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EFFECT OF SOME TREATMENTS ON PURPLE BLOTCH, GROWTH AND PRODUCTIVITY OF GARLIC (*Allium sativum* L.).

Abd El-Kader A. E. S*; A.E.A.I.Gouda*; M. N. A Gahwash* and K. M. Ghoneem**

*** Veg. Dep.; Hort. Res. Institute; Agric. Res. Center; Giza, Egypt.**

****Seed Patho. Res. Dep.; Plant pathology Res. Institute; Agric. Res. Center; Giza, Egypt.**

ABSTRACT

Two field experiments were carried out at private farm at Basandela village, Belqas district, Dakahlyia Governorate, during the two growing seasons of 2012 / 2013 and 2013 /2014 to study the effect of foliar spray garlic plants by $CuSo_4$ (at levels of 0.5 % and 0.1 %), Zn So_4 (at levels of 0.1% and 0.2 %),Urea(at levels of 0.5 and 1 %) Borax(at levels of 0.1 %) and some of their combination as well as fungicide (Radomil plus) (at levels of 2.5 g /Liter), on garlic growth, yield and its components and some chemical compositions of garlic as well as pruple blotch infection of garlic Cv. Sids 40. The obtained results indicated that :

Spraying garlic plants with treatment urea 1% or $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5 % + Borax 0.1% or treatment $CuSo_4$ 0.1 % + Zn So_4 0.1% + Urea 1% + Borax 0.1 % or radomil plus 2.5 gm / Liter , produced the highest plant height and lowest bulbing ratio, while these treatments with exception Radomil plus treatment produced the highest value of plant fresh weight.

The highest cured yield and bulb weight were obtained from spraying garlic plants with treatments Radomil plus or $CuSo_4$ 0.1% +$ZnSo_4$ 0.1% + Urea 1 % + Borax 0.1 % or spraying by $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5% + Borax 0.1%.

The heaviest clove weight was obtained from spraying garlic plants with $CuSo_4$ 0.1 % + Zn So_4 0.1% + Urea 1% + Borax 0.1 % in the first season, while the treatments $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5% + Borax 0.1 % gave the highest weight in the second season.

Spraying garlic plants with $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5% + Borax 0.1% or $CuSo_4$ 0.1 % + Zn So_4 0.1% + Urea 1 % + Borax 0.1 % produced cloves with contents of the highest percent of nitrogen, phosphorus and potassium. These two treatments, also produced cloves contains the highest ppm values of Cu, Zn, B.

The highest values of chlorophyll A,B were obtained by spraying with Zn So_4 0.1 % or $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5 % + Borax 0.1 % or $CuSo_4$ 0.1 % + Zn So_4 0.1 % + Urea 1 % + Borax 0.1 % , while the highest values of carotenoids were obtained when garlic plants were sprayed ($CuSo_4$ 0.1 % or Urea 0.5 %).

The aforementioned last two treatments $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5 % + Borax 0.1 % or $CuSo_4$ 0.1 % + Zn So_4 0.1 % + Urea 1 % + Borax 0.1 % in addition to Radomil plus treatment resulted in the lowest disease severity and incidence of purple blotch.

INTRODUCTION

Garlic (*Allium sativum* L.) is the second most widely used of the cultivated bulb crops after Onions in Egypt, it is cultivated for both local consumption and exportation. It is commonly used as a spice or in the medical purpose. Garlic area cultivation in Egypt was 26183 feddan with total production of 246919 tons in season 2013 / 2014*

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Several factors have been identified for the low productivity of garlic in Egypt. The most important factors responsible are the diseases like purple blotch, downy mildew, Stemphylium blight, basal rot and storage rots and non availability of varieties resistant to biotic and abiotic stresses. Among the foliar diseases, purple blotch may cause garlic leaves to become blighted and die prematurely. The destructiveness of the disease varies widely with locality and season, depending on how often and how long garlic foliage is wet by dew, fogs, or showers. Leaves that are blighted and killed prematurely are often covered later by secondary olive green to black molds, such as *Alternaria* and *Macrosporium* (Uddin *et al*., 2006 and Tripathy *et al.*, 2013).

With the rising vegetable consumption within the country and the emphasis laid on export of vegetables, there is greater need to increase the production of vegetables. Apart from this, as a result of increasing health consciousness among the people and strict norms in the export of vegetables in recent years, the focus has been shifted in finding out safer alternatives to chemical fungicides in managing the plant diseases.

Micronutrients are needed for plants in small quantities; however, their deficiencies cause a great disturbance in the physiological, cellular functions and metabolitic processes in the plant. Also, they work as a co-enzyme for a large number of enzymes. In addition to, they play an essential role in improving yield and quality, and highly required for better plant growth and yield of many crops; Hansch and Mendel, 2009 and Alam *et al.*, 2010).

The micronutrients play an important role in photosynthesis, N- fixation, respiration and/or the metabolic process of the plant (Naga Sivaiah *et al*., 2013). Foliar application of micronutrients during crop growth was successfully used for correcting the deficits and improving the mineral status of plants as well as increasing the crop yield and quality (Kolota and Osinska, 2001).

Nutrients elements are important for growth and development of plants and they are important factors in disease control (Agrios, 2005). All the essential nutrients can affect disease severity (Huber and Graham; 1999).

An increase the severity of the disease or have a completely opposite effect in a different environment (Marschner, 1995 and Huber and Graham, 1999).

Copper is a redox – active transition element that has roles in photosynthesis, respiration, C and N metabolism, and protection against oxidative stress. Some studies suggest that Cu may play a part in the synthesis or the stability of chlorophyll and other plant pigments. Most of the function of Cu are based on enzymatically bound Cu which catalyses redox reaction (Yurela, 2009). Liew *et al*., 2012 showed that foliar application of Cu and boron was found to be able to reduce fungal disease infection in MR 219 rice cultivar.

Zinc is one of the essential micronutrients required for optimum crop growth. It actives some of enzymes such as dehydrogenises, pretenses, peptidases and phosphohydrolases It plays an important role in many biochemical reactions within the plants. Zinc is important in the formation of the growth hormone auxin and controls cell division; it is also needed by leaf cells to form the green leaf pigment chlorophyll, its regulates starch formation (Wassel *et al*., 2007, Mousavi *et al.,* 2011 and Yosefi *et al.,* 2011).

Zinc increase quality of crops and its shortage of this elements led to decline in plant photosynthesis and destroy RNA, decreased amount of solution carbohydrates and synthesis of protein, and the performance and quality of crop will be decreased (Mousavi *et al*., 2007). El- Sallami and Gad (2005) found that, spraying Zn element at 100 ppm increased the vegetative growth i.e., plant height and number of leaves.

Abd El- Samad *et al.,* (2011) on Onion, found that foliar application with Zn gave the highest values of vegetative growth parameters and yield expect average weight of bulb in both seasons. Chanchan *et al.*, (2013) on garlic, showed that the maximum plant height with zinc sulphate 0.25 % and the maximum number of cloves and yield of bulb were observed with borax 0.2 and zinc sulphate 0.25 %.

Boron (B) is a micronutrient necessary for plant growth. It plays an important roles in cell wall synthesis, sugar transport, cell division, cell development, auxin metabolism, good pollination and fruit set, seed development, synthesis of amino acids and protein, nodule formation legumes and regulation of carbohydrate metabolism (Pilbeam and Kirkby, 1983; Marschner and Rimmington, 1996 and Ahmad *et al.,*2014).

Boron has also help to reduce disease severity in some crops because of it is effect on plant metabolism, cell membranes and cell wall structure (Dordas,2008 and Donald and Porter, 2009). Boron reduced the infection of pathogens by improving cell wall and membrane strength with cross- linked polymers and steng thening the plants vascular bundles (Liew *et al* ., 2012). In general, boron foliar application in potato significantly increased vegetative growth parameters, yield and its components and highest concentration of N, K and B in plants (El-Banna and Abd El-Salam 2005 and Jafari – Jood *et al.,* 2013).

Nasreen *et al*., (2009) on garlic, found that application of zinc and boron significantly increased plant height, number of leaves per plant, cloves number per bulb, diameter and weight of bulb and yield at both seasons. Manna *et al*., (2014), showed that foliar application of 0.5 % boron sprayed on onion significantly increased plant height, number of leaves, yield and quality. Abd El- Fatah *et al.,*(2002) indicated that foliar application of garlic with micronutrients (100 ppm Fe + 100 ppm Zn + 100 ppm Cu) had significant increases of vegetative growth parameters i.e. plant height, leaf area and plant dry weight expect number of leaves per plant and bulbing ratio. In addition, total yield and its components, with exception of the number of cloves per plant were better with spraying the plants with mixture of micronutrients comparing with the untreated plants. El-Tohamy *et al.,* (2009) found that essential oil, growth and yield of onion plants significantly increased by the application of Fe, Zn and Mn compared to control plants. Rizk *et al.,*(2014) reported that the application foliar spray of some micronutrients (Fe, Zn or Mn) gave the highest values of vegetative growth characters expect for number of leaves / plant and neck dry weight.

Similar results Brahma *et al.*, (2009) on onion; Abou-El-Khair *et al.,*(2011) on garlic; Shehata *et al.,*(2012) on onion, Khan (2013) on garlic; and Eisa and Ali, (2014) on cowpea found that application mixture of micronutrients resulted in marked increase in vegetative growth parameters, yield and its components and chemical constituents and uptake of elements. Liew *et al.,* (2012) showed that foliar application of Cu and B reduced fungal disease infection in MR 219 rice cultivar.

Anant *et al.,* (2002) showed that foliar application of urea at (0, 0.5 and 1 %) concentrations significantly increased vegetative growth. All urea and GA levels (expect at 200 ppm) improved bulb fresh weight, the maximum bulb weight of onion was obtained at 1 % urea. Charbaji *et al.,* (2008) on onion, indicated that urea foliar application significantly increased bulb fresh and dry weight of bulb and concentrations of N, P and K.

The objective of this study was to: 1) evaluate the efficacy of foliar spray by some microelements Copper sulphate, Zinc sulphate, Urea and Borax individually and in combinations as well as Ridomil plus in controlling purple blotch disease under field conditions and 2) study their role in enhancing growth, physiological activities, yield and improving garlic quality.

MATERIALS AND METHODS

Two field experiments were carried out at Basandela village ; Dakahlia Governorate during the two successive seasons of 2012 / 2013 and 2013 /2014 on garlic, cultivar Sids-40 to study the effect of foliar spray by $CuSo_4$ levels (0.5, 0.1%), Zn So_4 at levels (0.1, 0.2 %), Urea at levels (0.5 and 1 %), Borax 0.1 % and their some of combination as well as fungicide (Ridomil plus) 2.5 gram / L on growth, yield and its components and chemical composition of garlic as well as purple blotch disease.

The experimental field soil was clay loam in texture with PH 7.8, available, N 60 ppm, P11ppm, K 240 ppm, Cu 4.7 ppm, Zn 0.30 ppm and B 0.50 ppm (standard methods of Jackson,1967 was used for soil analysis).

The experiments design was randomized complete block design with three replicates and 11 treatments

Experimental of treatments:

1- Control
2- $CuSo_4$ 5 H_2O 0.5 % (5 gram/Litter water)
3- $CuSo_4$ 5 H_2O 0.1 % (1 gram/Litter water)
4- Zn So_4H_2O 0.1 %(1 gram/Litter water)
5- Zn So_4 H_2O 0.2 % (2 gram/Litter water)
6- Urea spray 0.5 % $(NH4)_2$ Co (5 gram/Litter water)
7- Urea spray 1 % $(NH4)_2$ Co (10 gram/Litter water)
8- Borax 0.1 % (1 gram Borax (Na_2 B_4O_7. 10 H_2O) / Litter water)
9- $CuSo_4$5 H_2O 0.5 % + Zn So_4 H_2O 0.2 % + Urea spray 0.5 % + Borax 0.1 %.
10-$CuSo_4$ 5 H_2O 0.1 % + Zn So_4 H_2O 0.1 % + Urea spray 1 % + Borax 0.1 %.
11-Fungicide (Radomil plus 2.5 gram / Litter water).

Treatments were applied as a foliar spray three times at (70, 90 and 110 day after planting).

The cloves were planted on the 5th and 7th of October in the first and second seasons, respectively. Garlic cloves were selected uniformly in shape. The cloves were planted on both sides of each ridge at 10cm apart. The plot area was $11.2m^2$, which contained 4 ridges with 4 m length and 0.7 m width. Cattle manure at rate 30 m^3 / fed. during soil perpetration.

Phosphours was used in the form of superphosphate (P_2O_5 15.5 %). At the rate of 75 kg / fed. in two equal rates at 30 and 60 days after planting. Nitrogen fertilizer was used as Ammonium sulfate (NH_4 20.5 %) at the rate of 120 kg / fed in two equal rates at (30 and 60 days after planting) Potassium fertilizer was added as potassium sulfate (K_2o 48 %) at the rate of 72 kg /fed in two equal rates at (30 and 60 days after planting).

The harvest was done at 180 days after planting in both seasons.

The following data were determined.

Monitoring of disease incidence

The crop was observed for purple blotch disease at 20 days intervals commencing from 70 days after planting. Data were collected on leaf infection and percent Leaf Area Diseased (LAD) and calculated in terms of disease incidence (DI) and disease severity (DS) by following formula:-

$$DI = \frac{Nmber\ of\ infected\ leaf}{Total\ number\ of\ inspected\ leaf} \times 100$$

$$DS = \frac{Total\ sum\ of\ numerical\ ratings}{Number\ of\ observation \times Maximum\ disease\ rating\ in\ the\ scale} \times 100$$

The 0-5 disease scoring scale was used to estimate the disease severity (PDI-Percent Disease Index) of purple blotch complex of leaves for each unit plot under each treatment. The scale was followed by Islam *et al.* (1999) as described below:

0 = no disease symptoms in the plant

1 = a few spots towards the tip, covering less than 10% leaf area

2 = several dark purplish brown patches covering less than 20% leaf area

3 = several patches with paler outer zone, covering up to 40% leaf area

4 = long streaks covering up to 75% leaf area or breaking of leaves / stalks from the centre

5 = complete drying of the leaves/ stalks or breaking of the leaves / stalks from the base

A-Vegetative growth characters:

Five plants from each plot were randomly chosen in both seasons after 120 days from planting date and the following characteristics were recorded:-

1-Plant height (cm).

2-Leaves number.

3-Plant fresh weight (g).

4- Plant dry weight (g).

5-Bulbing ratio = $\frac{\text{neck diameter (cm)}}{\text{Bulb diameter (cm)}}$ Mann (1952)

B-Yield and its components:
1-Total yield (ton / feddan) after curing.
2-Bulb weight (g).
3-Number of cloves / bulb.
4-Clove weight (g).

C-Chemical composition:

1- Photosynthetic pigments (Chlorophyll A, B and carotenoids) were determined according to the spectrophotometric method recommended by Macking (1941).

2- Nitrogen, Phosphorus and Potasssium percentage in the dry matter of cured cloves were determined according to methods described by AOAC (1990) for nitrogen, phosphorus and potassium by Ranganna (1979).

3- Copper, Zinc and Boron (ppm) were analyzed by electrothermal atomic absorption spectrometery, perkinelmer Model 5100 as described by Kampulainein *et al*., (1983).

Statistical analysis

Obtained data were subjected to statistical analysis using technique of the randomized complete block design according to Sendecor and Cochran (1982) using Costat computer. The treatment means were compared using Dancan`s Multiple Rang Test (Duncan, 1955).

RESULTS AND DISCUSSION

A-Vegetative growth characters:

Data presented in Table 1 indicated that, the highest value of plant height was recorded with urea 1 % in both seasons. The highest values of leaves number was recorded with (Zn So_4 0.2 %) at first season, while the treatment ($CuSo_4$ 0.5%) gave the best results in the second season. Using urea (1 %) gave the highest plant fresh weight in both seasons. The spraying with ($CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5 % + Borax 0.1%) recorded the highest value of plant dry weight in both season. Concerning with the bulbing ratio, the results reported that the highest value was obtained from control treatment while, the lowest values of bulbing ratio were found at fungicide (radomil plus), followed by ($CuSo_4$ 0.5 % + Zn So_4 0.2 % + Urea 0.5 % + Borax 0.1 %) and ($CuSo_4$0.1 % + Zn $So_4$0.1 % + Urea 1 % + Borax 0.1 %) in both seasons.

El- Sallami and Gad (2005) found that, spraying with Zn at 100 ppm increased the vegetative growth i.e., plant height and number of leaves. On the other hand, the positive influence of foliar application of micro-nutrients on crop growth may be due to the improved ability of the crop to absorb nutrients, photosynthesis and they play vital role in various bio- chemical processes (Nasiri *et al*., 2010). Similar results were obtained by El- Sallami and Gad (2005), El- Tohamy *et al.,* (2009), Alam *et al*., (2010), Abd El-Samad *et al*., (2011), Brahma *et al.,* (2012), Shehata *et al*., (2012), Chanchan *et al.,* (2013), Eisa and Ali (2014), Manna *et al.,* (2014) and Rizk *et al.,* (2014).

B-Yield and its components

Data presented in Table 2 indicate that the highest total cured yield and bulb weight were obtained from fungicide (Radomil plus) treatment followed by ($CuSo_4$0.1 % + Zn So_4 0.1 % + Urea 1 % + Borax 0.1 %) and ($CuSo_4$ 0.5 % + Zn So_4 0.2 % + Urea 0.5 % + Borax 0.1 %) in both seasons. While, the highest value of number of clove was recorded with Borax 0.1 % in the first season but, the highest value of number of cloves was recorded with control in the second season., the highest value of clove weight was recorded with ($CuSo_4$0.1 % + Zn $So_4$0.1 % + Urea 1 % + Borax 0.1 %)in the first season, while the treatment ($CuSo_4$ 0.5 % + Zn So_4 0.2 % + Urea 0.5 % + Borax 0.1 %) gave the highest weight in the second season. The highest value of dry matter of clove was recorded with ($CuSo_4$0.1 % + Zn $So_4$0.1 % + Urea 1 % + Borax 0.1 %) in the both seasons.

The increase in total yield may be due to the increase in vegetative growth Table 1 and high photosynthesis capacity expressed in leaf pigment Table 5. These increases might be ascribed to the favorable role of the used micronutrients in pigment formation, photosynthesis activation and carbohydrates assimilation (Bhuiyan *et al.,* 2008 and Gad and Kandil 2013).

Higher photosynthesis accumulation in the clove would ensure higher clove / bulb, large bulb diameter, and higher bulb weight. The results are similar to those reported by Abdel- Fattah *et al*., (2002); Nasreen *et al*., (2009); Abd El- Samad *et al.,* (2011); Abou – El- Khair *et al*. (2011) ; Brahma *et al*., (2012) ; Chanchan *et al.,* (2013) ; Khan (2013) ; Eisa and Ali (2014) and Manna *et al*., (2014).

C-Chemical composition

Data in Tables 3 and 4 indicate that treatment of ($CuSo_4$0.1 % + Zn $So_4$0.1 % + Urea 1 % + Borax 0.1 %) had recorded the highest values of N,P,K, Cu and B in garlic cloves in both seasons. On the other hand, the highest values of Zn was recorded with ($CuSo_4$ 0.5 % + Zn So_4 0.2 % + Urea 0.5 % + Borax 0.1 %) in the both seasons.

The uptake of all the macronutrients and micronutrients were significantly influenced by different micronutrients treatments and the maximum accumulation with the application of mixture of micronutrients, obtained results was in agreement with those reported by Abd EL-Fattah, (2002) and Eisa and Ali, (2014).

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Table 3: Effect of foliar spray treatments on concentration of N,P,K in cloves during 2012/2013 and 2013/2014 seasons.

Treatments	N%		P%		K%	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	2.49k	2.54j	0.414j	0.418j	1.77i	1.80i
CuSO4 0.5%	2.98g	3.04e	0.481f	0.488f	2.13e	2.16e
CuSO4 0.1%	2.73j	2.78h	0.447h	0.450g	1.96g	2.02f
ZnSO4 0.1%	2.87h	2.93g	0.465g	0.472h	2.04f	2.09g
ZnSO4 0.2%	3.10f	3.15f	0.493e	0.499e	2.22d	2.28d
Urea 0.5%	3.37d	3.41c	0.527c	0.535c	2.35c	2.40c
Urea 1%	3.53c	3.59b	0.546b	0.550b	2.46b	2.51b
Borax 0.1%	2.60j	2.65i	0.429i	0.434i	1.90h	1.96h
CuSO4 0.5% + ZnSO4 0.2% + Urea 0.5% + Borax 0.1%	3.66b	3.72a	0.552b	0.554b	2.50b	2.53b
CuSO4 0.1% + ZnSO4 0.1% + Urea 1% + Borax 0.1%	3.73a	3.77a	0.565a	0.569a	2.57a	2.63a
Fungicide (Radomil pluse)	3.22e	3.28d	0.509d	0.515d	2.26d	2,31d

Table 4: Effect of foliar spray treatments on concentrations of Cu,Zn and B in cloves during 2012/2013 and 2013/2014 seasons.

Treatments	Cu++ ppm		Zn++ ppm		B+ ppm	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	4.95k	5.02k	20.04k	20.10k	17.20j	17.24j
CuSO4 0.5%	10.40d	10.44d	23.62i	23.66i	18.68h	18.70h
CuSO4 0.1%	15.87b	15.93d	25.00h	25.03h	20.24f	20.28f
ZnSO4 0.1%	7.00g	7.04g	44.04d	44.07d	19.42g	19.45g
ZnSO4 0.2%	6.41h	6.47h	50.54b	50.58b	20.79e	20.84e
Urea 0.5%	7.39f	7.46f	29.97f	30.02f	21.47d	21.52d
Urea 1%	7.78e	7.83e	33.13e	33.15e	22.03c	22.07c
Borax 0.1%	5.68j	5.57j	21.61j	21.65j	27.62b	27.65b
CuSO4 0.5% + ZnSO4 0.2% + Urea 0.5% + Borax 0.1%	13.27c	13.31c	51.47a	51.51a	30.04a	30.00a
CuSO4 0.1% + ZnSO4 0.1% + Urea 1% + Borax 0.1%	18.59a	18.63a	50.83b	51.17b	30.03a	30.05a
Fungicide (Radomil pluse)	5.95i	6.00i	27.17g	27.21g	17.92i	17.95i

D-Incidence (DI) and severity (DS) of purple blotch disease on clove plant

As can be seen from the results Table 5, most of the micronutrants reduced DI and DS in both growing season, irrespective to fungicide treatment (Radomil plus). At 90 days, $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5 % + Borax 0.1% and $CuSo_4$ 0.1 % as well as fungicide applications showed the highest reduction in disease parameters in comparison with all other treatments in both seasons. $CuSO_4$ at 0.1% concentration as compared fungicide and check treatment came in the second order in reducing of disease severity of leaf spot along the growth period in both growing seasons.

Table 5. Effect of foliar spray treatments on purple blotch infection under field conditions during 2012/2013 and 2013/2014 seasons.

Treatments	Disease severity		Disease incidence	
	1st seasons	2nd seasons	1st seasons	2nd seasons
Control	52.58 a	49.58 a	52.78 a	60.17 a
CuSO4 0.5%	12.73 de	15.29 e	28.64 de	28.17 d
CuSO4 0.1%	13.28 de	14.07 ef	22.64 f	21.50 e
ZnSO4 0.1%	45.00 b	40.13 b	41.78 bc	43.67 b
ZnSO4 0.2%	37.50 c	35.01 c	37.74 c	38.17 c
Urea 0.5%	33.01 c	31.28 d	44.46 b	42.27 bc
Urea 1%	33.67 c	31.10 d	44.33 b	42.67 bc
Borax 0.1%	15.28 d	16.61 e	29.00 de	27.33 d
CuSO40.5%+ZnSO40.2%+Urea 0.5%+Borax 0.1%	9.460 ef	11.42 fg	27.00 d-f	25.00 de
CuSO40.1%+ ZnSO4 0.1%+Urea 1%+Borax 0.1%	10.00 ef	11.28 fg	31.65 d	29.17 d
Fungicide (Radomil pluse)	6.970 f	8.400 g	25.00 ef	26.67 d

E-Effect of foliar spray treatments on chlorophyll A, B, Total chlorophyll and carotenoids

Significant increases in the photosynthetic pigments of clove leaves were detected as a result of different micronutrients foliar applications during the two seasons its indicated from Table 6. The highest values of chlorophyll A &B were obtained by praying plants with Zn So_4 0.1% or $CuSo_4$ 0.5 % + Zn So_4 0.2% + Urea 0.5% + Borax 0.1 % or $CuSo_4$ 0.1 % + Zn So_4 0.1% + Urea 1% + Borax 0.1%, while, the highest values of carotenoids were obtained when garlic plants were sprayed by $CuSo_4$ 0.1 % or Urea 0.5%. While the infected plants gave the lowest values of photosynthetic pigments in both seasons. Increasing photosynthetic pigments by foliar application of different micronutrients is expected to increase carbohydrate content in plant tissues. Carbohydrates are the main repository of photosynthetic energy, they comprise structurally polysaccharides of pectin that consider a barrier against plant pathogens invasion and phenolic compounds are associated with structural carbohydrates, which play a major and important role in plant defense (Hahlbrock and Scheel, 1989). In addition, the enhancement in chlorophyll content is resulting from stimulation pigment synthesis, which is an important element in essential oil biosynthesis (Cseke *et al*., 2006) and increasing the efficacy of photosynthetic apparatus with better potential for resistance as well as decreasing photophosphorylation rate, which occurred after infection (Amaresh and Bhattm, 1988).

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CONCLUSION AND RECOMMENDATION

It can be concluded and recommended by using treatment of foliar spraying garlic plants by CuSo4 0.1 % + Zn So_4 0.1% + Urea 1 % + Borax0.1% three times i.e., after 70, 90 and 110 days from planting which resulted in marked decreasing in infection by purple blotch and increasing garlic productivity and quality as well as saving environment from pollution by fungicides such as Radomil plus

REFERENCES

AOAC. (1990). Association of official analytical chemists. Official. Methods of Analysis 15th Ed. Washington DC. USA.

Abd El- Fattah, A.E. ;Z.S.El- Shal and E.M.Awad (2002). Response of garlic productivity and storability to application times of phosphorus and certain micro- nutrients. J. Agric Sci. Mans. Univ., 27 (9) : 6231 – 6241.

Abd El- Samad, E.H.; R.KH.M.Khalifa; Z.A.Lashire and M.R.Shafeek (2011). Influenced of urea fertilization anf foliar application of some micronutrients on growth, yield and bulb quality of onion. Asutralian J. of Basic and applied Sci., 5 (5) : 96 – 103.

Abou El –Khair, E.E. ;I.A.S.Al – Esaily and N.M.El- Sarkassy (2011). Physiologiacl response of garlic plant grown in sandy soil to foliar spray with Iron, Zinc and Manganese either individual or in mixture form. Minufiya J. Agric. Res., 36 (2) : 409 – 426.

Agrios, N.G. (2005). Plant pathology, 5th; El- Sevier- Academic press, p 635.

Ahmad, W; M.H. Zia; S. S. Malhi ; A. Niaz and Saifullah (2014). Boron deficiency in soil and crops: Areview. Available on line : http:II WWW.intechopen.com / book/ crop-plant/ boron- deficiency- in soil – and –crop-a –review (accessedon 4 June).

Alam, M.N. ;M.D.Abedin and M.A.K.Azad (2010). Effect of micronutrients on growth and yield of onion under calcareous soil environment .International J. Plant Science, vol., 1 (3) : 56 – 61.

Amaresh, C. and R.K. Bhattm (1988) Biochemical and physiological response to salicylic acid in reaction to systemic acquired resistance. Photosynthetica, 35, 255-258.

Anant , B.; V.N.Maury and A.Bahadur (2002).Effect of GA3 and foliar freeing of urea on bulb production of onion.Vegetable Science,28(1):90– 91.

Bhuiyan, M.M.H.; N.M.Rahman; F.Afroze; G.N.C. Sutrajhar and M.S.I.Bhytyan (2008). Effect of phosphorus, molybdenum and rhizobium inoculation on growth and nodulation on mung bean Journal of Soil and Nature . 2 (2) 25 – 30.

Brahma, S. ; M.N. Yousef and R. Ara (2012). Effect of micro- nutrients on growth, yield and quality of summer onion. Research Report 2009, Spices Research Center, BARI, Shibganj, Bogra.

Chanchan, M.; J.K.Hore and S.Ghanti (2013). Response of garlic to foliar application of some micronutrients.J.of Crop and Weed,9(2):138 – 141.

Charbaji,T. ;M.I.E.Arabi and M.Jawhar (2008).Urea foliar fertilization affects onion weight and nutrient content. International J.Vegetable Scince:3, 204.

Cseke, L.J., K., Ara; B.K., Peter, L.W Sara,., A.D. James, and L.B. Harry, (2006): Natural products from plants (Second Edition). CRC Press. Taylor and Francis Group, 101 – 142.

Donald, C. and I.Porter (2009). Integrated control of club root. J. Plant growth Regul, 28 : 289 – 303.

Dordas, C. (2008). Role of nutrients in controlling plant diseases in sustainable agriculture. AreviewAgron Sustainable Dev, 28 : 33- 46.

Duncan, D.B. (1955). Multiple range and multiple F test. Biometrics : 1- 42.

Eisa, G.S.A. and T.B.Ali (2014). Impact spraying of some micronutrients on growth, yield nitrogenase activity and anatomical features of Cowpea plants. World J. Agric Sci. 10 (2) : 57 – 67.

El-Banna, E.N.andH.Z.Abd El-Salam (2005). Response of potato plants for different sources of potassium with different foliar rates of boron and molybdenum. J.Agric. Sci. Mansoura Univ., 30 (10) 6221- 6233.

El- Sallami, I.H. and M.M. Gad (2005). Growth and flowering response of New York aster to a slow release fertilizer and foliar applied Zinc. Assuit. J. Agric.Sci. 36 (2) : 121 – 136.

El- Tohamy, W.A. ;A.K.H.Khalid ; H.M.El-Abagy and S.D.Abou- Hussein (2009). Essential oil, growth and yield of onion (*Allium cepa* L.) in response to foliar application of some micronutrients. Australian J.Basic and Applied Science , 3 (1) : 201 – 205.

Gad, N. and H. Kandil (2013). Evaluate the effect of molybdenum and different nitrogen levels on Cowpea. Journal of Applied Sciences Res., 9 (3) : 1490 – 1497.

Hahlbrock, K. and D. Scheel, (1989) Physiology and molecular biology of phenyl propanoid metabolism. Anna. Rev. Plant Physiol. Plant Mol. Biol., 40, 347-369.

Hansch,R. and R.R.Mendel (2009). Physiological functions of mineral micronutrients(Cu, Zn,Mn, Fe, Ni, Mo, B, Cl). Current opinion in plant Biology, 12: 259- 266.

Huber, D.M.; and R.D.Graham (1999). The role of nutrition in crop resistance and tolerance to disease , in Rengel Z. (Ed.); Mineral nutrition of crops fundamental mechanisms and implications, food product press, New York, pp 205- 226.

Islam, M.R., M.H.; Ashrafuzzaman, S.K Adhikari,.; M.H. Rahman, and M.H Rashid. 1999. Effect of fungicidal treatments in controlling *Alternaria porri* causing purple blotch of onion. Progress Agric.10 (1&2): 43-46 pp.

Jackson, M.L. (1967). Soil Chemical Analysis. Prentice-Hall of India private Limited Newdelhr, p.115.

Jafari Jood, S. ;A.H.Shiranirad ; J. Daneshian and A.Rokhzaf (2013). Effect of nitrogen application and spraying of boron and manganese on growth trails of two potato cultivars. Intern.J.of Bio. Sci., 3 (9) : 298 – 303.

Kampulainein, I. ;A.M.Raittila ; I. Lehto and P. Koiristainen (1983). Electro thermal Atomic Absorption spectrometric determination of heavy metals in foods and diets. J. Associ off. Anal. Chem. 66: 1129 – 1135.

Khan, U.A.(2013). Effect of Zinc and boron on the growth and yield of garlic.Annual Research Report 2012-13.

Kolota, E. ; and M.Osinska(2001). Effect of foliar nutrition of field vegetables grown at different nitrogen rates. Acta. Hort.; 563. 87-91.

Liew, Y.A.; S.R.SyedOmar ;M.H.A.Husni ; A.N.Zainal and P.A.NurAshikin (2012). Effect of foliar applied copper and boron on fungal diseases and Rice yield on cultivar MR219. Pertanika. J.Trop.Agric. Sci.35 (2)339 – 349.

Macking, G. (1941). Absorption of light by chlorophyll solution. J.Biol. Chem., 140 : 315 – 322.

Mann, L.K. (1952). Anatomy of the garlic bulb and factors affecting bulb development. Hilgardia, 21 : 195 – 228.

Manna, D. ; T.K.M aity and A.Ghosal (2014). Influence of foliar application of boron and zinc on growth ,yield and bulb quality on onion. J. of crop and weed, 10 (1) : 53 – 55.

Marschner, H. ;G.Rimmington (1996). Mineral nutrition of Higher plants ;Acadmic press : London,UK.

Marschner, H.(1995). Mineral nutrition of higher plants, 2nd ed., Academic, press, London, p 889.

Mousavi, S.R. ;M.Galavi and G.Ahmad Van (2007). Effect of Zinc and manganese foliar application on yield, quality and enrichment on potato. Asian J. Plant Sci, 6 : 1256 – 1260.

Naga, S.K.; S.K.Swain; V.V.Sandeep and B.Raju (2013). Effect of foliar application of micro- nutrients on growth parameters in tomato. J.Agric. Food Sci. 1: 146 – 151.

Nasiri, Y. ;Z. S. Saeid; N. Sofar; N. Nostratollh and G.G. Kazem (2010). Effect of foliar application of micronutrients (Fe and Zn) on flower yield and essential oil of chamomile. J.Med. Plants Res. 4 (17) : 1733- 1737.

Nasreen, S.; M.N.Yousef ;A.N.M.Mamun ; S.Brahma and M.M.Haquc (2009). Response of garlic to zinc, boron and poultry manure application. Bangladesh J.Agric. Res. 34 (2) : 239 – 245.

Pilbeam, D.; E.Kirkby (1983). The physiological role of boron in plants. J.Plant Nutr.,6 :563 – 582.

Ranganna, S. (1979). Manual analysis of fruit and vegetable products Tata MC Grow H :11 publishing company Limited New Delhi, pp634.

Rizk, F. A. ; A.M. Shaheen ; E.H.Abd El- Samad and T.T.El- Labban (2014). Response of onion plants to organic fertilizer and foliar spraying of some micronutrients under sandy soil condition. Journal of Applied Science Research 10 (5) : 383 – 392.

Sendecor, G.H. and W.G.Cochran (1982). Statistical Methods. Lowa State Univ. Press USA. 6th Ed. pp 34 – 93.

Shehata, S.A. ;M.Y.Hashem; I.Ghada and K. F. A. BD El- Gawad (2012). Effect of some per harvest treatments on onion seeds production under sandy soil conditions. Journal of Applied Science Research 8 (2) : 763 – 769.

Tripathy, P.; , A ,.Priyadarshini.; S.K. Das,; B.B.Sahoo, and Dash (2013). Evaluation of onion (Allium cepa L.) genotypes for tolerance of thrips (Thrips tabaci L.) and purple blotch [Alternaria porii (Ellis) Ciferri]. International Journal of Bio-resource and Stress Management, 4(4): 561-564.

Uddin, M.N.; M.R. Islam,; N. Akhtar, and A.N. Faruq, (2006). Evaluation of fungicides against purple blotch complex of onion (*Alternaria porii* and *Stemphylium botryosum*) for seed production. J. Agric. Educ. Technol. 9(1&2): 83-86.

Wasssel, A.H. ;M.A.Hameed ; A.Gobara and M.Attia (2007). Effect of some micronutrients, gibberellic acids and ascorbic acid on growth, yield and quality of while Botany seedless grapeniens. African crop Sci. Conference proceeding, 8: 547 – 553.

Yosefi, K ; M. Galavi ; M.Ramradi and S.R. Mousavi (2011). Effect of bio-phosphate and chemical phosphorus fertilizer accompanied with micronutrient foliar application on growth, yield and yield components of maize (single cross 704). Australian J. crop Sci., 5 (2) : 175 – 180.

Yurela, I. (2009). Copper in plant : acquisition, transport and interactions. Funct Plant Biol. 36, 409 – 430.

تأثير بعض المعاملات على اللطعة الارجوانية والنمو والانتاجية فى الثوم

أحمد السيد عبد القادر*، أنور الدسوقى على اسماعيل جودة*، محمود نبيه محمد على جحوش* و خالد محمد ابراهيم غنيم**.
*قسم بحوث الخضر – معهد بحوث البساتين- مركز البحوث الزراعية – الجيزة- مصر.
**قسم بحوث أمراض البذور - معهد بحوث أمراض النباتات- مركز البحوث الزراعية – الجيزة- مصر.

اجريت تجربتان حقليتان بمزرعة خاصة بقرية بسينديلة – مركز بلقاس – محافظة الدقهلية خلال موسمى النمو ٢٠١٢ /٢٠١٣ و ٢٠١٣ / ٢٠١٤ لدراسة تاثير الرش الورقى على نباتات الثوم كبريتات نحاس (بمستويات ٠,٥ % و ٠,١ %) كبريتات الزنك (بمستويات٠,١ % و ٠,٢ %) اليوريا معاملة بمستويات (٠,٥ % و ١ %) البوراكس (بمستوى ٠,١ %) وبعض التفاعلات بينهما بالاضافة الى الرش بالمبيد الفطرى ريدوميل بلاس بتركيز (٢,٥ جرام / لتر) على نمو الثوم ، المحصول ومكوناته والتركيب الكيماوى بالاضافة الى العدوى باللطعة الارجوانية على الثوم سلالة - سدس ٤٠.

أوضحت النتائج المتحصل عليها أن رش نباتات الثوم بالمعاملة يوريا ١% او المعاملة بكبريتات النحاس بمعدل ٠,٥ % + كبريتات الزنك بمعدل ٠,٢ % + اليوريا بمعدل ٠,٥ % + البوراكس بمعدل ٠,١% او المعاملة بكبريتات النحاس بمعدل ٠,١ % + كبريتات الزنك بمعدل ٠,١ % + اليوريا بمعدل ١ % + البوراكس بمعدل ٠,١ % . او المعاملة بالمبيد الفطرى رادوميل بلاس بتركيز (٢,٥ جرام / لتر) أعطى أعلى قيمة لطول النبات وأقل قيمة لمعامل التبصيل بينما هذة المعاملات بدون معاملة الريدوميل بلاس أعطت أعلى قيمة لوزن النبات الطازج .

تم الحصول على أعلى قيمة للمحصول الجاف – وزن البصلة عند رش نباتات الثوم بمعاملة ريدوميل بلاس بتركيز (٢,٥ جرام / لتر) أو الرش بمعاملة بكبريتات النحاس(بمعدل ٠,١ %) + كبريتات الزنك بمعدل(٠,١ %)+ اليوريا (بمعدل ١ %) + البوراكس (بمعدل ٠,١ %) أو الرش بكبريتات النحاس(بمعدل ٠,٥ %) + كبريتات الزنك (بمعدل ٠,٢ %) + اليوريا (بمعدل ٠,٥ %) + البوراكس(بمعدل ٠,١%) .

تم الحصول على أعلى قيمة لوزن الفص عند رش نباتات الثوم بالمعاملة بكبريتات النحاس(بمعدل ٠,١ %) + كبريتات الزنك بمعدل(٠,١ %)+ اليوريا (بمعدل ١ %) + البوراكس (بمعدل ٠,١ %) فى الموسم الأول بينما الرش بكبريتات النحاس(بمعدل ٠,٥ %) + كبريتات الزنك (بمعدل ٠,٢ %) + اليوريا (بمعدل ٠,٥ %) + البوراكس(بمعدل ٠,١ %) فى الموسم الثانى.

رش نباتات الثوم بكبريتات النحاس(بمعدل ٠,٥ %) + كبريتات الزنك (بمعدل ٠,٢ %) + اليوريا (بمعدل ٠,٥ %) + البوراكس(بمعدل ٠,١ %) أو الرش بكبريتات النحاس(بمعدل ٠,١%) + كبريتات الزنك بمعدل(٠,١ %)+ اليوريا (بمعدل ١ %) + البوراكس (بمعدل ٠,١ %) أعلى قيمة للنسبة المئوية للنيتروجين والفوسفور والبوتاسيوم فى محتويات الفصوص الناتجة وهاتان المعاملتان أيضا اعطت اعلى قيمة مقدرة بالجزء / مليون للنحاس والزنك والبورون.

تم الحصول على اعلى قيمة للكلوروفيل (أ & ب) عند رش النباتات بكبريتات الزنك بمعدل ٠,١ % أو الرش بكبريتات النحاس(بمعدل ٠,٥ %) + كبريتات الزنك (بمعدل ٠,٢ %) + اليوريا (بمعدل ٠,٥ %) + البوراكس(بمعدل ٠,١ %) أو الرش بكبريتات النحاس(بمعدل ٠,١ %) + كبريتات الزنك بمعدل(٠,١ %)+ اليوريا (بمعدل ١ %) + البوراكس (بمعدل ٠,١ %) بينما أعلى قيمة للكاروتينات تم الحصول عليها عند الرش الورقى للنباتات الثوم بكبريتات النحاس بمعدل ٠,١ % أو اليوريا بمعدل ٠,٥ %.

أدت المعملتان بكبريتات النحاس(بمعدل ٠,١ %) + كبريتات الزنك بمعدل(٠,١%)+ اليوريا (بمعدل ١ %) + البوراكس (بمعدل ٠,١ %) او الرش بكبريتات النحاس(بمعدل ٠,٥ %) + كبريتات الزنك (بمعدل ٠,٢ %) + اليوريا (بمعدل ٠,٥ %) + البوراكس(بمعدل ٠,١ %) بالاضافة المعاملة الرش بالريدميل بلاس للحصول على أقل نسبة وشدة الاصابة باللطعة الارجوانية.

Table 1:Effect of foliar spray treatments on vegetative growth characteristics after 120 days from planting during 2012/2013 and 2013/2014 seasons.

Treatments	Plant height cm		Leaves number		Plant freshweight (g)		Plant dry weight (g)		Bulbing ratio	
	Season 1	*Season 2*	*Season 1*	*Season 2*	*Season 1*	*Season 2*	*Season 1*	*Season 2*	*Season 1*	*Season 2*
Control	53.66 c	52.22 d	9.67 d	9.56 b	38.82 c	35.51 c	6.61 i	7.57 e	0.29a	0.26a
CuSO4 0.5%	56.00 bc	57.89ab	10.67bc	10.78a	38.93 c	49.27ab	8.30 h	8.60 d	0.25b	0.25a
CuSO4 0.1%	60.44ab	53.56cd	10.89abc	10.11ab	48.17 b	48.13 ab	11.25 ef	8.03 e	0.20de	0.20b
ZnSO4 0.1%	56.44abc	52.78d	10.89abc	10.22ab	47.44 b	48.09 ab	13.36 d	9.90 b	0.23bc	0.24a
ZnSO4 0.2%	55.56 bc	54.89bcd	11.67a	9.67ab	41.99 c	47.71 b	10.47 fg	8.70 d	0.21cd	0.21b
Urea 0.5%	56.56abc	54.11cd	11.33ab	10.11ab	47.79 b	47.91 b	18.48 a	9.70 bc	0.23bc	0.24a
Urea 1%	62.00 a	59.89a	11.22abc	10.11ab	57.35 a	53.92 a	14.92 c	9.63 bc	0.20de	0.21b
Borax 0.1%	56.66 bc	55.22bcd	10.44c	10.45ab	39.06 c	50.22 ab	9.62 g	9.48 bc	0.21cd	0.21b
CuSO4 0.5% + ZnSO4 0.2% + Urea 0.5% + Borax 0.1%	59.45 ab	56.78abc	10.89abc	9.33b	49.91 b	51.39 ab	16.89 b	10.62 a	0.18e	0.20b
CuSO4 0.1% + ZnSO4 0.1% + Urea 1% + Borax 0.1%	59.33 ab	57.45ab	10.89abc	9.33b	49.62 b	50.94 ab	11.23 ef	9.23 c	o.18e	0.20b
Fungicide (Radomil pluse)	58.98abc	57.56ab	10.67bc	9.33b	41.84 c	48.57 ab	11.54 e	9.29 c	0.18e	0.18b

Table 2: Effect of foliar spray treatments on yield and its components during 2012/2013 and 2013/2014 seasons.

Treatments	Total cured yield (ton/fed.)		Bulb weight (g)		No. cloves		Clove weight (g)		DM % clove	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	6.770 c	7.030 f	50.85g	51.85d	13.47ab	20.00a	3.79d	2.62f	30.78ef	30.98f
CuSO4 0.5%	7.530 b	7.867 cde	56.57def	59.14c	13.56ab	13.33b	4.18cd	4.54a	30.53f	30.69f
CuSO4 0.1%	7.550 b	7.917cde	56.71cdef	59.71c	11.44c	14.00b	5.03ab	4.44ab	30.99e	31.22f
ZnSO4 0.1%	7.570 b	8.030 cd	56.85cdef	60.31bc	13.67ab	16.33b	4.19cd	3.70e	32.49d	32.61e
ZnSO4 0.2%	7.600 b	8.076 c	57.14cde	60.57bc	13.56ab	14.33b	4.32cd	4.26abcd	34.63b	35.03e
Urea 0.5%	7.470 b	7.810 de	54.57ef	58.71c	14.11ab	15.00b	3.92cd	3.93de	32.48d	32.60e
Urea 1%	7.560 b	7.800 e	54.28f	58.57c	12.22bc	14.67b	4.47bcd	4.02cde	33.51c	33.71b
Borax 0.1%	7.750 ab	8.300 b	58.28bcd	62.34ab	14.33a	14.67b	4.08cd	4.08bcde	33.37c	33.50bc
CuSO4 0.5% + ZnSO4 0.2% + Urea 0.5% + Borax 0.1%	7.870 ab	8.500ab	59.34abc	62.57ab	14.00ab	15.33b	4.24cd	4.63a	34.44b	34.4bc
CuSO4 0.1% + ZnSO4 0.1% + Urea 1% + Borax 0.1%	7.990 ab	8.480 ab	60.00ab	63.71a	10.89c	14.67b	5.53a	4.38abc	35.08a	35.27a
Fungicide (Radomil pluse)	8.340 a	8.550 a	61.25a	64.28a	13.33ab	16.00b	4.61bc	4.47ab	33.70c	32.80cd

Table 6. Effect of foliar spray treatments on chlorophyll A, B, Total chlorophyll and carotenoids during 2012/2013 and 2013/2014 seasons.

Treatments	Photosynthetic pigments							
	Chlorophyll a		Chlorophyll b		Total Chlorophyll		Carotenoids	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	0.2018 d	0.1770 d	0.1954 d	0.1455 d	0.3971 e	0.3226 e	0.3211 b	0.3168 b
CuSO4 0.5%	0.4048 bc	0.3948 bc	0.2821 bc	0.2874 bc	0.6869 cd	0.6821 cd	0.3994 a	0.3772 a
CuSO4 0.1%	0.4311 a-c	0.4157 b	0.2660 b-d	0.2774 bc	0.6971 cd	0.6931 cd	0.4128 a	0.3951 a
ZnSO4 0.1%	0.5042 a	0.5134 a	0.3659 a	0.3546 a	0.8700 a	0.8679 a	0.3567 ab	0.3564 ab
ZnSO4 0.2%	0.4673 ab	0.4733 a	0.3399 ab	0.3383 ab	0.8063 a-c	0.8117 ab	0.3963 a	0.3889 a
Urea 0.5%	0.4240 a-c	0.4176 b	0.3223 a-c	0.3384 ab	0.7213 b-d	0.7560 bc	0.4044 a	0.3988 a
Urea 1%	0.3637 c	0.3710 bc	0.2582 cd	0.2891 bc	0.6219 d	0.6601 cd	0.4041 a	0.3995 a
Borax 0.1%	0.3542 c	0.3530 c	0.2668 b-d	0.2611 c	0.6210 d	0.6141 d	0.3934 a	0.3855 a
CuSO4 0.5%+ ZnSO4 0.2%+Urea 0.5%+Borax 0.1%	0.5055 a	0.5187 a	0.3910 a	0.3871 a	0.8965 a	0.9058 a	0.3907 a	0.3761 a
CuSO4 0.1%+ ZnSO4 0.1%+Urea 1%+Borax 0.1%	0.4751 ab	0.4830 a	0.3799 a	0.3723 a	0.8550 ab	0.8552 a	0.3981 a	0.3851 a
Fungicide (Radomil pluse)	0.4975 a	0.5138 a	0.3830 a	0.3523 a	0.8805 a	0.8661 a	0.3987 a	0.3847 a