108.2	220.7	190.7	754.7	945.4
LSD 5 % for foliar			1.93	0.63		1.05	1.29		4.90	1.24	
P			NS	**		**	NS		**	**	
N			**	**		**	**		NS	**	
Interactions			4.15	1.42		1.91	1.19		NS	3.16	

N_1 = 70 kg N fed^{-1}, N_2 = 50 kg N fed^{-1}, P_1= 6.60 kg P fed^{-1} and P_2 = 13.20 kg P fed^{-1}

applications (zinc, ascorbic acid and its combination) and different N, P levels on Fe, Mn and Zn-uptake (g fed^{-1}) in grains and straw at harvest stage showed differences significant at all studied parameters except grains at Zn-uptake. Whereas the 50 kg N fed^{-1} + 13.20 kg P fed^{-1} of zinc + ascorbic acid treatment, gave the highest values for Fe-uptake in grains, while 50 kg N fed^{-1} + 6.60 kg P fed^{-1} of the same treatment showed the highest values for Fe-uptake in grains and straw (257.66 and 59.40, respectively) in both seasons. It can be seen from the result that Mn-uptake was increased at 50 kg N fed^{-1} + 6.60 kg P $fed^{-1}$of zinc + ascorbic acid treatment, in grains, but in straw the highest values occurred with the 50 kg N fed^{-1} + 6.60 kg P fed^{-1} of ascorbic acid. The individual treatment increases were 121.42 and 113.10, respectively in two seasons. Otherwise, Zn-uptake increased with the 70 kg N fed^{-1} + 13.20 kg P fed^{-1} of zinc + ascorbic acid treatment in grains while in straw was 50 kg N fed^{-1} + 13.20 kg P fed^{-1} of previous treatment, viz, 225.10 and 754.70, respectively, for two seasons. Generally, the results referred to the total uptake of Fe and Zn-uptake were increased with the 70 kg N fed^{-1} + 6.60 kg P fed^{-1} and 50 kg N fed^{-1} + 13.20 kg P fed^{-1}, respectively, of zinc + ascorbic acid treatment while the total of Mn-uptake increased with the 50 kg N fed^{-1} + 6.60 kg P $fed^{-1}$of ascorbic acid treatment. The results of Abd El-Hameed (2003), confirmed these findings.

B. N-uptake and its recovery by wheat plants as affected by N-levels.

Data in Table 4 revealed that, N-uptake at harvest stage of wheat plants were significantly decreased with raising the nitrogen dose. At 50 kg N fed^{-1} (N_2 treatment), the N-uptake was the maximum. The values were 34.60 and 20.62 in grains and straw respectively in both seasons.

The uptake percentage of wheat grains was 4.43 and 25.36 % for 70 and 50 kg N fed^{-1}, respectively, compared with the control. The lower harvest ratio and unbalanced distribution of absorbed nitrogen between (straw and grains) and foliar application on the wheat plants were at high level of nitrogen (N_1= 70 kg N fed^{-1}).

The results recorded in Table 4 showing that, the highest percentage of nitrogen recovery

Table 4: N-uptake and its recovery by wheat plants at harvest as affected by N-levels in both seasons.

Treatments	Wheat yield (ton fed^{-1})			N-uptake					
	Grains	Straw	Total	Grains N-uptake (kg fed^{-1})	Straw N-uptake (kg fed^{-1})	Total N-uptake (kg fed^{-1})	Fertilizer N-uptake (kg fed^{-1})	% derived from fertilizer	% total recovery
Control (N_1P_1)	2.74	5.23	7.97	27.60	14.66	42.26	-	-	-
N_1	3.08	4.84	7.92	33.73	17.80	51.53	9.27	17.99	13.24
N_2	3.49	5.25	8.74	34.60	20.62	55.22	12.96	23.47	25.92
LSD 5 %	0.13	0.17	0.21	0.09	0.52	0.62	-	-	-

N_1 = 70 kg N fed^{-1} N_2 = 50 kg N fed^{-1}

Table 5: P-uptake and its recovery by wheat plants at harvest as affected by P-levels in both seasons.

Treatments	Wheat yield (ton fed^{-1})			P-uptake					
	Grains	Straw	Total	Grains P-uptake (kg fed^{-1})	Straw P-uptake (kg fed^{-1})	Total P-uptake (kg fed^{-1})	Fertilizer N-uptake (kg fed^{-1})	% derived from fertilizer	% total recovery
Control (N_1P_1)	2.74	5.23	7.97	4.82	4.68	9.50	-	-	-
P_1	3.06	5.22	8.28	5.63	6.41	12.04	2.54	21.10	38.48
P_2	3.68	4.86	8.54	5.68	7.00	12.68	3.18	25.08	24.09
LSD 5 %	0.12	0.16	0.20	0.4	0.61	0.72	-	-	-

P_1= 6.60 kg P fed^{-1} P_2 = 13.20 kg P fed^{-1}

(25.92 %) was obtained with (N_2= 50 kg N fed^{-1}). The recovery percentage did not increase with higher levels of nitrogen. These results agreed with those of Sarhan (2004).

It can be seen from the results that, the higher nitrogen level (N_1= 70 kg N fed^{-1}) was insignificant but the lower level of nitrogen (N_2= 50 kg N fed^{-1}) gave high significant effect in grains and straw. These findings agree with Sarhan (2004).

C. P-uptake and its recovery by wheat plants as affected by P-levels.

Table 5 shows that, the P-uptake at harvest stage of wheat plants was significantly increased with the higher rate of phosphorus dose. At 13.20 kg P fed^{-1} (P_2 treatment), the P-uptake gave the maximum values, i.e. 5.68 and 7.00 in grains and straw, respectively in both seasons. The P-uptake percentage of grains was 16.80 and 17.84 % for 6.60 and 13.20 kg P fed^{-1}, respectively.

The results at the previous table show that, the highest percentage of P-recovery (38.48 %) was obtained with (P_1= 6.60 kg P fed^{-1}) indicated that the recovery percentage values decreased as applied P increased at harvest stage. These results agree with those of Hamissa (1995), Elmancy *et al.* (1997) and Abd El-Hameed *et al.* (2003).

It obvious that, the higher levels of phosphorus application (P_2= 13.20 kg P fed^{-1}) caused a significant effect while the other level (P_1= 6.60 kg P fed^{-1}) gave a slight increase in grains and straw. These results were confirmed with the work of Sweeney *et al.* (2000) and Abd El-Hameed *et al.* (2003).

D. N, P and K uptake by wheat plants as affected by foliar application treatments.

Data in Table 6 show that, N, P and K-uptake by wheat, plants (kg fed^{-1}) at harvest stage (grains & straw) as affected by the foliar application. N-uptake in grains and straw increased with the foliar application treatment comparing with the control. However, the increase percentage were 44.28 and 45.59 %, respectively with the Zinc + ascorbic acid treatment.

These deduction due to (a) secretion certain types of organic acids which may be synthesized internally by plants such as barely and wheat. These results were confirmed by Yong-Hua Yang and Hong-YanZhang (1998). (b) low

Table 6: N, P and K uptake by wheat plants at harvest as affected by foliar application treatments in both seasons (kg fed^{-1}).

Treatments	N-uptake			P-uptake			K-uptake		
	Grains	Straw	Total	Grains	Straw	Total	Grains	Straw	Total
Control	27.60	14.96	42.56	4.82	4.68	9.50	5.90	39.84	45.74
Zinc	32.13	18.14	50.27	6.73	5.27	12.00	7.97	47.87	55.84
Ascorbic acid	30.55	17.64	48.19	4.85	6.92	11.87	8.17	51.68	59.85
Zinc + ascorbic acid	39.82	21.31	61.13	5.39	7.92	13.31	8.63	55.00	63.63
LSD 5%	0.07	0.60	0.72	0.06	0.22	0.34	0.22	0.16	0.23

Table 7: Effect of foliar application and P-levels on yield (ton fed^{-1}), macro (kg fed^{-1}) and micronutrients (g fed^{-1}).

Treatments		Wheat yield		N-uptake		P-uptake		K-uptake		Fe-uptake		Mn-uptake		Zn-uptake	
		Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw
Zinc	P_1	2.93	4.56	30.01	18.03	6.35	4.41	7.59	48.39	149.9	21.53	23.20	71.90	173.2	470.4
Ascorbic acid	P_1	3.02	5.28	29.92	18.81	5.61	7.13	7.56	56.34	190.1	36.50	98.26	88.45	188.7	645.7
Zinc + ascorbic acid	P_1	3.33	5.81	39.12	22.11	5.10	7.70	7.77	56.05	253.3	40.35	106.4	76.35	203.9	480.4
Zinc	P_2	3.18	4.71	34.25	18.25	7.12	6.14	8.36	47.36	163.6	30.33	104.5	77.05	194.6	493.5
Ascorbic acid	P_2	3.08	4.78	31.18	16.48	4.10	6.72	8.79	47.02	196.2	19.70	99.33	71.67	190.6	485.7
Zinc + ascorbic acid	P_2	3.36	5.11	40.52	20.51	5.69	8.14	9.50	53.96	231.0	25.90	104.8	87.10	207.9	579.6
LSD 5 % for foliar		0.24	0.25	0.07	0.59	0.006	0.22	0.22	0.16	1.93	0.63	1.05	1.29	0.94	1.24
P		**	**	**	**	NS	**	**	**	NS	**	**	NS	**	**
Interactions		0.47	0.19	0.47	3.22	0.12	0.33	0.04	0.43	1.72	1.65	1.68	1.02	1.63	2.96

P_1= 6.60 kg P fed^{-1} P_2 = 13.20 kg P fed^{-1}

molecular weight of organic acids. (c) The organic acids are known as a growth regulator factor that influence many physiological processes such as the synthesis of enzymes, nucleic acids, proteins and act as co-enzymes. These results were confirmed by El-Greadly, Nadia (2002).

Also, P-uptake increment with foliar application treatment over control was 39.62 and 69.23 % in grains and straw, respectively, with the zinc and zinc + ascorbic acid treatments, respectively. These results agree with the work of Rajpal Singh *et al.* (2001).

On the other hand, K-uptake with foliar application treatments showed higher mean values compared with the control. The percentage of increases were 46.27 and 39.03 %, respectively in grains and straw, using zinc + ascorbic acid treatment.

It is clear that the zinc + ascorbic acid treatment gave a highly significant effect in grains and straw yields. These results agreed with those of El-Greadly, Nadia (2002).

The values recorded in Table 7 indicate that the second level of P_2 gave high significant effect for grains yield, N, K, Fe and Zn-uptake with the zinc + ascorbic acid treatment, while level of P_1 with ascorbic acid treatment gave a high value in grains of K-uptake. Also, level of P_1 combined with zinc + ascorbic acid treatment in grain of Mn-uptake.

Whereas, the uptake of straw, at level of P_1 combined with zinc + ascorbic acid treatment gave the highest value for N and Fe uptake, but level of P_1 with ascorbic acid treatment was Zn and Mn-uptake (straw yield), while P-uptake of straw was P_2 level with zinc treatment. These results confirmed with Sweeney *et al.* (2002).

Data in Table 8 reveal that, the lower level of nitrogen (N_2= 50 kg N fed^{-1}) gave the highest value with zinc + ascorbic acid treatment of grains yield, N, Fe and Mn-uptake while (N_2) with Zinc treatment gave a high value for P-uptake, whereas (N_2) with ascorbic acid treatment for K-uptake except Zn-uptake caused a higher value with the high level of nitrogen (N_1= 70 kg N fed^{-1}) with zinc + ascorbic acid treatment.

However, in straw, the second nitrogen level N_2 with zinc + ascorbic acid treatment gave the highest values for straw yield, N, K, Fe and Mn-uptake while the grains yield, N, Fe and Mn-uptake were increased with N_2 + ascorbic

Table 8: Effect of foliar application and N-levels on yield (ton fed^{-1}), macro (kg fed^{-1}) and micronutrients (g fed^{-1}).

Treatments		Wheat yield		N-uptake		P-uptake		K-uptake		Fe-uptake		Mn-uptake		Zn-uptake	
		Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw
Zinc	N_1	3.07	4.31	33.82	17.44	6.87	4.98	7.73	5.48	156.02	18.76	96.34	56.00	179.27	385.13
Ascorbic acid	N_1	3.00	4.96	28.52	16.85	5.01	7.43	6.93	52.41	175.80	23.50	93.34	71.05	185.00	503.55
Zinc + Ascorbic acid	N_1	3.23	5.24	38.86	19.11	4.72	8.46	7.91	54.31	239.08	19.65	94.20	68.50	216.75	445.75
Zinc	N_2	3.05	4.97	30.44	18.84	6.59	5.57	8.22	50.27	157.45	33.10	101.36	92.95	188.43	578.79
Ascorbic acid	N_2	3.09	5.10	32.58	18.44	4.70	6.42	9.42	50.65	210.40	32.70	104.25	89.07	194.25	627.75
Zinc + Ascorbic acid	N_2	3.37	5.68	40.77	23.51	6.06	7.38	9.36	55.70	245.23	46.60	116.99	94.95	195.10	614.20
LSD 5 % for foliar		0.24	0.25	0.07	0.59	0.06	0.22	0.22	0.16	1.93	0.63	1.05	1.29	4.90	1.24
N		**	**	**	**	**	**	**	**	**	**	**	**	NS	**
Interactions		0.25	0.26	0.54	0.30	0.43	0.19	0.11	0.40	2.94	1.00	1.35	0.84	2.45	2.24

Table 9: Effect of P and N levels on yield (ton fed^{-1}), macro (kg fed^{-1}) and micronutrients (g fed^{-1}).

Treatments		Wheat yield		N-uptake		P-uptake		K-uptake		Fe-uptake		Mn-uptake		Zn-uptake	
		Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw	Grains	Straw
P_1	N_1	3.04	5.02	32.41	18.00	5.69	6.74	7.38	53.92	191.27	24.88	88.71	60.67	183.80	483.50
	N_2	3.09	5.41	33.61	21.29	5.68	6.08	7.89	53.27	204.24	40.70	109.86	97.13	193.40	580.80
P_2	N_1	3.18	4.65	35.05	17.59	5.38	7.16	7.66	47.54	189.33	16.39	100.54	69.70	203.54	406.13
	N_2	3.23	5.08	35.58	19.23	5.89	0.83	10.10	51.34	204.49	34.23	105.20	37.52	191.79	633.03
LSD 5 % for P		**	**	**	**	NS	**	**	**	NS	**	**	NS	**	**
N		**	**	**	**	**	**	**	**	**	**	**	**	**	**
Interactions		NS	NS	0.44	0.25	0.35	0.16	0.09	0.33	N.S	0.82	1.10	0.69	2.00	1.83

N_1 = 70 kg N fed^{-1}, N_2 = 50 kg N fed^{-1}, P_1= 6.60 kg P fed^{-1} and P_2 = 13.20 kg P fed^{-1}

acid treatment. While Zn-uptake gave the highest value with N_1 combined with zinc + ascorbic acid treatment, as well as P-uptake gave the highest value for N_2 combined with zinc + ascorbic acid treatment. These results were confirmed by Sarhan (2004).

Data in Table 9 show that, the second nitrogen level (N_2) with P_1 gave the highest value for straw yield, N, Fe and Mn-uptake of straw and Mn-uptake of grains. While (N_2) with (P_2) gave the superiority for grains yield, N, P, K and Fe-uptake of grains and Zn-uptake of straw. These findings confirmed with those of Abd El-Hameed (2003) and Sarhan (2004).

It could be concluded that, the foliar applications (zinc, ascorbic acid and its combination) with different levels of N & P fertilization treating wheat plants with the 50 kg N and 13.20 kg P fed^{-1} combined with zinc + ascorbic acid showed saving about 40 % of N and P fertilization, then reducing environmental pollution.

REFERENCES

Abd El-Hameed, A.M.; S.H. Sarhan and M.A. Abd El-Razik (2003). Interactive effects of zinc and phosphorus on growth, nutrient uptake, yield and seed quality of wheat. J. Agric. Sci. Mansoura Univ., March (18): 219-226.

Abdel-Halim, S.M. (1995). Effect of some vitamins as growth regulators on growth, yield and endogenous hormones of tomato plants during winter. Egypt J. Appl. Sci., 10(12): 322-334.

Black, C.A. (1965). Methods of Soil Analysis. Part 1 and 2, USA, Madison, Wisconsin, USA.

Diez, J.A.; R. Roman; M.C. Cartagena; A. Vallojo; A. Bustos and R. Caballero (1994). Controlling nitrate pollution of aquifers by using different nitrogenous controlled release fertilizers in maize crop. Agric. Ecosyst. Environ, 48: 49-56.

El-Greadly, Nadia H.M. (2002). Effect of foliar application of ascorbic acid, etherel and their combination on growth yield and endogenous hormones in cucumber plants. J. Agric. Sci., Mansoura Univ., 27(8): 5269-5281.

El-Leithi, A.A.; K.M.M. Sayed and M.S. Elyamani (1996). Influence of different levels of N, K and Zn fertilization on wheat yield and chemical

composition in salt affected soil. J. Agric. Sci. Mansoura Univ., 21(10): 3735-3741.

El-Mancy, M.H.; M.Th.A. Kotb; Kh.H. El-Hamdi and S.A. Hammad (1997). N,P and contents of rice crop in relation to Algalization combined with N, P fertilization. J. Agric. Sci. Mansoura Univ., 22(9): 3053-3065.

El-Naggar, E.M. (1999). Efficiency use of bio and chemical fertilizers on wheat. Ph. D. Thesis. Fac. Of Agric., Mansoura Univ., Egypt.

Foth, H.D. (1984). Fundamentals of soil science. 7th ed John Wiley and sons, Inc., New York.

Gomez K.A. and A.A. Gomez (1984). Statistical Procedures for the Agricultural Research. John Wiley and sons, Inc., New York.

Hamissa, A. M.M.I. (1995). Studies on the effect of some fertilizers on productivity of rice crop. Ph.D. Thesis, Fac. Agric. Tanta Univ., Egypt.

Mikkelsen, D.S. (1987). Nitrogen budgets in flooded soils used for rice production. Plant and Soil, 75: 455-472.

Othman, A.D. (1989). Influence of zinc and iron on broad bean production as related to soil phosphorus. M. Sc. Thesis Fac. Agric., Zagazig Univ.

Page, A.L. (1982). Methods of Soil Analysis part II, Chemical and Microbiological Properties. 2nd ed., Madison, Wisconsin, USA.

Paul, E.A. and F.E. Clark (1996). Soil Microbiology and Biochemistry. 2nd ed. Academic press, Inc. California.

Peterburgsiki, A.V. (1968). "Hand Book of Agronomic Chemistry" Kolos Publication House, Moscow. (In Russian) pp. 25-90.

Rajpal Singh, Godara, N.R.; V.p. Alawat and S.S. Dahiya (2001). "Mineral composition of ber (*Zizphus mauritiana* lamk) leaves as affected by foliar application of growth regulators and nutrients". Haryana Journal of Horticultural Sciences, 30(1/2): 10-11.

Reda, F.; M. Fadl; R.S. Abdel-All and A. El-Morsi (1977). Physiological studies on *Ammi visnaga,* L. the effect of thiamine and ascorbic acid on growth and hormone yield. Egypt J. Pharm. Sci., 18: 19-27.

Sarhan, S.H. (2004). Effect of zinc and ascorbic acid foliar application under soil applied nitrogen and phosphorus

fertilization on growth, yield and some nutrient contents of wheat. J. Produc. and Develop., 9 (1): 149-155.

Sweeney, D.W.; G.V. Granade; M.G. Eversmeyer and D.A. Whitney (2000). "Phosphorus, potassium, chloride and fungicide effects on wheat yield and leaf rust severity. Journal of Plant Nutrition, 23(9): 1267-1281.

Traffa, Sh.A., Karima; M. Gamal El-Din and Laila K. Balbaa (1999). The response of vegetative growth, essential oil of lemon grass (uzmbopogon citrates Hort) to foliar application of ascorbic acid, nicotinamide and some micronutrients. Arab Univ. J. Agric. Sci., Ain-Shams Univ. Cairo, 7(1): 247-259.

Yong-Hua Yang and Hong-Yan Zhand (1998). Effect of citric acid on aluminum toxicity in the growth of mungbean seedlings. Journal of Plant Nutrition, 21(5): 1037-1044.

تأثير التسميد النيتروجيني والفوسفاتي على الإنتاج والمحتوى المعدني لنباتات القمح تحت الرش الورقي بالزنك وحمض الأسكوربيك

عادل محمد عبدالحميد

قسم تغذية النبات ـ معهد بحوث المياه والأراضي والبيئة ـ مركز البحوث الزراعية ـ الجيزة ـ مصر

أجريت تجربتان حقليتان لموسمي (٢٠٠١/٢٠٠٢ و ٢٠٠٢/٢٠٠٣) بقرية ميت النحال دكرنس ـ الدقهلية لدراسة تأثير التسميد النيتروجيني والفوسفاتي مع الرش الورقي (زنك ـ حمض الاسكوربيك ـ زنك + حمض الاسكوربيك) على المحصول والتركيب المعدني لمحصول القمح.

وأظهرت النتائج المتحصل عليها ما يلي:

١ـ زيادة المحتوى الكلي للنيتروجين والفوسفور الممتص مع المستوى ٥٠ كجم ن /فدان ١٣,٢٠ كجم فو/فدان تحت نفس المعاملة (زنك + حمض الاسكوربيك) بينما يزداد المحتوى الكلي للبوتاسيوم الممتص مع المستوى ٧٠ كجم ن /فدان ١٣,٢٠ كجم فو/فدان تحت المعاملة السابقة.

٢ـ زيادة المحتوى الكلي للحديد الممتص مع المستوى ٧٠ كجم ن /فدان ٦,٦٠ كجم فو/فدان تحت المعاملة (زنك + حمض الاسكوربيك) في حين زاد المحتوى الكلي للمنجنيز الممتص مع المستوى ٥٠ كجم ن /فدان ٦,٦٠ كجم فو/فدان تحت المعاملة (حمض الاسكوربيك) بينما يزداد محتوى الزنك الممتص مع المستوى ٥٠ كجم ن /فدان ١٣,٢٠ كجم فو/فدان تحت المعاملة (زنك + حمض الاسكوربيك).

٣ـ زيادة النسبة المئوية للاستفادة من النيتروجين (تقريبا ٢٥,٩٢ %) مع المستوى النيتروجيني ٥٠ كجم ن /فدان بينما كانت للفوسفور (٣٨,٤٨ %) مع المستوى الفوسفاتي ٦,٦٠ كجم فو/فدان.

٤ـ كانت الأولوية للمستوى ٥٠ كجم ن /فدان ١٣,٢٠ كجم فو/فدان تحت المعاملة (زنك + حمض الأسكوربيك) حيث أعطت محصول الحبوب (٣,٣٧ طن/فدان) ومحصول القش ٥,٦٨ طن/فدان.

٥ـ زيادة النيتروجين ، الفوسفور ، البوتاسيوم الممتص عن الكنترول بمقدار ٤٤,٢٨ ، ٣٩,٦٢ ، ٤٦,٢٧ % في الحبوب على التوالي بينما كانت في القش ٤٥,٥٩ ن ٦٩,٢٣ ، ٣٩,٠٣ % تحت معاملة الزنك + حمض الاسكوربيك بالتوالي.

٦ـ وفرت المعاملة (زنك + حمض الاسكوربيك) مع المستوى ٥٠ كجم ن /فدان ١٣,٢٠ كجم فو/فدان تقريبا ٤٠ % من الأسمدة النيتروجينية والفوسفاتية مما يساعد على قلة تلوث البيئة.