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Effect of Foliar Nutrition on Post-Harvest of Onion Seed under Sandy Soil and Saline Irrigation Water Conditions

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Summary: Foliar application has been determined to be an effective nutrients delivery strategy in vegetable and fruits. The enhancement of vegetable and fruit yields affected by foliar nutrients application has been recognized in previously conducted studies with perennial tree crops. The efficiency of foliar nutrition is dependent on soil, climate, fertilizer and the amount of nitrogen used. There is no sufficient information concerning cooperation of foliar nutrition with all nutrients form as well as the rates of these nutrients fertilization in vegetable and fruit crops. Two successive winter seasons of 2008/2009 and 2009/2010 were conducted under sandy soil conditions to study the effect of spraying with 12 commercial compounds on inflorescences diameter, flower stalk length, number of seed stem /plant, weight of 1000 seed, germination percentage, seed yield, moisture content, catalase , peroxidase activity and malondialdehyde content of onion seeds. The plants sprayed with union Zn, union Mn, union feer, shams k, elga 600, boron, and amino x had the highest vegetative growth parameter, germination percent and enzyme activity. The plants sprayed with union Zn, union feer, shams K, magnesium, caboron, hummer and amino X had the highest seed yield ha^{-1}. The seeds were stored for one year to study the effect of different commercial compounds and storage temperatures on germination, moisture content and change in antioxidant enzymes activities of onion seeds during the storage period. Storage at cold temperature showed higher germination percent, moisture content and lower malondialdehyde content than storage at room temperature. The treatment with union Zn, union feer, union Mn, boron, elga 600, caboron, amica, hummer and amino x had the highest germination percent.

Keywords: *Onion; pre-harvest; post-harvest; foliar application; seeds production; sandy soil*

Introduction

It is well known that from the time of harvest quality declines in fruit and vegetables and many nutrients are lost rapidly, particularly if produce is not cooled effectively. This quality decline includes visual symptoms, such as loss of turgor and yellowing of green produce, as well as loss of important nutrients, such as sugars and vitamin C (***Jones et al. 2006***). Postharvest decays of fruits and vegetables account for significant levels of postharvest losses. It is estimated that about 20–25 % of the harvested fruits and vegetables are decayed by pathogens during postharvest handling even in developed countries (***Sharma et al. 2009***). The fresh fruit and vegetable postharvest sector is dynamic, due largely to increasing consumer demand for quality produce. This, together with the fact that machines are more consistent than humans, the scarceness of labor in developed countries, and the opportunity to reduce labor costs, has led to remarkable mechanization and automation in packinghouses during the past few decades (***Moreda et al. 2009***).

Onion (*Allium cepa* L.) is a species of the *alliaceae* family it is of great economic importance in Egypt. It is the most important cash crop after rice in Egypt. The total planted area for onion seed production is 2752 fed (ha = 2.4 fed). Producing 742 tons with an average of 270 kg fed^{-1} according to the Egyptian Ministry of Agriculture report (2008). Increasing its yield with consequent economic return is the major concern of the farmers (***Abd El-Gawad, 2012***). Egypt is considered the 4th producer of dry onion in the world, where it produce about 2,208,080 ton, average yield per hectare is 358833 kg ha^{-1} and the total harvested area from dry onion 61535 ha in 2010 (***FAO, 2012***). Onion is considered as beneficial for health and is recommended for curing or preventing a wide variety of diseases. Moreover, epidemiological studies present that the increase consumption of onions can reduce the risk of cancer at specific sites (***Dorant et al. 1996***). Onions contain a wide variety of micro-constituents such as flavonoids, mainly quercetin, and sulfur compounds, like sulfides and polysulfides, which may have protective effects against cancer. The administration of such components in pure form to animals was able to influence the carcinogenicity of environmental chemicals (***Suschetet et al. 1998***). Allyl sulfides and alkyl sulfides have been shown to increase phase II enzymes such as glutathione S-transferase (GSI) and UDP-glucuronosyltransferase (UGT) implicated in mechanisms of cancer prevention and/or modulate cytochromes P450 (CYP) activities responsible for carcinogen activation. Many in vitro studies show CYP inhibition by quercetin (***Arnault and Auger, 2006***).

Onion seeds are eaten, especially in some Indian dishes, they do not affect the breath as the bulbs, and nevertheless, their commercial availability is currently limited. Perhaps, if consumers were much more acquainted with onion seed nutritional and functional properties, there would be a boost in the trade market for this product (***Dini et al. 2008***). Onion seeds in general have poor longevity and lose viability rapidly within 1-2 years. It is necessary to store seeds for a period of several months to a year or more. However, no storage procedure guarantees that seeds will remain viable forever. Seeds eventually lose vigor and then viability with time (***Korkmaz et al. 2004***). The deterioration (ageing) of seeds may begin before harvest and continues during harvest, processing and storage, at a rate greatly influenced by genetic, production and environmental factors. Some of the deleterious effects of aging are associated with damages occurring at membrane, nucleic acids and protein levels (***Fujikura and Karssen, 1995***). Peroxidation of unsaturated fatty acids is considered to be one of the main reasons for loss of storability, which occurs due to decreased level of antioxidants, reduce activity of free radical and peroxide scavenging enzymes, and increased lipid peroxidation, viz, malondialdehyde content (***Chiu et al. 1995***). The initial phase of seed deterioration is seed degradation in which there is reduction in ATP synthesis, respiration and biosynthesis rates, resulting in reduced emergence and development of abnormal seedling (***Abd El-Gawad, 2012***).

Sandy soils are characterized by the predominance of rigid coarse particles that are inevitably associated with small amounts of clay minerals. The inability of these soils to buffer changes in physical, chemical and biological predisposes them to accelerated rates of degradation. Physical, chemical and biological characteristics of sandy soils often act as a severe limitation in crop production. Their sandy nature; low organic carbon content; high hydraulic conductivity rates; low nutrient and water supply capacity; limited buffering capacity; and inadequate biological diversity invariable necessitate high levels of external inputs (***FAO, 2005***).

By manipulating the constituent components of the soil through the addition and conservation of organic matter or through the physical application of organic waste and clay materials, the potential productivity of the sandy soils can be realized. The semi-arid conditions, high irrigation water salinity and very low soil fertility are the most common problems in Egyptian agriculture. Therefore, the aim of this study was to investigate the effect of foliar application with 12 commercial compounds on onion growth, seed production and its longevity under sandy soil and saline irrigation water conditions. Also, the study aimed to monitor the antioxidant enzyme capacity under these conditions.

Materials and Methods

Experimental design

The aim of this investigation was to study the effect of foliar application with 12 commercial compounds and untreated treatment (foliar with water) on onion seed production under sandy soil conditions. The applied commercial compounds are listed in **Table 1**. The seeds for this study produced at Waddy Elnatron farm, Agricultural Experimental Station of the Faculty of Agriculture, Cairo University.

This study conducted in two successive seasons in 2008/2009 and 2009/2010. Waddy Elnatron farm is reclaimed

Table 1: Commercial compounds, their structures and using rate of them

Compound	**Company**	**Compound structure**	**Using rate**
1- Shetocare	Kemia Masr	1000 ppm N + 500 ppm K + 100 ppm Zn + 50 ppm Cu + 500 ppm P + 100 ppm Fe + 50 ppm Mn + 50 ppm B	1ml l^{-1}
2- Amica	Technogreen	10 % amino acid + 5 % total nitrogen + 14 % calcium + 7 % organic matter	1ml l^{-1}
3- Caboron	Technogreen	6 % chelate calcium + 1.5 % chelate B + 20 % calcium oxide	1ml l^{-1}
4- Elga 600	Technogreen	1 % N + 18 % potassium oxide + 2 % S	1g l^{-1}
5- Amino X	UAD	80 % total amino acid + 16 % free amino acid + 10 % organic nitrogen + 2.5 % potassium oxide	1g l^{-1}
6- Hummer	UAD	Humic acid containing 6 % potassium oxide + 86 % potassium hummat	1g l^{-1}
7- Union Zn	UAD	12 % Zn chelated on amino and organic acids	1g l^{-1}
8- Union Mn	UAD	13 % Mn chelated on amino and organic acids	1g l^{-1}
9- Union Feer	UAD	6 % Fe chelated on amino and organic acids	1g l^{1}-1
10- Shams K	UAD	50 % potassium oxide + 1 % magnesium oxide	1g l^{-1}
11- Boron	UAD	–	0.5 g l^{-1}
12- Magnesium	UAD	–	0.5 g l^{-1}
13- Untreated	–	sprayed with water	–

Table 2/A: Physical and chemical analysis of the experimental soil in 2008/2009 and 2009/2010 seasons

Season	Soil texture	Soluble cations (meq l^{-1})				Soluble anions (meq l^{-1})		
		K^+	Na^+	Ca^{++}	Mg^{++}	HCO_3^-	SO_4^{+2}	Cl^-
2008/2009	Sandy	10.0	17.52	16.11	6.37	1.33	21.67	18.0
2009/2010	Sandy	10.8	40.83	64.37	50.78	5.90	21.34	31.5

Table 2/B: Physical and chemical analysis of the experimental soil in 2008/2009 and 2009/2010 seasons

Season	Soil EC (dS m^{-1})	Soil pH	Available nutrients (mg kg^{-1})					
			N	P	Fe	Cu	Zn	Mn
2008/2009	4.20	7.70	18.0	28.2	17.5	1.20	2.40	5.20
2009/2010	3.90	8.35	18.9	35.4	16.2	1.55	3.18	6.28

Table 3: Chemical analysis of irrigation water

Water EC (dS m^{-1})	Water pH	Soluble cations (meq l^{-1})				Soluble anions (meq l^{-1})		
		K^+	Na^+	Ca^{++}	Mg^{++}	CO_3^{--}	SO_4^{+2}	Cl^-
3.9	7.5	0.39	29.88	2.16	7.15	4.04	12.71	22.83

sandy soil, its chemical and physical analysis is presented in **Table 2/A, Table 2/B** and water chemical analysis is presented in **Table 3**.

One commercial onion cultivar was selected for this study, viz., Giza 20. Bulbs were brought from Agricultural Research Center, Giza. Bulbs were sown on Dec. 18th and 14th in 2008 and 2009, respectively. Seeds were harvested on June, 14 and 7 in 2009 and 2010, respectively when the open capsules reached to 5 % of total capsules. The area of each plot was 16 m^2 (4 rows × 4 m long × 1 m width). Bulbs were sown on the center of the ridge and spaced 25 cm between each bulb in four replicates using standard commercial practices. The method of irrigation was drip. A completely randomize blocks design (CRBD) was used with four replicates. The commercial compounds were treated three times during the season of growth at vegetative growth, flowering and flower set (after two months of sowing date, one month later and one month later, respectively).

Onion seed production parameters

After harvesting, capsules were dried by sun and then seeds were threshed by sticks and cleaned by winnowing. Vegetative growth was measured after 4 months of sowing date as follows: flower stalks length, inflorescence diameter and number of seeds stalk/plant. All the measurements of vegetative growth were recorded on 8 plants (2 plants from each row × 4 rows) of each plot. The measured characters of yield and yield components of onion were as follows:

1. Weight of 1000 seeds: Thousand seeds randomly chosen and weighted with a sensitive balance with scale 0.001.

2. Seeds germination percent: Germination test was conducted in Petri dishes at 25°C for 14 days (***ISTA, 2012***). Germination was determined for 400 seeds (100 seed × 4 replicates). Seedling counts were performed at 7 and 14 days and total percent of germination were calculated for each treatment. The germination test was conducted after harvest (zero time).

3. Seeds water content: Seeds water content was determined by using WILE55 (digital grain moisture meter) after harvest.

4. Total dry seeds yield ha^{-1}: Total dry seeds yield were recorded per plot for each treatment in each replicate and then calculated per hectare.

Biochemical assessments of onion seed

Two grams of seeds were ground in a mortar and homogenized in 20 ml of 0.1 M phosphate puffer (pH 7.8) containing 0.4 g polyvinyl pyrrolidone, 2 mM dithiotheitol and 0.1 mM EDTA followed by centrifuging at 16,000 × g for 15 min at 4°C (***Rao et al. 2006***).

Catalase activity (CAT)

Catalase was assayed by measuring the decrease in absorbance due to disappearance of H_2O_2 at 240 nm according to **Chance and Maehly (1955)**. The enzyme extract (100 µl) was added to 100 µl of 100 mM H_2O_2 and the total volume was made up to 1 ml by 250 mM phosphate buffer pH 6.8. The decreasing in optical density at 240 nm against blank was recovered every minute. For reproducible results, the absorbance at 240 nm should be between 0.450 – 0.500 and start decrease by adding enzyme extract.

Peroxidase activity (POD)

This enzyme assayed spectrophotochemically according to **Amako *et al.* (1994)**. The assay was carried out at 25°C in 1.0 cm light bath cuvette and the reaction mixture was consisted of 1500 µl phosphate buffer, 1000 µl pyrogallol and 480 µl H_2O_2 solution. After mixing, the reaction was initiated by adding the enzyme extract (20 µl) and increasing in optical density at 430 nm against blank (without extract) was continuously recorded every minute for three minutes. The calculation was per enzyme unit (EU), where this unit definition (EU) is defined as the amount of enzyme required to cause an increase in the optical density at 430 nm /min at 25°C under standard conditions (0.01OD= 1 EU).

Malondialdehyde content (MDA)

Seed material (0.5 g) was homogenized in 5 ml of 0.1% trichloroacetic acid (TCA) and centrifuged at 20,000 × g for 10 min to 1 ml of extract, 4 ml of 0.5% (w/v) thiobarbituric acid (TBA) in 20% (w/v) TCA was added. The homogenate was incubated at 95°C for 30 min cooled on ice and centrifuged at 16,000 × g for 30 min and MDA content (mmol g^{-1} fw) was spectrometrically determined at 452 nm according to **Health and Parker (1968)**.

Statistical analysis

Data were organized in a completely randomized block design (CRBD). Analyses of variance (ANOVA) were obtained using M. State statistical software. The new LSD method (***Waller and Duncan, 1969***) was used for testing the significance of means in all experiments conducted.

Results

Onion seed production

Inflorescence diameter, flower stalk length and number of seed stem were measured. Foliar application with union feer, union Mn, boron, elga 600 or amino X had the highest inflorescence diameter than all tested treatments in the second season. Whereas, foliar application of shams K, boron, magnesium or elga 600 in the first season, and foliar application of shams K, boron, amica or amino X in the second season had the highest flower stalk length. The highest number of seed stem/plant was recorded with application of shams K, boron or shetocare in the first season. Foliar application with commercial compounds had no significant effect on seed stem/plant in the second season (**Figure 1**). These results are in agreement with those of **Arancon *et al.* (2006)** on pepper and **Abd El- Mawgoud *et al.* (2007)** on tomato as they mentioned that the growth promoting activity of humic substance was caused by plant hormone like material contained in the humic substances. Furthermore, the effects of humus on plant metabolism are conditioned by the release of the hormone like activities. Also, the dispersion and solubilization of humic molecules which are essential to the release of cytokinins like activity and preliminary to the release of auxin and gibberellins like activities. Also, Enhancing effect of amino x on plant growth may be due to an effect attributed to enhanced nitrogen, sulfur metabolism and antioxidant activity (***Pablo and William, 2005***).

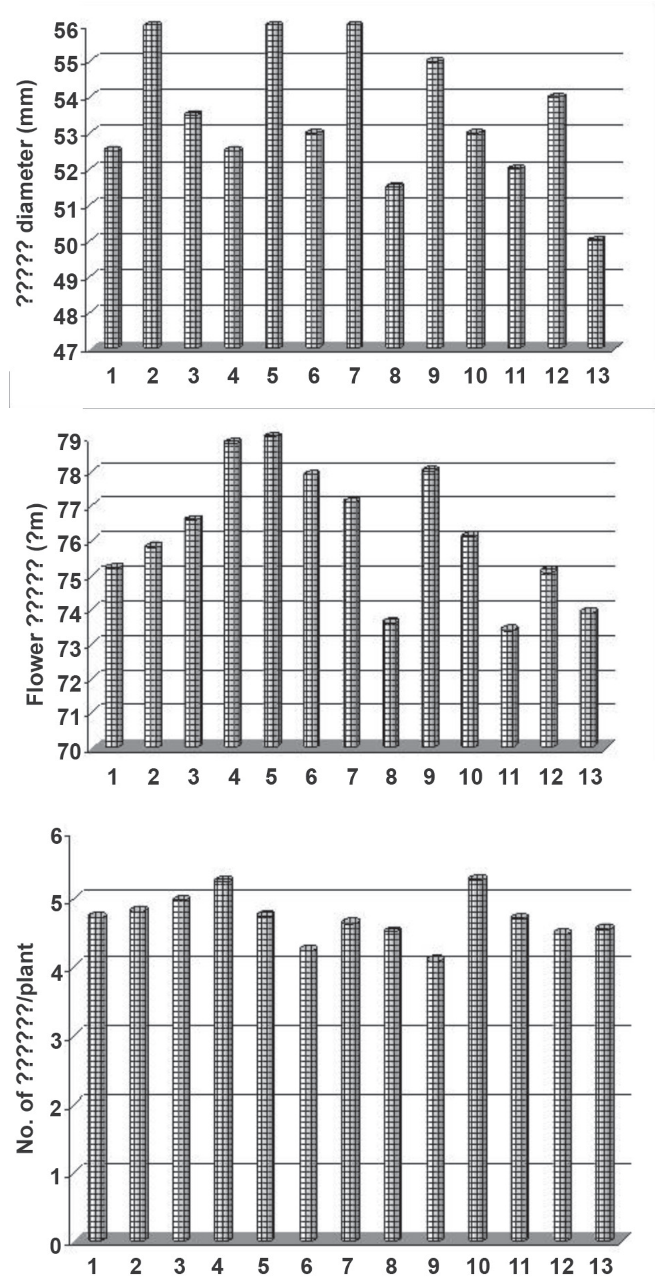

Figure 1: Effect of foliar application with commercial compounds on inflorescence diameter (mm), flower stalks length (cm) and number of seeds stalk/plant (mean of the 2 seasons)

Treatments from 1 to 13: Shetocare, Amica, Caboron, Elga 600, Amino X, Hummer, Union Zn, Union Mn, Union Feer, Shams K, Boron, Magnesium and control, respectively

Weight of 1000 seeds

Thousand seeds weight is important in terms of the quality of the seeds. As shown in **Table 4**, there was non significant effect of foliar application with commercial compounds on weight of 1000 seeds as compared to the control in the second season. The results are true in both seasons. It appears from the same data that there were significant differences between the commercial compounds on seeds weight in both

Table 4: Effect of foliar application with commercial compounds on seed yield per hectare, germination percent and weight of 1000 seeds (gm) in seasons of 2008/2009 and 2009/2010

Treatments	**Seed yield (kg ha^{-1})**		**Germination (%)**		**Weight of 1000 seeds (gm)**	
	2008/2009	**2009/2010**	**2008/2009**	**2009/2010**	**2008/2009**	**2009/2010**
Union Zn	767.5 a-b	656.6 b	93.75 c-e	93.00 c-d	4.51 c	5.08 a-c
Union Feer	782.6 a	813.3 b	96.50 b	95.50 a-b	4.66 a-c	4.88 b-d
Union Mn	675.6 c	666.2 b	95.25 b-c	94.75 a-c	4.50 a-c	5.15 a-b
Shams K	773.7 a	831.6 b	91.50 e	95.50 a-b	4.72 a-c	4.93 b-d
Boron	684.9 b-c	792.9 b	99.50 a	96.75 a	4.76 a-c	4.98 a-d
Magnesium	800.6 a	633.1 b	91.25 e	92.50 d	4.61 b-c	4.80 d
Elga 600	665.5 c-d	713.5 b	94.50 b-d	94.25 b-d	4.60 b-c	5.22 a
Caboron	716.6 a-c	740.6 b	96.00 b-c	94.25 b-d	4.67 a-c	4.96 a-d
Amica	686.4 b-c	670.5 b	93.75 c-e	93.50 b-d	4.66 a-c	5.04 a-d
Shetocare	687.3 b-c	756.4 b	95.50 b-c	94.25 b-d	4.85 a-b	4.85 c-d
Hummer	743.7 a-c	670.3 b	92.50 d-e	93.00 c-d	4.79 a-c	5.03 a-d
Amino X	721.2 a-c	1154.4 a	96.25 b-c	93.25 c-d	4.74 a-c	4.87 b-d
Untreated	588.9 d	721.4 b	92.00 d-e	92.75 c-d	4.93 a	5.02 a-d
$LSD_{0.05}$	**35.47**	**130.0**	**2.656**	**2.189**	**0.3076**	**0.2796**

Treatments from 1 to 13, Shetocare, Amica, Caboron, Elga 600, Amino X, Hummer, Union Zn, Union Mn, Union Feer, Shams K, Boron, Magnesium and control, respectively

seasons. The lowest seed weight was recorded for union Zn and magnesium in first and second seasons, respectively.

Seed yield per hectare

Regarding to the effect of foliar application of commercial compounds on seed yield, data in **Table 4** show that all foliar applications of commercial compounds significantly increased seed yield in the first season. Foliar application with union Zn, union feer, shams K, Magnesium, caboron, hummer and amino x in the first season produced the highest seed yield as compared to all other tested commercial compounds. The treatment with amino x had the highest seed yield as compared to all tested treatments in the second season.

Germination rate

The germination rate (%) of onion seeds is presented in **Table 4**. Statistical analysis shows that there were significant differences between foliar applications with commercial compounds on seeds germination comparing with untreated treatment in both seasons. The highest germination rate was recorded with boron treatment in the first season and union feer, union Mn shams K or boron in the second season.

Biochemical assessments

Catalase activity

Data in **Table 5** show that foliar application of commercial compounds had a significant effect on catalase activity of onion seeds after harvest in both seasons. The treatment with union Zn, union feer, union Mn, shams K, boron, caboron, amica, shetocare, hummer or amino X had the highest catalase activity in the first season. While, the treatment with union Zn, union feer, shams K, boron, caboron, shetocare or amino X had the highest catalase activity in the second season.

Peroxidase activity

Data illustrated in **Table 5** show that foliar application of commercial compounds had non significant effect on peroxidase activity of onion seeds after harvest in both seasons compared with untreated treatment. The treatment with union Zn, magnesium, caboron, amica, hummer and amino x in the first season and the treatment with union Zn, magnesium, caboron and hummer in the second season had the lowest peroxidase activity as compared to all other tested commercial compounds.

Malondialdehyde content

Concerning to the effect of foliar application with commercial compounds on malondialdehyde content, data in **Table 5** shows the treatment with magnesium and the untreated had the highest malondialdehyde content in both seasons. These results may be due to that these treatments had the lowest antioxidant activity in both seasons (**Table 5**). These results are in agreement with **Xin and Wang (2006)**. They found that the malondialdehyde content increased at the same time the enzymatic antioxidant activities (catalase and peroxidase) decreased.

Discussion

Environmental stresses including soil and water salinity affect nearly every aspect of the physiology and biochemistry of plants and significantly diminish yield. One of the most

Table 5: Effect of foliar application with commercial compounds on catalase and peroxidase activity and malondialdehyde content of onion seed after harvest in seasons of 2008/2009 and 2009/2010

Treatments	**Peroxidase (Enzyme unit)**		**Catalase activity (µmol H_2O_2 consumed /mg protein /min)**		**Malondialdehyde (mmol g^{-1} fw)**	
	2008/2009	**2009/2010**	**2008/2009**	**2009/2010**	**2008/2009**	**2009/2010**
Union Zn	9.983 b-c	8.511 b	20.13 a-b	19.04 a-b	10.07 c-e	11.11 b-c
Union Feer	16.68 a	11.98 a-b	19.24 a-c	19.11 a-b	12.66 a-d	12.71 a-c
Union Mn	12.56 a-b	14.28 a	16.48 a-c	15.82 b-c	9.353 d-e	9.920 c
Shams K	17.07 a	11.30 a-b	21.36 a	21.40 a	12.71 a-d	14.93 a-b
Boron	12.17 a-b	11.71 a-b	20.16 a-b	19.29 a-b	8.835 d-e	9.662 c
Magnesium	6.659 c	7.193 b	13.21 c	14.09 b-c	15.45 a	15.97 a
Elga 600	13.71 a-b	14.01 a	13.96 b-c	15.80 b-c	8.525 e	9.817 c
Caboron	10.55 b-c	7.267 b	18.87 a-c	17.34 a-c	14.11 a-b	13.12 a-c
Amica	9.509 b-c	10.15 a-b	15.30 a-c	14.82 b-c	12.76 a-d	12.71 a-c
Shetocare	11.98 a-b	11.66 a-b	21.43 a	17.10 a-c	12.92 a-c	14.11 a-b
Hummer	8.791 b-c	8.627 b	16.42 a-c	13.56 c	13.02 a-c	14.11 a-b
Amino X	10.38 b-c	10.36 a-b	19.87 a-b	19.22 a-b	10.85 b-e	12.81 a-c
Untreated	12.06 a-b	11.56 a-b	14.87 b-c	14.15 b-c	15.04 a	15.55 a
$LSD_{0.05}$	**5.198**	**5.041**	**6.242**	**5.289**	**3.615**	**3.827**

Treatments from 1 to 13, Shetocare, Amica, Caboron, Elga 600, Amino X, Hummer, Union Zn, Union Mn, Union Feer, Shams K, Boron, Magnesium and control, respectively

important abiotic factors limiting plant productivity is water stress induced by drought or salinity. This is especially acute in arid and semi-arid regions. Many arid and semi-arid regions in the world contain soils and water resources that are too saline for most of the common economic crops, which affect plants through osmotic effects, ion specific effects, and oxidative stress (***Munns, 2002***).

Nitrogen is an important constituent of protoplasm and enzyme, the biological catalytic agents with speed up life processes (***Mengel et al. 2001***). The effect of commercial compounds such as shetocare and Elga 600 on vegetative growth may be due to containing these products some macronutrient such as K, N and Ca, and it may also play a great role in enhancing plant growth as a result of stimulation of the immunity of plants and simulation of roots, shoots, leaves, chlorophyll content and photosynthesis. Enhancing effect of shams K on plant growth may be due to the fact that potassium has essential functions in osmoregulation, enzyme activation, regulation of cellular pH, cellular cation-anion balance, and regulation of transpiration by stomata and transport of assimilates (***Singh and Singh, 2003***). Also, enhancement of plant growth using humic acid had been reported to be due to increasing nutrients uptake such as N, Ca, P, K, Mg, Fe, Zn, and Cu (***Adani et al. 1998***) and binding toxic elements such as Al (***Tan and Binger, 1986***).

There was non significant effect of foliar application with commercial compounds on weight of 1000 seeds as compared to the control in the second season. The results are true in both seasons. It appears from the same data that there were significant differences between the commercial compounds on seeds weight in both seasons **(Table 4.)**

The lowest seed weight was recorded for union Zn and magnesium in first and second seasons, respectively. These results disagree with those obtained by **Ahmed and Raymond (1984)** on onion. They found that heavier seeds were produced from bulbs which had received high K regimes. Similar results were obtained by **Singh and Singh (2003)** and **Ali *et al* (2007)** on onion. The enhancing effect of these commercial compounds may be attributed to its role in enhancing plant growth and its role in many biochemical and physiological processes such as chlorophyll and protein synthesis, mineral uptake, the role in photosynthesis, translocation of photosynthesis and activation of enzymatic system. All of these processes will enhance plant growth as well as productivity (***Marscher, 1995***). Also, it may be due to that these treatments gave the highest weight of 1000 seeds. These results were in agreement with those obtained by **Ahmed and Raymond (1984)**, **Singh and Singh (2003)**, and **Ali *et al*. (2007)** on onion.

There were significant differences between foliar applications with commercial compounds on seeds germination comparing with untreated treatment in both seasons (**Table 4**). The highest germination rate was recorded with boron treatment in the first season and union feer, union Mn shams K or boron in the second season. These results are in agreement with those of **Ahmed and Raymond (1984)**, and **Ali *et al.* (2007)** on onion. These results may be due to the fact that there was a positive correlation between the germination rate and antioxidant enzyme activation and also, there was a negative correlation between germination percent and malondialdehyde content (***Demirkaya et al. 2010***).

Salinity stress affected in plant metabolism is mediated by the enhanced production of reactive oxygen species (ROS), such as superoxide ($O_2\cdot$), hydrogen peroxide (H_2O_2), singlet oxygen, and hydroxyl radical (***Foyer and Noctor, 2003***). These ROS are extremely cytotoxic and can seriously disrupt normal metabolism through oxidative damage to lipids (***Alscher et al. 2002***), nucleic acids, and proteins (***Herbette et al. 2002***). In order to avoid the damage caused by ROS compounds, plants have evolved molecular defense systems that both limit the formation of ROS and promote its removal (***Alscher et al. 2002***). The plant enzymatic defenses include antioxidant enzymes such as the phenol peroxidase (POX), ascorbate peroxidase (APX), glutathione peroxidase (GPX), superoxide dismutase (SOD), and catalase (CAT), which together with other enzymes of the ascorbate-glutathione cycle promote the scavenging of ROS (***Heidari and Jamshidi, 2011***).

Antioxidants play a vital role in both food systems as well as in the human body to reduce oxidative processes. In food systems, antioxidants are useful in retarding lipid peroxidation and secondary lipid peroxidation product formation, and thus help to maintain flavor, texture, and, in some cases, the color of the food product during storage. Antioxidants further reduce protein oxidation as well as the interaction of lipid derived carbonyls with proteins that leads to an alteration of protein functionality (***Elias et al. 2008***). Natural antioxidants such as vitamin C, tocopherols, herbal extracts like rosemary and sage, as well as tea extracts have already been commercialized as alternatives to synthetic antioxidants in food systems. Proteins and protein hydrolysates derived from sources like milk, soy, egg, and fish have also been shown to exhibit antioxidant activity in various muscle foods (***Samaranayaka and Li-Chan, 2011***). The favorable effects of these commercial compounds on antioxidant activity (catalase and peroxidase) could be due to its important role either as a metal component of enzymes, or as a functional, structural or regulatory factor of enzymes. Also, it involved in enzyme activation. These results are in agreement with those of ***Prasad (2003)*** and ***Heidari and Jamashidi (2011)***. It is clear from these results that the malondialdehyde content increased as enzymatic antioxidant activity (catalase and peroxidase) decreased.

The application of this research is concerned with the improvement of the water irrigation use and management under saline conditions of Egypt. At the same time, physiological and biochemical findings can be considered in onion seed storage under arid and semi-arid zones. The semi-arid conditions, high irrigation water salinity and very low soil fertility are the most common problems in Egyptian agriculture. Therefore, the addition and conservation of organic matter or through the physical application of organic waste and clay materials, the potential productivity of the sandy soils can be realized.

Conclusion

Integrated soil fertility management is about expanding the choice set of farmers by increasing their awareness of the variety of options available and how they may complement or substitute for one another. It is very important to improve the biological, chemical and physical properties of sandy soils and this problem associated with decline soil fertility. It could be achieved that using integrated organic, mineral and bio-fertilizers. It could be also applied these fertilizers using foliar nutrition depending that on plant species, soil type, irrigation water quality and the environmental conditions. The sustainable management of foliar nutrition and post harvest of onion seed production under sandy soils using saline irrigation water should be monitored and re-plan every short time to overcome the expected problems under these conditions.

Soil and water salinity is one of the most yield limiting agricultural problems in arid and semiarid regions in different parts of the world. It is estimated that currently at least 30% of irrigated lands in the world is affected by soil salinity. The supply of nutrients via the roots is restricted under saline soils because of the negative effect of drought and salinity on nutrient availability. At early growth stages, foliar fertilization could increase P and K supplies at a time when the root system is not well developed. Thus, foliar nutrient application under salinity conditions may be able to exclude or include a water deficit or nutrient effect under short-term drought or salt stress. Therefore, the soil and water salinity may be influenced on the onion seed quality after harvesting under foliar application of nutrients.

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