J. Plant Production, Mansoura Univ., Vol. 7(10): 1109 - 1113, 2016

Effect of Mineral, Bio and Organic fertilization on Garlic production

Zaghloul, M. M. [1]; A. H. Morsy [2] and S. S. Elafifi [2]
[1]Fact. Of Agric. Mansoura Univi.
[2]Agric. Res. center. Agric. Ministry. Egypt

ABSTRACT.

Two field experiments were carried out at Mansoura Agriculture Research Station during the two seasons of (2014 / 2015) and (2015 / 2016) to study the effect of spraying micro elements in combination with Bio. and organic fertilization on garlic production. The treatments tested are Zn at 60 Ppm , Mn at 60 Ppm , Fe at 80 Ppm and Zn + Mn + Fe at 60 – 60 – 80 Ppm respectively were sprayed on garlic plants grown in plots treated with Bio fertilizer (Nitrobin + Phosphorin) and combined with organic fertilizer at rate of 10 m^3 / Fed . + 50 % of the recommended dose of chemical fertilizer and 100 % chemical fertilizer. The results indicated that chemical fertilizers at 100 % and 50 % (FYM) + 50 % chemical fertilizers have insignificant effect on plant height, bulbing ratio and bulbing diameter in the two years. While number of leaves and neck diameter were higher in the first season .as affected by 50 % (FYM) + 50 % (chemical fertilizers). Moreover 100 % chemical fertilizers give less yield than 50 % (FYM) + 50 % (chemical) in the two years. Bio - fertilizers treatments give higher yield than treatments without Bio fertilizers. However, number of leaves was higher in the Bio fertilizers treatments but neck diameter, bulbing diameter and bulbing ratio were not affected in the two yearsAs for spraying with microelements (Zn, Mn, Fe) all parameters were affected significally in the two years. Since microelements give rise to higher values in vegetative growth and total yield (Ton / Fed). The results indicated that the triple interactions have no effect on all vegetative growth parameters in the two years but total yield was affected significally in the two years. Finally spraying garlic with (Zn + Mn + Fe) gives the highest yield under application of (nitrobin + phosporin) in combination with 50 % FYM + 50 % chemical fertilizers.

INTRODUCTION

Garlic (*Allium sativum L*,) occupies the second rank among Allium species after onion over all the world. The four leading countries in the world for garlic production are China, India, Korea and Egypt, according to FAO (2011) staticties, total garlic production reached to 244,626 MT in Egypt. Garlic is used as a spice form, flavoring and seasoning dishes, pickles and sauces. In addition, garlic cloves have a lot of health benefits. Recently, most producers tend to dehydrate cloves to overcome high lost percent during storage and using their extracts in medicines purposes, insecticides, plant nourishments and explosives. Increasing garlic production needs to focus attention on several factors affecting it i.e. mechanization, rationalized irrigation, planting intensification, favorable climate, use of improved garlic cultivars and use virus free garlic.

Garlic feeding through chemical fertilizers alone can have deleterious effect on soil fertility and can lead to unsustainable yields, while, application of chemical fertilization with organic manures and biofertilizers can maintain soil fertility and soil productivity Fawzi et al. (1987) . In addition, the increasing concern on the influences of chemical fertilizer on the environment makes organic manures and biofertilizers safer and better alternatives some of nutrients to crop. Therefore, integrated use of inorganic, organic and biofertilizers are preferred to get better growth, bulb characters, and marketable yields in garlic.

Several researchers carried out a number of trials to show the effect of bioferitilizers on garlic vegetable growth. For example, Nainwal *et al* (2015) found that phosphate solubilizing bacteria (PSB) and trichoderma supplemented with farm yard manure (FYM) and 100% recommended dose of NPK gave higher values of plant growth parameters viz., plant height, number of leaves and leaf length. Moreover, clove treatment with phosphate solublizing bacteria (PSB) was effective for all parameters.

Sabagh et al. (2014) reported that application of manure at various levels (0, 10, and 20 tons. Ha -1) with recommended dose of thiobacillus bacteria enhanced the growth attributes in garlic over control.

In addition, (Jawadagi *et al* (2012) reported that plant height and leaf length could be increased with the treatment of 50 % FYM (12.50 t ha -1) + 50 % vermicompost (2t ha-1) + bio – fertilizers *(Azospirillum* and phosphate solubizing bacteria) in garlic .

Adding, micronutrients as a foliar application can compensate their deplation as a result of continuous cultivation of soil with vegetable crops, so, in this study fe, Zn and Mn alone or in combination can be accounted because of their essential role in respiration, N metabolism, activation of enzymes, photosynthesis chloroplast formation, chlorophyll synthesis and natural hormone biosynthesis (Nijjar 1985 and Marshner, 1995).

Gupta and Ganeshe (2000) reported that zinc sulphate (25 Kg / Ha) + borax 10 Kg / ha) lead to obvious increase in yield of garlic. Srivastava *et al* (2005) reported that Boric acid at 0.1 % and zinc sulphate at 0.4 % gave rise to maximum bulb yield and total soluble solids. Significant influences were observed on yield of garlic when microelements were applied (chanchan , 2013).

The lack of evidence on the effect of microelements on garlic neussitated the assessment of the efficacy of Zn, Mn and Fe in order to achieve its productivity potential.

Therefore, This investigation aimed to the effect of organic, biofertilizer and microelement on growth, productivity of garlic.

MATERIALS AND METHODS

The present experiments were conducted during the two seasons (2014 / 2015) and (2015 / 2016) at Agriculture Research station of Mansoura University. The soil of the experimental site contained 2.18 % coarse sand, 23.05 % fine sand and 33 % silt and 41.8 % clay. the PH , EC , Organic carbon , available N , phosphors , K , of the soil was 8.1 , 1.07 DSm^{-1} , 1.65 g/kg^{-1} , 48 mg/kg , 4.25 mg / kg and 375 mg / kg respectively .

Split split system in a randomized complete blocks design with three replicates was used. The main plot contains 100 % chemical fertilizer and 50 % organic (FYM) + 50 % chemical fertilizer (100 kg N – P – K, 19 – 19 – 19 while sub plot contains biofertilizer and without biofertilizer.

Microelement spraying treatments were assigned in the sub sub plot . the area of sub sub plot was 10.5 m^2 . The experiment includes 20 treatments which were the combination of 2 fertilizers levels x 2 biofertilizers rate x 5 foliar microelements application .

Garlic cloves were used at 150 k.g / fed. For the experiments. cloves of garlic were planting after preparing the experimental plots on the first week of October during the two seasons . FYM was applied at 10 m^3 per fed. at 10 days before planting .

N P K (19 – 19 – 19) was applied at 200 kg / fed. (recommended rate) in 3 parts half at the time of planting , one fourth at 60 days after planting and one fourth at 100 days after planting .

The cloves were treated with nitrobin and phosphorin as pre treatment at the time of sowing. The cloves were planted on one side of the ridges at the distance of 10 cm apart .

Three microelements namely zinc as zinc sulphate ($ZnSO_4 . 7H_2O$ at 60 Ppm , iron as ferous sulphate ($FeSO_4 . 7H_2O$) at 80 Ppm and manganese as manganese sulphate ($MnSO_4 . H_2O$) at 60 Ppm and Zn + Mn + Fe as a mixture were applied as foliar spray at 45 , 60 , 75 days after planting . Control treatment was sprayed with tap water only .

A random sample of five plants were randomly taken from each plot at 135 days after planting in the two seasons to estimate the growth parameter of garlic i.e. plant height , No. of leaves , neck diameter , bulb diameter , bulbing ratio Total yield per fed. was recorded after 160 days from planting .

Statistical analysis:-

Data of both experiments were subjected to proper statistical analysis of variance according to snedecor and cochran (1980) The treatments means were compared using least significant differences (LSD) at 5 % level method as mentioned by gomez and gomez (1984).

RESULTS AND DISCUSSION

Data presented in Table 1 indicate that plant height, bulb diameter and bulbing ratio were not responded to FYM at 10 m^3/ Fed. + 50 % of the recommended rate of chemical fertilizer or 100 % chemical fertilization treatment in both years of study. While number of leaves, plant and neck diameter were significantly responded to the previous treatments in the first year only. On the other hand , the two fertilizer treatments had positive effect on total yield / fed in both years , since the first treatment (FYM at 10 m^3/ Fed + 50 % of the recommended rate of chemical fertilizer) gave the higher total yield as compared with the second one (100 % of the recommended rate of chemical fertilizer) during the two years. Such increase in total yield could be due to being FYM + chemical valuble as a source of macro and microelements to plants and used as a good natural soil texture conditioner, which in turn lead to increase availability and uptake of nitrogen , phosphorus and potassium.

In this regard , photosyntheis and metabolic processes of organic compounds are stimulated, Sabagh *et al* (2014) came out to similar conclusions.

Biofertilizer treatment (nitrobin + phosphorin) gave rise to significant increases as for plant height and number of leaves in the first year, while bulb diameter , neck diameter and bulbing ratio were not responded to biofertilizer in the two years . In addition total yield / fed . was significantly increased in both years due to biofertilizers application

The previous results could be explanied on the basic of that various strains of microorganisms make the macroelements more available to plant . Moreover , the increase in vegetable growth is due to the vital rate of bacteria present in the applied biofertilizer to secrete some hormone substances such as gibberellic , auxins and cytokinines (cacciari et al, 1989) .

Such phytohormones may stimulate cell elongation and division which in turn reflect on plant growth (koch et al. 1997).

Plant height recorded at 135 days after planting indicated significant variations in the two years table 1. The tallest plants were recorded in all treatments of foliar microelement sprays in the two years. Likewise, number of leaves, bulb diameter and neck diameter increased significantly in all microelements treatments in the two years as compared with control. Also, total yield in all plots treated with microelements, increased clearly as compared with control in the two years. Such clear increased in vegetative growth parameters and total yield due to spraying microelements could be related to their involvement in cell division and cell expansion, improve physiological activities like photosynthesis during food manufactured by the plant and translocate in the bulb. These results are in agreements with those of yousuf et. al. (2016) and chanchan et. al. (2013).

Table 2 showed that the interaction between organic and chemical fertilization and biofertilizer had no significant effect as for plant height, bulbing ratio and total yield ton / fed. in the two years . while, neck diameter was affected significantly with this interaction in the two years . On the other hand, number of leaves , plant and bulb diameter were only affected in the first year.

Table 1. Effect of mineral and / or organic fertilizer and foliar microelements applications on vegetative growth parameters and total yield of garlic in the two seasons 2015 – 2016.

Treatments		Plant height Cm		No. of leaves		Bulb diameter Cm		Neck diameter Cm		Bulbing ratio		Total yield ton / fed	
		2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Chemical fertilizers	50%	87.95	90.0	10.1	9.24	4.4	5.3	1.26	1.67	0.28	0.30	10.72	10.16
	100%	82.8	87.3	9.08	8.94	3.8	5.24	1.10	1.62	0.28	0.30	7.90	10.83
F test at 5 %		N S	N S	0.49	N S	N S	N S	0.11	N S	N S	N S	0.33	0.61
Bio fertilizer	Without	82.5	88.3	9.8	8.9	4.1	5.25	1.17	1.64	0.28	0.31	9.41	10.1
	With	87.8	89.2	9.4	9.3	4.1	5.45	1.18	1.65	0.29	0.30	9.20	11.0
F test at 5 %		2.6	N S	0.29	N S	N S	N S	N S	N S	N S	N S	N S	0.81
Foliar treatment	Cont	77.1	76.4	8.5	8.3	3.37	3.90	1.18	1.18	0.30	0.30	5.72	7.84
	Zn	85.0	91.6	10.1	9.4	4.26	5.32	1.23	1.68	0.29	0.31	10.53	11.39
	Mn	88.0	88.3	9.9	9.4	4.14	5.43	1.17	1.70	0.28	0.31	9.91	10.85
	Fe	86.5	91.4	9.9	9.0	4.38	5.79	1.24	1.79	0.28	0.31	9.29	10.61
	Zn+Mn+Fe	89.9	96.5	9.5	9.6	4.30	5.94	1.28	1.94	0.29	0.32	11.01	11.83
F test at 5 %		6.2	7.3	0.61	0.71	0.42	0.51	0.14	0.51	N S	N S	0.79	0.93

Table 2. Effect of the interaction between biofertilizer, organic and / or mineral fertilizer on vegetative growth parameters and total yield of garlic in the two seasons 2015 – 2016

Treatments		Plant height Cm		No. of leaves		Bulb diameter Cm		Neck diameter Cm		Bulbing ratio		Total yield ton / fed	
		2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
50 % fym + 50 % chem	without	84.5	10.5	10.5	9.4	4.47	5.24	1.23	1.63	0.27	0.30	10.35	9.23
	With bio	91.4	9.7	9.7	9.1	4.30	5.37	1.30	1.71	0.30	0.31	11.10	11.70
100% chemical fertilizer	without	81.3	9.0	9.0	8.5	3.81	5.28	1.12	1.65	0.29	0.31	8.50	10.80
	With bio	84.4	9.2	9.2	9.4	3.77	5.20	1.06	1.60	0.28	0.30	7.34	10.86
l s d at 5 %		N S	N S	5.30	N S	0.17	N S	2.36	2.11	N S	N S	N S	N S

Data given in Table 3 indicated that number of leaves per plant and neck diameter are signifícnly affected by the interaction between organic and chemical fertilization and microelements spraying in the two years. While, plant height, bulbdiameter, bulbing ratio and total yield were not signifcantly affected by their interaction in the two years.

Table 3. Effect of the interaction between organic and / or mineral fertilizers and microelements spraying on vegetative growth parameters and total yield of garlic in the two seasons 2015 - 2016

Treatments		Plant height Cm		No. of leaves		Bulb diameter Cm		Neck diameter Cm		Bulbing ratio		Total yield ton / fed	
		2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
50 % fym +50% chem	Control	77.9	75.2	8.7	8.4	3.57	3.90	1.04	1.15	0.29	0.29	5.88	7.42
	Zn	85.5	94.7	11.1	9.4	4.70	5.33	1.33	1.73	0.28	0.31	11.91	11.48
	Mn	91.9	88.6	10.3	9.7	4.33	5.45	1.26	1.66	0.29	0.30	12.07	11.31
	Fe	90.8	94.3	10.0	8.8	4.85	5.85	1.30	1.85	0.27	0.32	10.26	9.28
	Zn,Mn,Fe	98.3	97.8	10.4	9.9	4.46	6.01	1.40	1.97	0.29	0.33	13.85	10.47
100% chemical fertilizer	Control	76.1	76.5	8.3	8.2	3.16	3.91	1.00	1.20	0.31	0.31	5.63	8.26
	Zn	84.2	88.7	9.2	9.3	3.81	5.31	1.12	1.63	0.29	0.30	9.51	11.28
	Mn	84.3	88.0	9.5	9.0	3.96	5.41	1.07	1.75	0.26	0.32	7.71	10.39
	Fe	83.1	89.4	9.8	9.1	3.91	5.72	1.15	1.73	0.28	0.30	8.31	11.94
	Zn,Mn,Fe	86.5	95.0	8.6	9.4	4.13	5.86	1.15	1.91	0.29	0.32	8.43	12.17
L S D at 5 %		N S	N S	10.3	11.2	N S	N S	3.56	3.78	N S	N S	N S	N S

Plant height and total yield as shown in Table 4 were significantly responded to the interaction between biofertilizer and microelements spraying, while numbers of leaves, plant bulb diameter, neck diameter, bulbing ratio were not affected by that interaction.

Bulb diameter , neck diameter , bulbing ratio and total yield were significantly affected by the triple interaction in the two year, while, plant height, number of leaves, plant and bulb diameter were not affected in the two years (Table 5) .

Table 4. Effect of the interaction between biofertilizer and microelements on vegetative growth parameters and total yield of garlic in the two seasons 2015 - 2016

Treatments		Plant height Cm		No. of leaves		Bulb diameter Cm		Neck diameter Cm		Bulbing ratio		Total yield ton / fed	
		2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Without Bio	control	74.7	76.7	8.6	7.8	3.50	3.81	1.05	1.15	0.30	0.29	5.59	7.52
	zn	84.2	87.6	9.4	9.3	4.43	5.43	1.30	1.71	0.28	0.30	11.77	10.84
	mn	88.4	87.5	10.1	9.3	4.38	5.08	1.16	1.65	0.26	0.32	10.35	10.36
	fe	79.8	92.9	10.2	8.6	4.12	5.81	1.23	1.80	0.29	0.31	9.08	10.03
	zn,mn.fe	88.5	96.6	9.5	9.8	4.23	6.09	1.23	1.91	0.29	0.31	10.33	11.45
With Bio fertilizer	control	79.5	75.0	8.3	8.7	3.24	4.00	0.98	1.20	0.29	0.30	5.86	8.16
	zn	85.7	95.6	9.9	9.4	4.09	5.21	1.23	2.66	0.30	0.31	9.28	11.94
	mn	87.7	89.1	9.7	9.4	3.90	5.68	1.16	1.75	0.30	0.30	9.48	11.34
	fe	94.2	89.3	9.7	9.3	4.64	5.76	1.18	1.75	0.27	0.30	9.49	11.19
	zn,mn,fe	96.4	96.3	9.5	9.4	4.38	5.78	1.34	1.97	0.31	0.33	12.01	12.22
L S D at 5 %		5.3	6.3	N S	N S	N S	N S	N S	N S	N S	N S	4.33	3.76

Table 5. Effect of the triple interaction on vegetative growth parameters and total yield of garlic in the two seasons 2015 – 2016

Treatment			Plant height cm		No. of leaves		Bulb diameter Cm		Neck diameter Cm		Bulbing ratio		Total yield ton / fe	
			2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
50% FYM+ 50% chem.	Without bio	Control	74.3	75.3	9	8	3.99	3.80	1.11	1.10	0.27	0.27	5.6	6.71
		Zn	81.7	90.6	12	9.6	4.90	5.35	1.30	1.71	0.26	0.30	12.2	10.76
		Mn	95.0	89.3	10.6	10.1	4.76	5.15	1.20	1.50	0.25	0.29	12.5	10.61
		fe	83.3	97.3	10.3	8.6	4.33	5.85	1.25	1.90	0.28	0.32	9.2	7.85
		Zn,mn+fe	88.3	97.6	10.7	10.6	4.35	6.07	1.30	1.95	0.29	0.32	12.1	10.22
	With bio	control	81.6	75.0	8.3	8.7	3.15	4.00	0.97	1.20	0.30	0.30	6.0	8.21
		Zn	90.0	98.6	10.3	9.2	4.50	5.31	1.33	1.75	0.30	0.32	10.8	12.21
		Mn	88.7	88.0	10	9.3	3.89	5.75	1.33	1.81	0.34	0.30	11.66	12.01
		Fe	98.3	91.3	9.7	9.1	5.36	5.85	1.30	1.83	0.25	0.31	11.2	10.71
		Zn,mn+fe	98.3	98.1	10	9.2	4.61	5.95	1.50	1.44	0.32	0.33	15.8	12.33
100% chemical	Without bio	control	75.0	78.0	8.3	7.7	3.00	3.81	1.00	1.20	0.33	0.31	5.4	8.33
		Zn	86.7	84.7	8.7	9.0	3.95	5.50	1.06	1.70	0.29	0.30	11.3	10.91
		Mn	81.6	85.6	9.6	8.5	4.00	5.20	1.06	1.79	0.28	0.34	8.2	10.11
		Fe	76.3	88.6	10	8.6	3.91	5.77	1.23	1.77	0.30	0.30	8.9	12.21
		Zn,mn+fe	86.6	95.6	8.3	9.1	4.10	6.11	1.33	1.87	0.28	0.30	8.4	12.07
	With bio	control	77.3	75.0	8.2	8.7	3.33	4.00	0.96	1.20	0.29	0.30	5.8	8.19
		Zn	81.6	92.6	9.6	9.6	3.67	5.11	1.06	1.57	0.29	0.30	7.7	11.66
		Mn	86.6	90.2	9.3	9.5	3.91	5.61	1.00	1.70	0.25	0.30	7.3	10.67
		Fe	90.0	88.3	9.7	9.6	3.91	5.67	1.13	1.66	0.29	0.29	7.7	11.67
		Zn,mn+fe	86.6	94.5	9	9.6	4.15	5.61	1.16	1.95	0.28	0.34	8.4	12.11
LSD at 5%			N S	N S	N S	N S	N S	5.2	1.6	1.6	0.28	0.30	1.59	1.6

It can be concluded that spraying garlic by a mixture of (Zn, Mn, Fe) could give the highest cloves yield / fed. If combined with biofertilizer (nitrobin + phosphorin) and 50% FYM + 50% chemical fertilizer under the condition of Dakhlia region.

REFERENCES

Cacciari, P. L., T. Pietrosonti and W. Pietrosonti 1989, phytohormones – like substances produced by single and mixed diazotrophric cultures of Azospirillum and arthrobacter plant and soil. 115: 151 – 153.

Chanchan, m., j. k. Hore and s. Gharti. 2013. Response of garlic to foliar application of some micronutrients of crop and weed. 9 (2): 138 – 141

FAO, 2011. Statistical your book. Food and Agriculture organization (FAO) Rome, Italy.

Fawzi , A.F.A, A. Amberger and M.M.El-fouly (1987) nutrient status of field crops in the vally area , Agrochem 31 : 53 – 547 .

Gomez, K. A. and A. A Gomez. 1984. Statistical producers for Agricultural Research. John Wiley and Soric Inc., New York. P. 214.

Gupta, N.K and R.K. Ganeshe. 2000 . Response of borax and Zinc Sulphate on growth and Yield of garlic (Allium Sativum) Adv. Pl. Sci 13 : 237 – 239 .

Jawadagi , R.S . , Basavaraji , N , Hemla , N.B, batil , B.N and Channappagoudar , B.B 2012. Effect of planting geometry and organic sources of nutrients on growth, yield and quality of rapi onion cv. Bellary red. Karanataka. J. Agric. 25: 236 – 270 .

Koch, M., Z. Tanawi, H. bodoni , S . Winingar and y. kapulinl (1997). Field application of vesicular Arabuscular Mycorrihizal Fungi improved garlic yield in disinfected soil. Mycrorhizae 7(12): 47 – 50.

Marshner, H. (1995) , Mineral nutrition of higher Plants . 2nd. Ed. Acadimic Press. Horcourt Bruce and Company Publishers. London, New York, Tokyo, Pd 864.

Main wal , R.c, D.Singh, R.S.Katiyar, L.Sharme and S.K.Tewari . (2015) . Response of Garlic to integrated nutrient management protices in a sodic soil of utar, pradesn, india. J. spices and aromatic crops. 24 (1): 33 – 36 .

Nijjar , G.S.L. 1985. Nutritients of fruit trees , Mrs Nesha , Raj kumar For Kxyamar , New delhi : 173 – 270 .

Sabagh, H., M. Khoramivafa , S. Honarmand , and A . B . Al – Agha. (2014) . Effect of Thiobacillus bacteria, Sulfur and manure on the nutrient and PH of soil in Garlic (Allium Sativum) . Int.J.of Biosci. 5 (4) : 186 – 193 .

Snedecor, G.W. and W.G. Cochram. 1980. "statistical Methods" 7th Ed . Th Iown state union , Press , Iowa , USA.

Srivastava, R. , Agarwal , A. , Tiwari, R.S and Kumari , S , 2005. Effect of micronutrients, Zinc , Boron on yield , quality and storability of garlic (*Allium Sativum*) . Indian J. Agric. Sci., 75: 157 – 159.

Yousuf , M.N., M.M. Hassan, S. brahana, Deeder Sultan and A.H.M.fazlul . Kabir. 2016. Response of Garlic to Zinc, Copper, Boron and Molybdenum appliction in grey Terrace soil of Amnura soil series. Bangaladish J. Agric. Res. 41 (1):85 – 90.

تاثير الرش بالعناصر الصغرى و التسميد الحيوى و العضوى على انتاجية الثوم

محمود محمد زغلول [١] , عبد الله حلمى المرسى [٢] و سامر سمير العفيفي [٢]
[١] قسم الخضر و الزينة - كلية الزراعة - جامعة المنصورة .
[٢] معهد بحوث الساتين – مركز البحوث الزراعية – وزارة الزراعة

اجريت تجربتان حقليتان خلال موسمى (٢٠١٤ / ٢٠١٥) – (٢٠١٥/ ٢٠١٦) لدراسة تاثير رش الثوم بالعناصر الصغرى مع اضافة الاسمدة العضوية و الحيوية وذلك لدراسة تاثيرها على الانتاج و النمو الخضرى . و كانت المعاملات التى استخدمت هى زنك بتركيز ٦٠ جزء فى المليون ، منجنيز بتركيز ٦٠ جزء فى المليون ، الحديد بتركيز ٨٠ جزء فى المليون . و كذلك اضافة مخلوط من العناصر السابقة بنفس التركيزات حيث تم رشها على نباتات الثوم التى سبق تسميدها بالاسمدة الحيوية (نتروبين + فوسفورين) و كذلك تسميدها بالسماد البلدى بمعدل ١٠ طن للفدان بالاضافة الى ١٠٠ كيلوجرام من سماد مركب (١٩- ١٩- ١٩) و ٢٠٠ كيلو جرام من نفس السماد . اشارت النتائج الى ان الاسمدة الكيميائية بمعدل ٢٠٠ كيلوجرام للفدان و كذلك التسميد بـــ ١٠ م^{٣} للفدان + ١٠٠ كيلو جرام سماد مركب (١٩ – ١٩ – ١٩) لم يكن له تاثير معنوى على ارتفاع النبات او نسبة التبصيل او قطر البصلة خلال عامى الدراسة . بينما تاثرت كل من عدد اوراق النبات و قطر العنق معنويا بهذة المعاملات خلال الموسم الاول . فضلا عن ذلك وجد ان التسميد بمعدل ٢٠٠ كيلو جرام سماد مركب(١٩ – ١٩ – ١٩) اعطى محصول اقل مما فى حالة اضافة ١٠م^{٣} سماد بلدى + ١٠٠ كيلو جرام سماد كيماوى مركب (١٩ – ١٩ – ١٩) وجد كذلك ان التسميد الحيوي ادى الى زيادة عدد الاوراق للنبات الواحد . بينما لم يكن لها تاثير على كل من قطر العنق و قطر البصلة و نسبة التبصيل و ذلك خلال عامى الدراسة . فيما يتعلق برش العناصر الصغرى اتضح ان جميع المعاملات الرش ادت الى زيادة مقاييس النمو الخضرى فى عامى التجربة و كذلك ادت الى زيادة المحصول الكلى مقارنة بمعاملة الكنترول (المقارنة) . التفاعل الثلاثى بين التسميد الحيوى و التسميد الكيماوى و التسميد العضوى و الرش بالعناصر الصغرى لم يكن له تاثير على مكونات النمو فى الثوم فى كلا عامى التجربة بينما زاد المحصول الكلى بصورة معنوية مقارنة بمعاملة الكنترول (المقارنة). و من النتائج المتحصل عليها يمكن التوصية برش الثوم بمخلوط من العناصر الثلاثة الصغرى (زنك و الحديد و المنجنيز) مع اضافة الاسمدة الحيوية الفوسفورين و النيتروبين و ذلك مع اضافة ١٠ م^{٣} سماد عضوى + ١٠٠ كيلو جرام سماد كيماوى مركب (١٩ – ١٩- ١٩) وذلك تحت ظروف محافظة الدقهلية .