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INTERACTIVE EFFECTS OF ZINC AND DIFFERENT NITROGEN SOURCES ON YIELD AND QUALITY OF ONION

[57]

Abdel-Mawgoud[1], A.M.R.; S.D. Abou-Hussein[1]; S.R. Salman[1] and M.A. El-Nemr[1]

ABSTRACT

This study was conducted on a sandy loamy soil at Giza, Egypt, in December 2002 and 2003 to investigate the interactive effect of Zn and different nitrogen sources, i.e., mineral nitrogen (ammonium sulfate) and organic nitrogen (poultry manure) on the growth and productivity of onion (*Allium cepa*) cv. Giza 20. Four levels of Zn application (0, 1, 2 and 3 ppm) in a sulfate form were foliar sprayed at 30 and 60 days after planting. Within each Zn application, three treatments of nitrogen dose were applied in different combination forms (mineral and organic sources). Nitrogen treatments were 100% mineral N; 75% mineral + 25% organic and 50% mineral + 50% organic. Organic-N source was poultry manure. All poultry manure treatments were applied during soil preparation. Data showed that all growth parameters of onion plants increased as the fraction of poultry manure increased. Zn had also a positive effect on all plant parameters except of plant length, and leaf dry weight. The interactive effect of Zn and poultry manure increased yield and quality of onion bulbs. The most effective treatments on bulb fresh weight, total yield and quality were the spraying with 1 or 2 ppm zinc and the application of N as 75% mineral and 25% organic, in both seasons.

Keywords: *Allium cepa*, Onion, Poultry manure, Zn, N-sources

INTRODUCTION

The demand for onion crop is growing worldwide with a trading amount reaching up to 4,788,235 tones having a value of 1,331 billion US-dollars of which Egypt exported 32 thousand tones with a value of 33 million US-dollars (**FAO, 2004**). Because of this importance, expansion of onion cultivation is taking place in the new reclaimed lands in Egypt. However, reclaimed lands have many problems such as poor structure and nutrient deficiency in particular micronutrients. Zinc is a very important micronutrient, which plays important roles in creation of many enzymes in plants that are responsible for driving many metabolic reactions in the synthesis of proteins. Growth and development would stop if these specific enzymes were not present in plant tissue (**Joiner, 1983; Jones, 1983; Resh, 1983 and Bergman, 1985**).

Effect of different application methods of Zn on onion crop was previously

1- Vegetable Research Department, National Research Center, Dokki, Cairo, Egypt

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reported (**Weaver, 1985; Khan and Weaver, 1989**). Although absorption of Zn from nutrient solution was more efficient than from soil (**Weaver, 1985**), foliar application of Zn was even more effective than application to the root environment (**Khan and Weaver, 1989**).

The effect of Zn on growth and yield of onion has been widely investigated. Sprays of Zn were effective for increasing all the growth parameters of onion (**Singh & Tiwari, 1995 and Kumar *et al* 1998 & 2000**). Also, yield of onion responded positively to foliar sprays with $ZnSO_4$ (**Brouwer *et al* 1981; Gupta, 1991; Pena *et al* 1999; Sliman *et al* 1999 and Kumar *et al* 1998 & 2000**).

Improving growth and productivity of onion in the newly reclaimed lands may be achieved by applying organic matter to the soil. The positive effects of organic matter on production have been extensively investigated (**Giardini *et al* 1992; Kropisz, 1992 and Vinay *et al* 1995**). More recently, **Gupta *et al* (1999) and Abbey (2000)** revealed that organic manure along with mineral fertilizers were effective in increasing the growth, yield and quality contributing characters. Poultry manure has long been recognized as the most desirable of natural fertilizers because of its high nitrogen content and other essential plant nutrients and serve as a soil amendment by adding organic matter (**Sloan *et al* 1996**).

The effect of soil organic matter content on the availability of Zn has been discussed in the literature. Soil organic matter amendments influence the availability of micronutrients to plants by forming fulvic acid during decomposition. By complexation with fulvic acid, Zn availability may be increased in soils under aerated conditions (**Tagwira *et al* 1992**). Recent research on sandy soils indicates that the response to Zn can occur when high yields are grown on sandy soils with a low organic matter content (**Rehm and Schmitt, 2000**).

Therefore the aim of this study was to investigate the interactive effect of different levels of poultry manure and foliar zinc applications on the growth and productivity of onion.

MATERIAL AND METHODS

This study was conducted on a sandy clay loam soil at Kafr Hakim village, Giza, Egypt in December 2002 and 2003.Soil sample was collected from surface 20cm layer. The soil was air-dried, and sieved through 2mm sieve .The main physical and chemical properties are shown in Table 1 (a and b). Each experimental plot was 4 x 6 m contained 10 rows each of 4m long and 50cm width. The outside rows of each plot were considered as boarders. The center two rows of each plot were used for plant sampling. Onion (*Allium cepa*) cv. Giza 20 was transplanted on both sides of rows at 7-8 cm with in-row (38 plant m^{-2}) in December 2002 and 2003. Onion was surface-irrigated during the growing season.

Four levels of Zn application (0, 1, 2 and 3 ppm) in a sulfate form were foliary sprayed. The foliar applications were carried out at 30 and 60 days after transplanting. Within each Zn treatment, three poultry fertilizer rates (0.0, 15.0 and 30.0 m^3 ha^{-1}) were established. The analysis of the used poultry manure in this experiment is shown in Table 1 (c). The total dose of applied nitrogen was the same for all treatments and as recommended by the ministry of

Table 1a. Saturation percentage, particle size distribution, textural class,organic matter, and calcium carbonate percentage of the studied soil profile collected from Kafr Hakim .

Depth (cm)	Particle size distribution (%)				Textural Class	O.M %	$CaCO_3$ %
	Coarse sand	Fine sand	Silt	Clay			
0---20	19.4	39.8	8.00	32.8	Sandy clay loam	1.7	2.3
20--40	41.7	43.6	6.7	8.00	Loamy sand	0.6	1.2

Table 1b. chemical analysis of the studied soil profile collected from Kafr Hakim

Sample No.	Depth (cm)	pH	EC ds/m	Soluble cations (meq/L)				Soluble anions (meq/L)			
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$
1	00-20	7.11	1.4	3.7	2.8	7.4	0.1	---	4.1	5.8	4.1
2	20-40	7.23	0.93	2.7	1.3	5.2	0.1	----	3.6	4.0	1.7

Table (1c) Chemical analysis of poultry manure.

pH	O.M %	C %	N %	P %	K %	Ca %	Mg %	Na %	Fe %	Zn (ppm)	Cu ppm
7.5	45.6	36.9	3.1	0.183	2.25	1.19	0.52	0.32	0.13	523	387

Agriculture in Egypt (250 Kg N/ha.). However, this rate of nitrogen was established from the organic and mineral sources according to the experimental treatments, which were as follows:

1. 100% mineral nitrogen (Recommended dose) as control.
2. 75% mineral N dose + 25% Equivalent organic nitrogen (15 m^3 poultry manure)
3. 50% mineral N dose + 50% Equivalent organic nitrogen (30 m^3 poultry manure)

All the calculated amounts of poultry manure were applied during soil preparation. The mineral nitrogen fertilizer dose was split and applied to the soil 30 and 70 days after transplanting. Cultural operations other than experimental treatments were carried out according to the recommendations of Extension Services Department, Ministry of Agriculture, Egypt.

Plant lengths, number of leaves, fresh and dry weights of leaves were recorded at 80 days after planting. Onion samples were collected at harvest time, i.e., two rows, 2 m long, was harvested from each plot where, bulb diameter and thickness of neck were determined. The onion bulbs were weighted to determine fresh weight then dried at 60°C to determine DM content. Total yield were recorded and calculated as (ton/ha).

Chemical analysis of nitrogen and zinc in plant leaves (80 days after transplanting) was determined according to **Black (1965) and Chapman and Pratt (1961)** respectively.

A split plot design was used and the analysis of variance procedures were conducted using SAS statistical procedures (**SAS Inst., 1991**). All differences discussed are significant at the *P* 0.05 probability level unless otherwise stated. LSD was calculated only when the analysis-of-variance *F*-test was significant at the *P* 0.05 probability level. Linear regression analyses using data of the two seasons were carried out in order to find any possible correlation between different experimental factors and recorded parameters.

RESULTS

Vegetative growth

Effect of Zn foliar application

Plant length did not show any significant difference in response to Zn application Table 2 (a and b). The regression analysis showed also no correlation to Zn application (Table 3). The effect was more pronounced on leaf number, which showed a significant increment in response to all Zn applications compared to control. The response rate was also clear to the application rate of Zn. Leaf fresh weight responded positively to Zn application up to 2.0 ppm. However, application of Zn in concentration of 3.0 ppm was not significantly different than control. On the other hand, leaf dry weight was not significantly different in all Zn treatments.

Effect of poultry manure

Onion plants responded to nitrogen source treatments added in the form of poultry manure as shown in Tables (2a and b). There was a linear and significant increment in plant length in response to increasing the fraction of organic nitrogen source. The rate of response expressed as the slope of regression line, was very related to the amount of poultry manure applied to the crop ($R^2 = 0.86$) (Table 3). Number of leaves per plant showed similar positive trend to the amount of poultry manure applied with high correlation however in a slower rate. Leaf fresh weight increased significantly in response to poultry manure application compared to control treatment. However, plants receiving low poultry manure were significantly lower than those receiving high poultry manure. Linear regression showed a fair relationship ($R^2 = 0.55$) between leaf fresh weight and poultry manure application. Leaf dry weight showed a very clear significant response to poultry manure treatments with a very strong correlation however the rate of response was very low.

Interaction effect of poultry manure and Foliar Zn applications

Plant length responded positively to the interaction effect of poultry manure and Zn rate applications as shown in Tables (2a and b). Zn foliar application at 1.0-ppm concentration with the highest amount of poultry manure showed the highest effect on plant length compared to control. All combinations (Zn + poultry manure) of treatments significantly increased number of leaves per plant. Leaf fresh weight significantly increased in response to the interactive effect of the two experimental factors with exception of high poultry manure with null Zn and null poultry manure with 1ppm Zn treatments. Only in the first season, treatment of null poultry manure with 3 ppm Zn application was significantly lower than control. Leaf dry weight responded differently where the highest responses were recorded with the low and high poultry manure additions associated with 1, 2 and 3 ppm Zn foliar applications and were significantly higher than control.

Yield

Effect of Zn foliar application

Effect of Zn application on individual bulb fresh weight was positive compared to control (0.0 ppm Zn), Table (2 a and b). This was reflected on total yield, which is a function of individual bulb fresh weight and number of plants per hectare. Bulb dry weight responded positively to Zn application however, the response to 3 ppm application was smaller compared to 1 and 2 ppm application but still significant than control treatment. No linear relationship could be found between the applied concentrations of Zn and any of bulb fresh and dry weights and total yield.

Effect of poultry manure

Table (2a and b) shows that addition of low (25%) or high (50%) poultry manure amounts positively influenced bulb fresh weight compared to null addition. Low poultry manure treatment was significantly higher than high poultry manure treatment. Bulb dry weight showed the same positive response to the addition of poultry manure however this response was linear with rates of poultry manure addition (Table 3). Total yield was a reflection of individual bulb fresh weight and showed a similar response.

Effect of interaction of poultry manure and Zn applications

With no exception all combinations of poultry manure and Zn application treatments showed a positive and significant effect on fresh weight of individual bulbs (Table 2a and b). Total bulb yield was significantly higher in all treatments compared to control. The most effective treatments on bulb fresh weight and total yield were the spraying with 1 or 2 ppm zinc and the application of N as 75% mineral and 25% organic, in both seasons.

Bulb quality

Effect of Zn foliar application

Application of Zn resulted in linear response of bulb diameter to the applied concentration (Tables 2a&b and 3). However, difference between 2 and 3-ppm Zn application was not significant. The effect of Zn application on neck thickness was clear with 2 and 3 ppm Zn concentration treatments where it was significantly reduced (Tables 2,3). Dry matter content of bulbs was increased significantly with 1 and 2 ppm Zn applications however 3 ppm did not differ significantly than the control.

Effect of poultry manure

Diameter of bulbs and neck thickness responded positively and significantly to the application of poultry manure treatments (Tables 2a and b). Similarly, poultry manure applications increased linearly the dry matter content of the bulbs (Table 3).

Effect of interaction

There was a positive response of bulb diameter to both factors where this character increased as both factors increased (Tables 2a and b). The foliar spray of Zn at 3.0 ppm along with the application of N as 75% mineral and 25% organic was the best treatment in both seasons.

Bulb neck thickness showed a significant difference compared to control treatment where all treatments resulted in smaller neck thickness. All combination of treatments significantly increased dry matter content compared to control with exception of 3 ppm Zn with null poultry manure treatment.

Mineral content

Effect of Zn foliar application

Nitrogen and Zn contents in the leaves was significantly affected by Zn foliar applications, total Zn content showed a clear positive and significant response to these treatments (Tables 2a and b).

Effect of poultry manure

Nitrogen and Zn contents in the leaves responded positively and linearly to the application of poultry manure treatments with all differences between treatments being significant (Tables 2 and 3).

Effect of interaction

Nitrogen content in the leaves was significantly influenced by the interactive effect of the treatments (Table 2a and b). Only treatments with null poultry manure application associated with all Zn applications were not significantly different than control. Meanwhile there was a clear increment in the concentration of Zn in the leaves as the rate addition of Zn application and poultry manure was increased.

DISCUSSION

The aim of this study was to contribute to the optimization of onion crop growth and production by improving root zone environment (addition of organic matter) with possible interaction with shoot environment (Zn foliar application). Zinc is one of the most limiting trace element in agriculture and deficiencies are common in alkaline and sandy soils (**Sliman *et al* 1999**). Zinc is required for photosynthesis (**Sasaki *et al* 1998**) and hence root and shoot growth. This may explain the increment in the number of leaves associated with Zn foliar application in this study. The same result was previously reported by **Singh & Tiwari (1995) and Meena & Singh (1998)** where foliar application of Zn had a positive effect on all plant vegetative growth. This effect may come from the fact that

Table 2 (a). The effect of Zn and N treatments on growth characteristics, yield and mineral contents of onion plant in the first season 2002-2003.

Treatments		Leaf (gm)				Bulb					Total Yield ton/ha	Leaf mineral content	
Zn (ppm)	N (%)	Plant Length (cm)	Leaf No	F. W.	D. W.	Neck Thickness (cm)	Diame-ter (cm)	F. w. (gm)	D.w (gm)	DM (%)		N%	Zn ppm
0	100 mineral (control)	54.00	7.00	72.30	7.20	1.16	4.50	60.00	5.49	9.9	22.8	2.60	10.02
	75 mineral+25 organic	59.00	9.00	78.30	7.60	1.55	5.50	63.54	8.06	12.68	24.15	2.80	15.11
	50 mineral +50organic	62.17	10.00	70.50	8.80	1.80	5.60	69.03	8.46	12.26	26.23	2.95	16.00
1	100 mineral (control)	55.33	8.00	73.00	7.42	1.20	5.05	64.64	8.01	12.39	24.56	2.60	13.10
	75 mineral+25 organic	59.17	9.17	86.62	7.97	1.70	5.80	73.89	8.10	10.96	28.08	3.00	17.00
	50 mineral +50organic	66.00	11.00	84.37	9.13	1.50	5.90	68.22	9.10	13.34	25.92	3.21	15.08
2	100 mineral (control)	55.00	8.00	76.10	7.50	1.20	5.80	65.79	8.48	12.89	25.00	2.60	15.00
	75 mineral+25 organic	59.50	9.50	99.65	8.30	1.50	6.10	72.54	8.10	11.17	27.57	3.10	18.03
	50 mineral +50organic	65.00	10.50	105.05	9.20	1.10	6.10	66.78	9.09	13.61	25.38	3.32	19.00
3	100 mineral (control)	57.00	9.00	64.10	7.55	1.25	6.20	67.59	6.32	9.34	25.68	2.64	17.00
	75 mineral+25 organic	60.00	10.00	81.90	8.00	1.24	6.50	66.18	8.09	12.22	25.15	3.53	21.10
	50 mineral +50organic	65.00	10.00	77.55	9.40	1.38	5.80	67.77	9.21	13.59	25.75	3.82	22.11
LSD 5%		0.15	0.22	1.82	0.15	0.04	0.08	0.66	0.2	0.3	0.25	0.07	0.46
Average N treatments													
100 % mineral N		55.33	8.00	71.38	7.42	1.20	5.39	64.5	7.19	11.13	24.51	2.61	13.78
75 % mineral N+25% organic N		59.42	9.42	86.62	7.97	1.50	5.98	69.04	8.09	11.76	26.23	3.11	17.81
50 % mineral N+ 50% organic N		64.54	10.38	84.37	9.13	1.45	5.85	67.95	8.97	13.20	25.82	3.33	18.05
LSD 5%		0.07	0.11	0.91	0.07	0.02	0.04	0.33	0.1	0.15	0.12	0.03	0.23
Average zinc concentration													
zn 0 ppm		58.39	8.67	73.70	7.87	1.50	5.20	64.1	7.49	11.61	24.39	2.78	13.71
zn 1 ppm		60.17	9.39	81.33	8.17	1.47	5.58	68.92	8.40	12.23	26.19	2.94	15.06
zn 2 ppm		59.83	9.33	93.60	8.33	1.27	6.00	68.37	8.56	12.55	25.98	3.01	17.34
zn 3 ppm		60.67	9.67	74.52	8.32	1.29	6.17	67.18	7.87	11.72	25.53	3.33	20.07
LSD 5%		N.S.	0.28	3.00	N.S.	0.04	0.21	1.91	0.23	0.36	0.73	0.11	0.82

Table 2 (b). The effect of Zn and N treatments on growth characteristics, yield and mineral contents of onion plant in the second season 2003-2004 .

Treatments			Leaf (gm)			Bulb					Total Yield ton/ha	Leaf mineral content	
Zn (ppm)	N (%)	Plant Length (cm)	Leaf No	F.W.	D.W.	Neck Thickness (cm)	Diameter (cm)	F. w. (gm)	D.w (gm)	DM (%)		N%	Zn ppm
0	100 mineral (control)	56.70	7.35	75.92	7.56	1.22	4.73	63.00	6.24	10.4	23.94	2.70	10.42
	75 mineral+25 organic	62.19	9.49	82.53	8.01	1.63	5.80	66.97	8.49	13.36	25.45	2.92	15.74
	50 mineral +50organic	64.96	10.45	73.67	9.20	1.88	5.85	72.14	8.84	12.81	27.41	3.08	16.71
1	100 mineral (control)	58.10	8.40	76.65	7.79	1.26	5.30	67.87	8.41	13.01	25.79	2.70	13.62
	75 mineral+25 organic	62.36	9.66	91.29	8.40	1.79	6.11	77.88	8.54	11.55	29.59	3.13	17.71
	50 mineral +50organic	68.97	11.50	88.16	9.54	1.57	6.17	71.29	9.51	13.94	27.09	3.35	15.75
2	100 mineral (control)	57.75	8.40	79.91	7.88	1.26	6.09	69.08	8.90	13.53	26.25	2.70	15.60
	75 mineral+25 organic	62.71	10.01	105.03	8.75	1.58	6.43	76.46	8.54	11.77	29.05	3.23	18.79
	50 mineral +50organic	67.93	10.97	109.78	9.61	1.15	6.37	69.79	9.50	14.22	26.52	3.47	19.84
3	100 mineral (control)	59.85	9.45	67.31	7.93	1.31	6.51	70.97	6.63	9.81	26.97	2.75	17.68
	75 mineral+25 organic	63.24	10.54	86.32	8.43	1.31	6.85	69.75	8.52	12.88	26.51	3.68	21.99
	50 mineral +50organic	67.93	10.45	81.04	9.82	1.44	6.06	70.82	9.62	14.20	26.91	3.99	23.09
LSD 5%		0.86	0.22	1.92	0.15	0.04	0.09	0.07	0.21	0.31	0.27	0.07	0.48
Average N treatments													
100 % mineral N		58.10	8.40	74.94	7.79	1.26	5.66	67.73	7.55	11.69	25.74	2.71	14.33
75 % mineral N+25% organic N		62.63	9.93	91.29	8.40	1.58	6.30	72.77	8.52	12.39	27.65	3.24	18.56
50 % mineral N+ 50% organic N		67.45	10.84	88.16	9.54	1.51	6.11	71.01	9.37	13.79	26.98	3.47	18.85
LSD 5%		0.43	0.11	0.96	0.07	0.02	0.04	0.35	0.1	0.15	0.31	0.04	0.24
Average zinc concentration													
zn 0 ppm		61.28	9.10	77.37	8.26	1.58	5.46	67.37	7.68	12.19	25.6	2.90	14.29
zn 1 ppm		63.14	9.85	85.37	8.58	1.54	5.86	72.35	8.82	12.84	27.49	3.06	15.70
zn 2 ppm		62.80	9.80	98.24	8.75	1.33	6.30	71.77	8.98	13.17	27.27	3.13	18.08
zn 3 ppm		63.67	10.15	78.22	8.73	1.35	6.47	70.51	8.26	12.30	26.80	3.47	20.92
LSD 5%		N.S.	0.30	3.15	N.S.	0.05	0.22	2.01	0.24	0.38	0.76	0.11	0.86

Table 3. Constants of variables of liner regression, standard errors and their correlation of different crop characters in relation to poultry manure or zinc application (data of 2 seasons have been used for regression analysis).

			Leaf (gm)			Bulb					Leaf mineral content	
	Plant Length (cm)	Leaf No	F. W.	D. W.	Neck Thickness (cm)	Diameter (cm) (cm)	F. w. (gm)	D.w (gm)	DM (%)	Total Yield ton/ha	N%	Zn ppm
Variable coefficient (poultry manure rate)	0.186	0.048	0.262	0.035	0.067	0.009	0.036	0.042	0.026	0.015	0.088	0.186
Standard Error of Coefficient	0.037	0.006	0.118	0.006	0.054	0.006	0.005	0.009	0.021	0.002	0.024	0.037
R^2	0.866	0.934	0.554	0.894	0.276	0.397	0.930	0.857	0.276	0.913	0.771	0.866
Variable coefficient (foliar Zn concentration)	0.666	0.302	1.507	0.155	0.864	0.340	0.134	0.065	0.328	0.175	2.181	0.666
Standard Error of Coefficient	0.564	0.103	3.008	0.080	0.847	0.057	0.167	0.178	0.322	0.031	0.183	0.564
R^2	0.188	0.587	0.040	0.386	0.148	0.855	0.097	0.022	0.148	0.837	0.959	0.188

Zn is involved in so many plant enzymes specially those in the photosynthesis process (**Sasaki** ***et al*** **1998**), which means that deficiency greatly affects DM production (**Joiner, 1983; Jones, 1983; Resh, 1983; Bergman, 1985 and Kumar** ***et al*** **2000**). Zinc is also essential for bulb formation, therefore early application is important. If zinc is low when bulbs are forming, yields will be significantly reduced (**Kumar** ***et al*** **2000**). There was a positive relation between bulb yield and Zn foliar application in this study, which is in harmony with the findings of **Meena & Singh (1998) and Sliman** ***et al*** **(1999)**.

With the same number of plants per unit area, improvement in yield must have come from the improvement in individual plant yield. This is what has been observed in this study due to Zn application. Therefore bulb quality in terms of average individual fresh weight was improved by Zn application due to improvement in photosynthesis (**Sasaki** ***et al*** **1998**). This has been observed before as a result of applying Zn (**Pena** ***et al*** **1999**) and poultry manure (**Gupta** ***et al*** **1999 and Abbey, 2000**).

Soil organic matter content may help in improving the availability of micronutrient, including Zn, by forming complexes with them (**Tagwira** ***et al*** **1992**). Moreover, occasional manure applications will supply the zinc needs for plants (**Whiting** ***et al*** **2002**). It must be also noted that the amount of Zn in the poultry manure as revealed by the chemical analysis (Table 1b) may have contributed to the observed growth effects in this study.

Poultry manure has organic-N, which is being slowly recycled by a process called mineralization, back into plant available N (**Lampkin, 1990**). This resulted in increment in plant growth parameters such as plant length and number of leaves, which showed a linear correlation with the amount of poultry manure added in this study. This has been previously reported as a result of adding poultry manure to onion crop (**Gupta** ***et al*** **1999**).

Increment in vegetative growth in current study may be due to increment in water availability in the soil, which may be brought about by increasing organic matter content. Increasing leaf number and length of the plant means increasing leaf area of the plant that intercepts light. This means higher rate of photosynthesis and production of assimilates. Higher water availability and assimilate production means higher fresh and dry weights of the leaves and that what have been observed in this study. **Kumar** ***et al*** **(1998 and 2000)** found that yield of onion was positively correlated with plant length, number of leaves per plant, fresh weight of leaves per plant and this is in harmony with our results.

The observed high Zn content in the leaves can be explained on the basis that all sprayed Zn salt was not completely absorbed and translocated to different plant parts. This is supported by the findings of **Ferrandon and Chamel (1988)** who mentioned that Zn applied either in chelated or in the sulfate-salt form, an extensive fixation by cuticle occurred at the point of application. They added that foliar absorption of this element was lower from chelates than from the inorganic salt, but the translocation within the plant was greater when chelated forms were applied. **Sliman** ***et al*** **(1999)** mentioned that foliar spray treatments of $ZnSO_4$ increased Zn concentration to its highest concentration and content.

CONCLUSION

It could be concluded that under experimental conditions, substituting part of the nitrogen mineral fertilizer with equivalent organic fertilizer along with Zn foliar application can improve onion crop production and quality. This will contribute to environmental saving by reducing the application of mineral N fertilizer hence reducing the fraction of these fertilizer that being leached to the under ground water.

REFERENCES

Abbey, L. (2000). Effect of poultry manure and post-production application of fungicide on the shelf-life of onion cv. Bawku Red. *Crop Research Hisar. 20 (1): 87-92.*

Bergman, E.L. (1985). Nutrient Solution Culture of Plants. The Pennsylvania State University College of Agriculture, Extension Service Hort. *Mimeo Series II:160. pp: 21.*

Black, C.A. (1965). *Methods of Soil Analysis. Part2.* American Society of Agronomy, INC., Publisher, Madison, Wisconsin, USA.

Brouwer, H.M.; G.R. Stevens and J.G. Fletcher (1981). Differential varietal response to zinc foliar sprays in navy beans (*Phaseolus vulgaris*). Queensl. *J. Agric. Anim. Sci. 38: 181-185.*

Chapman, H.D. and P.F. Pratt (1961). *Methods of Analysis for Soils, Plant and Water.*, Div. of Agric. Sci. University of California, Riverside, USA.

FAO Statistics. (2004). *Production Yearbook 2003. Vol. 57"* Rome, Italy

Ferrandon, M. and A.R. Chamel (1988). Cuticular retention foliar absorption and translocation of iron, manganese and zinc supplied in organic and inorganic form. *J. Plant Nutr. 11: 247-264.*

Giardini, L.; M. Borin and G. Gianquinto (1992). Effects of poultry manure and mineral fertilizers on the quality of crops. *J. Agric. Sci. 118 (2): 215-221.*

Gupta, U. C. (1991). Iron status of crops in Prince Edward Island and effect of soil pH on plant iron concentration. *Can. J. Soil Sci. 71: 197-202.*

Gupta, R.P.; V.P. Sharma D.K. Singh and K.J. Srivastava (1999). Effect of organic manures and inorganic fertilizers on growth, yield and quality of onion variety Agrifound Dark Red. *Newsletter National Horticultural Res-earch and Development Foundation 19: (2-3) 7-11.*

Joiner, J.N. (1983). Nutrition and fertilization of ornamental greenhouse crops, J. Janick (ed.). In: *Horticultural Reviews, 5, pp. 380-403.* AVI Pub. Co., Inc. Westport, CT., USA.

Jones, J.B. (1983). *A Guide for the Hydroponic and Soilless Culture Grower. p. 124,* Timber Press, Beaverton Oregon.

Khan, A. and C.M. Weaver (1989). Pattern of zinc-65 incorporation into soybean seeds by root absorption, stem injection and foliar application. *J. Agric. Food. Chem. (37): 855-860.*

Kropisz, A. (1992). Organic fertilizers in all cases improved cropping, with the highest average yields. *Annals-of-Warsaw-Agricultural-University. 16: 9-13.*

Kumar, M.; P.S. Munsi; D.K. Das; T.K. Chattopadhyay and M. Kumar (1998). Effect of zinc and sulphur application on the yield and post harvest quality of onion (Allium cepa L.) under different methods of storage. *J. Interacademicia., 2 (3): 158-163.*

Kumar, M.; D.K. Das and D.K. Kumar (2000). Effect of zinc and sulfur application on their availability in soil in relation to yield and nutrition of onion (*Allium cepa* L.). ***Madras-Agricultural-Journal.84 (7): 382-384.***

Lampkin, N. (1990). ***Organic Farming. Farming Press Books and Video. p. 91.*** Wharfedale Road, Ipswich IPI 4LG, United Kingdom.

Meena, O.S. and D. Singh (1998). Effect of sulfur and zinc application on onion yield and sulfur and zinc uptake in three soil orders. ***J. Indian Society of Soil Sci. 46 (4):636-640.***

Pena, C.; B. Anez and M. Davila, (1999). Response of the onion (Allium cepa L.) to the application of sulfur, magnesium, zinc and boron in an alkaline soil. ***Revista-Forestal-Venezolana 43 (2): 173-182.***

Rehm,. G. and M. Schmitt, (2000). Zinc for crop production. **Publication of Extension Service of University of Minnesota F0-00720-GO., USA.**

Resh, H.M. (1983). ***Hydroponics Food Production. 2nd Ed. p 335.*** Woodbridge Press Publishing Co., Santa Barbara, CA.

SAS Institute (1991). SAS / STAT Users Guide. ***Version 6. 4th Ed. SAS Inst., Cary, NC.***

Sasaki, H.; T. Hirose; Y. Watanabe and R. Ohsugi (1998). Carbonic Anhydrase Activity and CO_2-Transfer Resistance in Zn-Deficient Rice Leaves. ***Plant Physiol. 118: 929-934***

Singh, D.P. and R.S. Tiwari (1995). Effect of micronutrients on growth and yield of onion *(Allium cepa* L.) variety ***Pusa Red. Recent-Horticulture. 2 (2): 70-77.***

Sliman, Z.T.; M.A. Abdelhakim and A.A. Omran (1999). Response of onion to foliar application of some micronutrients. ***Egyptian J. of Agric. Res. 77 (3): 983-993.***

Sloan, D.R.; G. Kidder and R. D. Jacobs (1996). Poultry manure as a fertilizer. ***Series of the Animal Science Department, pp. 1-3, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. USA.***

Tagwira, F.; M. Piha and L. Mugwira, (1992). Effect of pH, and phosphorus and organic matter contents on zinc availability and distribution in two Zimbabwean soils. ***Commun. Soil Sci. Plant Anal. 23: 1485-1500.***

Vinay, S.; R.K. Singh and V. Singh (1995). Response of onion (*Allium cepa* L.) to N, P, Zn and FYM. ***Annals of Agricultural Research. 16 (1): 79-81.***

Weaver, C.M. (1985). Intrinsic mineral labelling of edible plants, methods and uses. ***CRC Crit. Rev. Food Sci. Nutr.; Issue: 1: 75-101.***

Whiting, D.; C. Wilson, and A. Card (2002). ***Plant Nutrition. pp 1-7.*** Cooperative Extension. CMG Fact Sheet No. S31. Colorado State University. USA.

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التأثير التفاعلى لكل من الزنك ومصادر مختلفة من النيتروجين على جودة ومحصول البصل

[٥٧]

عبد الموجود رجب عبد الموجود[١]- شعبان دسوقى ابو حسين [١]- سمير رجب سلمان[١]- وماجد عبد العزيز النمر [١]

١. قسم بحوث الخضر-المركز القومي للبحوث- الدقى- القاهرة- مصر

أجريت هذه الدراسة فى تربة طمييـة رملية خلال شهر ديسمبر لعامى ٢٠٠٢-٢٠٠٣ بمحافظة الجيزة وذلك لدراسة التأثير التفاعلى لكل من الزنك ومصادر نيتروجين مختلفة على نمو وجودة البصل صنف جيزة ٢٠. وقد استخدم اربعة مستويات من الزنك (٠ ، ١ ، ٢، و٣ جزء فى المليـون) فـى صورة سلفات زنك تم رشها على النباتـات عنـد ٣٠ و ٦٠ يـوم مـن زراعـة الشتـلات. وقـد تـم اضـافة معـاملات النيتروجين فى صـورة معدنيـة (سـلفات امونيـوم) وصـورة عضـوية (سمـاد دواجن).

وكانت المعاملات ١٠٠ % معـدنى ، ٧٥% معدنى + ٢٥% عضوى و ٥٠ % معدنى + ٥٠% عضوى وقد تـم إضـافة جميع مستويات السماد العضوى خلال اعداد التربة للزراعة.

وقد بينت النتائج ان جميع قياسات النمو لنباتات البصل قد زادت بزيادة معدل اضافة السماد العضوى. كما ان اضـافة الزنـك اعطى تاثير موجب على نمو النبات فيمـا عدا طول النبات و الوزن الجاف للأوراق. وكان التأثير التفاعلى للزنك وسماد الدواجن ذا تأثير ايجابى علـى زيـادة المحصـول وجودة الابصال.

وكانت اكثر المعـاملات تـأثيرا علـى الوزن الطازج للابصال والمحصول الكلـى والجودة عندما رشت النباتات بتركيـز ١ - ٢ جزء في المليون زنك واضافة ٧٥% من النيتروجين المعدنى مـع ٢٥% نيتـروجين عضوى فى كلا الموسمين.

تحكيم: ا.د إبراهيم إبراهيم المكش
ا.د سمير عثمان السعيـد