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INFLUENCE OF SOAKING CLOVES OF BALADY AND CHINESE GARLIC CULTIVARS IN SOME MICRONUTRIENTS SOLUTIONS ON GROWTH, CHEMICAL COMPOSITION, YIELD, BULB QUALITY AND STORAGEABILITY

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ABSTRACT

Two field experiments were carried out during the two winters seasons of 2007 / 2008 and 2008/ 2009 at the Experimental Farm, Faculty of Agriculture, Moshtohor Benha University, to study the effect of soaking cloves of both Balady and Chinese garlic cultivars for 24 hours per-planting in solutions of 1000 ppm Mn, 500 ppm Zn or 400 ppm Cu solely or in their possible combinations on plant growth, chemical composition, bulb yield and quality as well as storageability.

Obtained results indicated that, both used cultivars showed significant differences in most of the studied characters. Balady cv. had the best results of some vegetative growth characters (plant height, fresh weight of leaves, neck diameter and bulbing ratio), chemical composition (N, p and K content of both leaves and bulbs), number of cloves per bulb, bulb quality (N, P, K, Mn, Zn, Cu content and total carbohydrates percentage of cloves).Whereas, Chinese cv. showed the highest values of some vegetative growth parameters, i.e., number of leaves, bulb diameter, dry weight of leaves, bulbs and plant, bulb yield and its components, i.e., fresh weigh and dry matter percentage of bulb, fresh weight of single clove as well as total cured yield per feddan and total soluble solids percentage of bulbs. Furthermore, Chinese cv. showed the least weight loss and diseases infection percentage during storage period for six months.

The micronutrients treatments significantly and positively affected all the studied characters.

From the obtained results, it can be recommended that soaking garlic cloves for 24 hours per-planting in mixture of 1000 ppm Mn+ 400 ppm Cu in case of Balady cv. or in 1000 ppm Mn+500 ppm Zn in case of Chinese cv. to obtain maximum values of most studied variables.

Key words: Soaking cloves, Balady & Chinese garlic cultivars, micronutrients solutions, growth, chemical composition, yield, bulb quality, storageability

INTRODUCTION

Garlic (*Allium sativum* L.) is one of the most important vegetable crops in Egypt and all over the world. There was a growing demand for garlic products due to the increasing knowledge of garlic benefits to human health. The Balady cultivar was dominating for a long time and still preferable for the local market and for export. On the other hand, an attention was paid to localize several varieties that have better yield and bulb quality. The Chinese cultivar is a softneck variety and is dominating for commercial mass production in several countries around the world. This cultivar dose not produce a seed stalk and show good bulb quality as well as high yield.

Increasing productivity of garlic with good quality is an important aim for the growers. This aim could be achieved through choosing the suitable agricultural practices among them cultivars and fertilization requirements.

In regards to the effect of grown cultivars on garlic growth, yield and its quality, Hassan *et al*. (1993) reported that Balady *cv.* significantly dominated the Chinese cultivar in the plant height, number of leaves, bulb diameter, number of cloves/bulb and cured yield. On the other hand, El-Sayed (2004) found that Chinese *cv.* surpassed Balady cultivar in number of leaves/plant, bulb diameter, fresh and dry weight of leaves and bulbs, as well as it gave the smallest neck diameter and bulbing ratio.

In most Egyptian soil pH is often high, thus applying micronutrients such as Mn, Zn, and Cu may play an important role for growth and yield of many plants. Simis and Patrick (1978) found that Fe, Mn, Zn and Cu were lower in the exchangeable fractions at higher pH than at lower one.

In this respect, many investigators reported the importance of applying Mn, Zn and Cu solely or in combinations on growth, chemical composition of plants, yield and its components, as well as quality and storageability of bulbs (Abed *et al*., 1988; Abdel-Ati *et al*., 1993; Ayman, 2002; Abd-El-Moneem *et al*., 2005 and Nasreen *et al*., 2009 on garlic and El-Mansi and Sharaf El-Dien, 2005; El-Tohamy *et al*., 2009 and Alam *et al*., 2010 on onion.

The aim of this study was to investigate the effect of pre - planting soaking cloves of the widely grown garlic cultivars in Egypt(Balady and Chinese) in micronutrients solutions, *i.e.*,Mn , Zn and Cu each alone or in their possible combinations on growth, chemical composition of plant, yield and its components, as well as, quality and storageability of produced bulbs.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Faculty of Agriculture, Moshtohor Benha University, Kalubia Governorate during the winters seasons of 2007/2008 and 2008/2009.This study was carried out to investigate the effect of pre-planting soaking garlic cloves cvs Balady

and Chinese for 24 hours in aqueous solutions of each of Manganese (Mn), Zinc (Zn) and Copper (Cu) or in their possible combinations in "sulphate form" on plant growth, chemical constituents, yield, quality and storageability of garlic bulbs (*Allium sativum* L.) under clay loam soil conditions.

Mechanical and chemical analysis for experimental soil were carried out using the standard methods mentioned by Jackson (1970) and Black (1982). Data for this respect are show in Table 1.

Table 1: Mechanical and chemical analysis of the experimental soil field during 2007/2008 and 2008/2009 seasons.

Soil characteristics	Values	
	2007/2008	**2008/2009**
Mechanical analysis		
Coarse sand (%)	7.63	7.66
Fine sand (%)	16.60	16.65
Silt (%)	34.55	34.71
Clay (%)	41.22	40.98
Texture class	Clay-loam	Clay-loam
Chemical analysis		
pH (soil paste)	7.5	7.6
Organic matter (%)	1.85	1.79
Available elements (ppm):		
N	82.70	82.50
P	20.45	20.50
K	280.0	278.80
Mn	8.40	8.32
Zn	2.75	2.60
Cu	2.22	2.15

Garlic cloves of *cvs* Balady and Chinese were planted on October 1st and 5th in 2007/2008 and 2008/2009 seasons, respectively. This experiment was set out in a split plot design with four replicates, where garlic cultivars were arranged in the main plots, while micronutrients treatments were distributed randomly in the sub plots. The experiment included sixteen treatments which were the combinations between two garlic cultivars, *i.e.*, Balady and Chinese and eight treatments of micronutrients as follows:

1- Control (tap water).
2- 500 ppm Zn.
3- 400 ppm Cu.
4- 1000 ppm Mn.
5- 1000 ppm Mn + 500 ppm Zn.
6- 500 ppm Zn + 400 ppm Cu.
7- 1000 ppm Mn +400 ppm Cu.
8- 1000 ppm Mn + 500 ppm Zn + 400 ppm Cu.

All experimental units area was 9.8 m^2. Each plot included four ridges (70 cm width and 3.5m long) which were planted, in addition one ridge was left without planting as a guard one between plots. Cloves were planted 7 cm apart on both sides of ridge

Plants were fertilized with 120 kg N/fed as ammonium nitrate (33.5% N), 76 kg P_2O_5/fed as calcium superphosphate (15-16 % P_2O_5) and 96 kg K_2O/fed as potassium sulphate (48 %K_2O). The amount of NPK fertilizers were divided at three equal portions and added two, three and four months after planting. Other agricultural practices of growing garlic plants were carried out as commonly followed in the district.

Data recorded:

a. Plant growth characteristics:

A random sample of ten plants was taken from each experimental plot at 140 days after planting in both seasons of study for measuring plant height, number of leaves, fresh and dry weight of leaves, bulb and plant as well as diameter of neck and bulb. Bulbing ratio was calculated by using the following formula described by Mann (1952).

$$\text{Bulbing ratio} = \frac{\text{Maximum neck diameter}}{\text{Maximum bulb diameter}}$$

b. Plant chemical composition:

Nitrogen, phosphorus and potassium were determined in the digested dry matter of leaves and bulbs according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively.

c- Yield and its components:

At harvest time (180 days from planting) plants of each experimental unit were harvested and left to be cured for two weeks , then plants were weighed (kg/plot) and total cured yield of whole plants (ton/fed)was calculated . A random sample of 10 bulbs was taken from each plot to determine:bulb fresh and dry weight, number of cloves / bulb as well as clove fresh weight.

d- Bulb quality:

At harvest time, a sample 100 g of cloves from each treatment were oven dried at 70 ^{0}C till constant weight, ground and wet digested to determine total nitrogen, phosphorus and potassium contents according to the same methods described previously in plant chemical composition. Moreover, manganese, zinc and copper contents were determined using the method described by Chapman and Pratt (1961) and total carbohydrates according to

Dubois *et al*. (1956). In addition total soluble solids (T.S.S.) was assayed in fresh cloves by using Carl Zeis Refractometer.

e- Storageability:

Samples of cured garlic bulbs (4 kg from every experimental plot) in both seasons were placed in nets and stored under normal room conditions (24 ^{0}C ±5 ^{0}C and 60% R. H.). In both seasons, the storage zero time was April 20th and the end was October 20th. The following data were recorded monthly:

a-Weight loss percentage (%): Bulb samples of each plot were weighed at 30 day intervals, then the cumulative weight loss percentage was calculated.

b-Infection and rot diseases percentage (%): it was estimated and expressed as percentage of number of infected bulbs.

Statistical Analysis:

All the obtained data were subjected to statistical analysis of variance according to Gomez and Gomez (1984). Means separation was done by using L.S.D. at 0.05 level of probability.

RESULTS AND DISCUSSION

a-Plant growth characteristics:

1- Effect of cultivars:

Results in Table 2 reflect significantly differences among Balady and Chinese cultivars in all studied growth characters. Balady cv.excel mostly the Chinese cv. in producing taller plants, fresh weight of leaves per plant, neck diameter and bulbing ratio during both seasons of study. On the other hand, Chinese cv. produced more leaves number per plant, fresh and dry weight of both bulb and plant, as well as bulb diameter during the two seasons of investigation. Moreover, observed small values of neck diameter and bulbing ratio recognized in Chinese cv. may be considered as a favorable character (Mann,1952 and Atwa,1970).

In this respect, Maksoud and El-Oksh,1983and Abd El-Hamied, 1990reported that the differences between cultivars could be due to genetic differences. These results are in agreement with those reported by Zaki (1984), Maksoud *et al*.(1987), El-Sawah(1990), Ayman(2002) and El-Sayed (2004) all working on garlic.

2- Effect of micronutrients:

It is evident from data in Table 2 that pre–planting soaking cloves in the solution of test micronutrients, *i.e*., Mn at1000ppm, Zn 500 ppm, Cu at 400ppm either alone or at their different combinations significantly affected all the studied variables of the vegetative growth during both seasons of study comparing with the control treatment. In general, the most effective treatment was variable according to the growth parameter and season.

In this concern, the treatment (1000+ 400 ppm) for Mn and Cu, respectively in the first season or Zn at 500 ppm with either Cu at 400 ppm or Mn at 1000 ppm in the second one gave the highest values of most characters compared with the other treatments. The increase in vegetative growth parameters of plants treated with micronutrients, *i.e.*, Mn, Zn and Cu can be explained on the basis that, these micronutrients activate the enzymes concerned with the metabolism of N, protein and RNA synthesis (Sauchelli, 1969). Moreover, such stimulative effect may be due to stimulation and increasing production of ouxins in plans tissues which may led to the activation of meristematic tissues (Ancpok, 1990 and Abd- El-Moneem *et al*., 2005). Obtained results are in conformity with those reported by Abed *et al*. (1988), Abdel- Ati *et al*. (1993), Ayman (2002), El-Zohery (2003) and Abd-El-Moneem *et al*. (2005) all working on garlic.

3- Effect of the interaction between cultivars and micronutrients:

Data in Table 2 indicate that the interaction between cultivars and micronutrients treatments had significant effect for all studied plant growth characters in both growing seasons, except plant height, number of leaves/plant and bulb fresh weight in the second season only. In this respect, soaking Balady cv. cloves for 24 hours before planting in solutions containing (1000 ppm Mn + 400 ppm Cu) or (500 ppm Zn + 400 ppm Cu) were the best treatments, meanwhile, Chinese cv. achieved superior results when cloves were soaked in solutions of (1000ppm Mn + 500 ppm Zn) compared with other treatments. All these results either for Balady or Chinese cultivars were changed according to the growth parameters and season. These results are in harmony with those reported by Abed *et al*. (1988), Abdel-Ati *et al*.(1993), Ayman (2002) and El-Zohery (2003) on garlic.

b-Plant chemical composition:

1- Effect of cultivars:

Data illustrated in Table 3 indicate that Balady cultivar exhibited significantly the highest values of nitrogen, phosphorous and potassium content of leaves and bulbs compared with Chinese cultivar during both growing seasons. The differences between cultivars in minerals content could be due to genetic factors of cultivars (Maksoud and El-Oksh, 1983). These results agree with those reported by Nurzynska and Wierdak (1997) and El-Sayed (2004) on garlic.

2- Effect of micronutrients:

Data in Table 3 show clearly that, pre-planting soaking cloves in solutions of Mn, Zn or Cu resulted in significant increments in N, P and K content of leaves and bulbs compared with the control treatment during both seasons of study. Generally, the highest N, P and K content of leaves and bulbs were resulted by using Cu lonely at the concentration of 400 ppm, especially in

the first season, followed by the treatment which contains a mixture of 1000 ppm Mn + 400 ppm Cu particularly in the second season. The simulative effect of micronutrients on leaves mineral content may be due to the increasing effect of tested micronutrients on plant growth and plant metabolic processes and this may led to higher accumulation of the studied leaf minerals, i.e. N, P and K (Gamili, 1987 and Abd El-Dayem and Badr, 1992).

Similar findings were reported by Abed *et al*. (1988) and El-Zohery (2004) on garlic and Ibrahim *et al*. (1980a) and El-Mansi and Sharaf El-Dien (2005) on onion.

3- Effect of the interaction between cultivars and micronutrients:

Data in Table 3 show that the maximum increments of N, P and K percentage in both leaves and bulbs of Balady cv. were obtained as a result of using mixture of 1000 ppm Mn +400 ppm Cu, meanwhile in Chinese cv. by using combination between 1000 ppm Mn +500 pmm Zn compared with other treatments. These findings are true during both seasons of study These results are agree with those reported by Abou-Grab *et al*.(1993) and El-Shobaky and Abd El-Mageed (2001) on different vegetable crops.

c-Yield and its components:

1- Effect of cultivars:

Data in Table 4 reveal that Balady cv significantly produced higher number of cloves, while the Chinese cv. had heaviest clove weight, fresh weigh of bulb, cloves and dry matter percentage per bulb. These results are true during both seasons of study. The varietal differences between cultivars may be due to the specific genetic constitution of each cultivar (Dushmukh and Deore, 1990). Obtained results are in confirmity with those reported by Maksoud *et al*. (1987), Mangal *et al*. (1990) and El- Sayed (2004) on garlic.

2- Effect of micronutrients:

Data presented in Table 4 show that, per-planting soaking cloves in solution contains Cu at 400 ppm + 1000 ppm Mn or 500 ppm Zn during the first season or 1000 ppm Mn + 500 ppm Zn in the second one recorded mostly the maximum increase compared with the other treatments in all studied yield characters. The simulative effect of copper on yield may be due to that copper may increase dry weight of bulb and total dry weight/plant (El-Mansi and Sharaf El-Dien, 2005). The increase in total yield and its components may be owing to the positive effect of these micronutrients on vegetative growth parameters (Table 2) and its chemical composition (Table 3) that followed by a good storing process of nutritional substances in the cloves (Table 5 and 6) and consequently increased bulbs yield. These results are in accordance with those reported by Abdel- Ati *et al*. (1993), Hassan *et al*. (1993), El-Zohery (2003)

and Abd-El-Moneem *et al*. (2005) on garlic and Havlin *et al*. (2007), El-Tohamy *et al*. (2009) and Alam *et al*. (2010) on onion.

3- Effect of the interaction between cultivars and micronutrients:

Data in Table 4 indicate that Balady *cv.* gave the highest values in most studied characters during the two growing seasons by soaking cloves pre-planting in solution contained 500 ppm Zn + 400 ppm Cu followed by the treatment which contained 1000 ppm Mn + 400 ppm Cu. In this respect, Chinese *cv.* achieved most maximum values by using solution contained 1000ppm Mn + 500 ppm Zn and came in the first rank followed the treatment contained 1000 ppm Mn + 400 ppm Cu.

Obtained results are in agreement with those found by El-Sawah (1990), Hassan *et al*. (1993), Ayman (2002) and El-Zohery (2003) on garlic and Bhonde *et al*. (1995), Mattew *et al*. (2000) , Havlin *et al*. (2007) and Alam *et al*. (2010) on onion.

d- Bulb quality:

1- Effect of cultivars:

Data presented in Tables 5 and 6 reflect significant differences among Balady and Chinese *cvs* in all studied bulb quality characters, i.e., N, P, K, Mn, Zn and Cu contents and total carbohydrates as well as total soluble solids percentages of cloves in both seasons. Balady cv. significantly surpassed Chinese cv. concerning all studied variables except T.S.S. % which showed opposite trend during the two seasons. As this regard, Dushmukh and Deore, (1990) reported that such differences may be due to the specific genetic constitution of each cultivar. Moreover, Nurzynska and Wierdak (1997) mentioned that chemical composition of garlic bulbs differ according to ecotypes and cultivars. These results are in agreement with those reported by Maksoud and El-Oksh (1983) and El- Sayed (2004), on garlic.

2- Effect of micronutrients:

Data in Tables 5 and 6 show clearly that soaking cloves in solutions of either 1000 ppm Mn, 500 ppm Zn or 400 ppm Cu solely or in their possible combinations as pre-planting treatments resulted in significant increments in N, P, K, Mn, Zn and Cu content as well as total soluble solids and total carbohydrates percentage of cloves compared with the control treatment during both growing seasons. In this connection, the highest increments in the aforementioned characters were obtained mostly as a results of soaking cloves in 1000 ppm Mn + 400 ppm Cu followed by the treatment 1000 ppm Mn + 500 ppm Zn compared with the other used treatments. These results were true during both seasons of this study. Obtained results are in agreement with those found by Abed *et al*. (1988), Abd El-Hamid (1997) and El-Zohery (2003) on garlic and Allam (1999) on onion.

3- Effect of the interaction between cultivars and micronutrients:

Data in Tables 5 and 6 illustrate that soaking cloves of Balady cv. pre-planting at mixture of 1000 ppm Mn + 400 ppm Cu gave mostly the highest values of chemical bulb quality followed by the treatment 1000 ppm Mn +500 ppm Zn .

As for Chinese *cv*., all studied characters were recorded the maximum increase compared with the other treatments by using the mixture of 1000 ppm Mn + 500 ppm Zn except Zn content and carbohydrates percentage which showed the highest values by the treatment 1000 ppm Mn + 400 ppm Cu. Obtained results are in conformity with those reported by Ismail (1995) on garlic, Allam (1999) on onion and El-Shobaky and Abd El-Mageed (2001) on Pea.

e-Storageability:

1- Effect of cultivars:

Data in Tables 7 and 8 clearly show that there were significant differences among Balady and Chinese cultivars with regard to storage potential could be detected . In this respect , data in Table 7 show that Chinese cv. Gave the least weight loss percentage of garlic bulbs during storage period as compared with Balady cv. Furthermore , the percentage of weight loss was increased as storage time increased , the highest percent of weight loss was noticed after 6 months from harvest . These results were true in the two seasons of study . In this concern , numerous investigators demonstrated the major factors affecting bulbs weight loss during storage period such as desiccation, respiration, physiological losses in weight, rotting losses and sprouting losses (Kale *et al*., 1991 and El-Kafoury *et al*., 1996). Obtained results are in conformity with those found by Shahien (1992), Nurzynska and Wierdak (1997) Aly *et al*.(2004) and El- Sayed (2004), on garlic.

Moreover, data in Table 8 demonstrate that garlic bulbs of both Balady and Chinese cultivars were satisfactorily stored without any infection or rot diseases in the first month during both growing seasons. The percentage of infection and rot diseases increased gradually with the time of storage from the second month up to the six month which recorded the maximum values. The higher percent in this respect was observed in Balady cv. than Chinese cv. These results might be due to the biochemical changes in cloves contents such as increasing sugars and or/decreasing volatile and phenolic compounds which enhanced cloves invasion by pathologenic fungi (Ragab *et al*., 1984). In addition , Bottcher and Gunther (1994) reported that antimicrobial materials from cloves predisposed to infection by many pathogenic fungi. On the other hand, the lower percentage of decay during storage period in cloves of Chinese cv. may be due to the higher dry matter content showed in Table 2 as compared with those of Balady cv. (Nassar *et al*., 1972 and Fouda *et al*., 1977). Obtained

results are in agreement with those found by Aly *et al*. (2004) and El- Sayed (2004) on garlic.

2- Effect of micronutrients:

Data presented in Table 7 show that soaking cloves pre-planting in 400 ppm Cu solely or mixed with 500 ppm Zn recorded the least weight loss percentage of garlic bulbs during storage period. On the other hand, beside control treatment and Mn alone at 1000 ppm , maximum weight loss percentage was observed also by the mixture of the three micronutrients used *i.e.,* 1000+500+400 ppm manganese, zinc and copper, respectively. Such results were true during both seasons of study. These results may be due to the main role of Cu as micronutrient necessary for bulbing crops and its effect on thickness of storage leaves and its effect on respiration and water loss rate (El-Zohery, 2003). Moreover, Marschner (1995) reported that copper affects the formation and chemical composition of cell wall which in turn affects lignification and this may decrease weight loss percentage of garlic bulbs. Obtained results are in agreement with those reported by Ayman (2002) and El-Zohery (2003)on garlic and El-Mansi and Sharaf El-Dien(2005) on onion.

In connection the infection and rot diseases percentage, data in Table 8 indicate that soaking cloves pre-planting in 500 ppm zinc combined with 400 ppm Cu or the last one singly recorded the least values.

These results may be attributed to that such micronutrients induce systemic resistance against the pathogen (Conti *et al*., 1994) and are confirmed by those obtained by Abd-El-Moneem *et al*. (2005) on garlic, Mukesh-Kumar and Kumar (1999) on onion .

3- Effect of the interaction between cultivars and micronutrients:

Data presented in Tables 7 and 8 reveal that Chinese cv. was more effective and showed the least weight loss as well as the infection and rot diseases percentage as compared with Balady cv., especially when cloves were soaked pre-planting in solution of either 400 ppm Cu singly or combined with 500 ppm Zn. On the other hand, beside control treatment both used cultivars showed the highest percentages in this respect by using 1000 ppm Mn or the triple mixture (1000 ppm Mn + 500ppm Zn + 400 ppm Cu) comparing with other treatments. These results agree with those reported by Aly *et al*. (2004)on garlic.

Conclusively, *it can be recommended that soaking garlic cloves for 24 hours per-planting in mixture of 1000 ppm Mn+ 400 ppm Cu in case of Balady cv. or in 1000 ppm Mn+500 ppm Zn in case of Chinese cv. to obtain maximum values of most studied variables.*

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تأثير نقع فصوص الثوم البلدي والصيني في محاليل بعض العناصر المغذية الصغري علي النمو، التركيب الكيماوي، المحصول، جودة الأبصال والتخزين

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إجريت تجربتان حقليتان خلال الموسمين الشتويين لعامي ٢٠٠٧/٢٠٠٨ ، ٢٠٠٨/٢٠٠٩ في مزرعة التجارب بكلية الزراعة بمشتهر، جامعة بنها لدراسة تأثير نقع

فصوص كل من الصنفين البلدي والصيني لمدة ٢٤ ساعة قبل الزراعة في محاليل بتركيز ١٠٠٠، ٥٠٠، ٤٠٠ جزء في المليون من عناصر المنجنيز ، الزنك والنحاس علي التوالي إما بصورة منفردة أو جميع التوافيق الممكنة علي نموالنبات ، التركيب الكيماوي، المحصول، جودة الأبصال والقدرة التخزينية.

وقد اوضحت النتائج التي تم الحصول عليها الآتي:

وجود اختلافات معنوية بين صنفي الثوم في معظم الصفات التي تم دراستها حيث حقق الصنف البلدي أفضل النتائج لبعض الصفات الخضرية (طول النبات، الوزن الغض للأوراق ، قطر العنق ومعدل التبصيل) التركيب الكيماوي (محتوي الأوراق والابصال من النتروجين ، الفوسفور والبوتاسيوم)، عدد الفصوص لكل بصلة ، جودة الابصال (محتواها من النتروجين، الفوسفور، البوتاسيوم ،المنجنيز، الزنك ، النحاس والنسبة المئوية للكربوهيدرات الكلية بالفصوص). بينما أظهر الصنف الصيني أعلي القيم لبعض الصفات الخضرية مثل عدد الأوراق، قطر البصلة، الوزن الجاف للأوراق والأبصال والنبات، المحصول ومكوناته مثل الوزن الغض والنسبة المئوية للمادة الجافة للبصلة ، الوزن الغض للفص المنفرد وكذلك المحصول الكلي المعالج للفدان والنسبة المئوية للمواد الصلبة الذائبة الكلية. كما أظهرالصنف الصيني اقل نسبة مئوية للفقد في الوزن والإصابة بأمراض العفن خلال فترة التخزين حتي ٦ شهور.

كما أدت معاملات العناصر المغذية الصغرى إلي حدوث تأثير معنوي موجب علي جميع الصفات التي تم دراستها.

التوصية: أوضحت نتائج التجربة أنه يمكن بنقع فصوص الثوم البلدي لمدة ٢٤ ساعة قبل زراعتها في مخلوط مكون من ١٠٠٠ جزء في المليون من المنجنيز مع ٤٠٠ جزء في المليون من النحاس أو ١٠٠٠ جزء في المليون من المنجنيز مع ٥٠٠ جزء في المليون من الزنك في حالة الصنف الصيني للحصول علي أعلي القيم لمعظم الصفات التي تم دراستها.