EFFECT OF FOLIAR APPLICATION OF ASCORBIC AND HUMIC ACIDS WITH BIO FERTILIZER ON YIELD COMPONENTS, GERMINATION, SEEDLING VIGOR AND NUTRIENTS CONTENT OF MAIZE GRAINS UNDER SALINE SOIL

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ABSTRACT: *A field experiment was conducted in the two summer successive seasons 2012and 2013 at Sahl- El-Tainia (North Sinia)to study the effect of foliar application Humic and Ascorbic acids and Azospirllim brasilense fertilizer on yield components, germination , seedling vigor and chemical analysis of maize grains. The two acids were applied according to factory recommendation (1.5 and 3.0 g per/ lit) seeds were inoculation with Azospirllim brasilense (200g/1kg seeds) before planting. The experimental design was randomized completely block design with three replications. The maize (Zea mays L) cultivar Triple hybrid 310 was used. The results showed that yield components , germination percentage ,shoot length, seedling fresh weight were increased under the application ascorbic acid 1.5g/l + Azospirllim brasilense, while the increase in radical length of seedling was under the application of humic acid 3.0g/l + Azospirllim brasilense. High reduction in accelerated ageing germination %, protein percentage in seeds were increased under ascorbic acid 1.5g/l and humic acid 1.5g/l with Azospirllim brasilense and seed oil percentage increased under ascorbic acid 1.5g/l with Azospirlliu brasilense .It was found the foliar application of ascorbic and humic acid combined with bio fertilizer increased macro- micronutrients concentration in maize grains compared with bio-fertilizer alone or control. From previous results we could recommend that the utilization of organic acids(ascorbic and humic acids combined with Azospirllim brasilense NO40 containing PGPR group) which gave the best results and improve of maize cultivar triple hybrid 310 productivity and quality under saline soil conditions in the North Sinai .*

Key word: *Azospirllim brasilense, germination, Ascorbic acid, Humic acid, Maize productivity and quality, nutrients content in grains.*

INTRODUCTION

Maize (Zea mays L.) is one of the most strategically crop in Egypt, to overcome the increasing requirement for maize grain for bread industry (20 % mixed with wheat flour to reduce the important quality of wheat), Bahr *et al* (2006). Grain yield of maize reduces if exposed to high day time temperature of 38C^{o} at reproductive stage which causes pollen desiccation and poor seed setting (Wahid *et al*, 2007). Maize yield could be affected by insufficient nutrients, which could decrease maize yield by 10 - 22 % (Subedi 2009). The plant growth and yield are reduced in salt affected soils because of the excess uptake of potentially toxic ions (Grattan and Grieve 1999).

Humic substances are organic compound that resulted from the decomposition of plant and animal materials. Addition of humic acids are known to posses many beneficial agriculture properties, they participate actively in the decomposition of organic matter, rocks and mineral, improve soil structure and change physical properties of soil, promote the chelation of many elements and make them available to plants, aid in accreting plant clerisies, enhancement of photosynthesis density and plant root respiration and resulted in greater plant growth (Poincelot 1993). Govindasamy and Chandrasekaran (2002) reported that, addition of humic acid was found to increase the content and enhance the uptake of N, P, K, Ca, Mg, Fe, Mn and Zn in rice. Several endogenous defense mechanisms, including enzymatic and non enzymatic, act in the cells to provide protection against oxidative damage .Important enzymes that scavenge pos include super oxide dismutase, ascorbate proxidsae and catalase (Noctor and Foyer, 2003), and non enzymatic metabolites like ascorbic acid (Athar *et al* 2008). Mohammad *et al* (2014) reported that the humic acids are heterogeneous, which include in the same macromolecule, hydrophilic acidic functional groups and hydrophobic groups. A distinction on the effects of humic acid should be made between indirect and direct effects on plants growth. Under water stress, foliar fertilization with humic molecules increased leaf water retention and the photosynthetic and antioxidant metabolism. Several studies showed that humic acid increased root length, root number and root branching. Stimulation of root growth is generally more apparent than shoot growth.

Ascorbic acid is one of the most important antioxidant at cellular processes including cell division and expansion, and at metabolism activity when germination started (Arrigoni *et al.* 1992). Also, L-ascorbic acid (L-ASA) ameliorated the toxic affect of heavy metals in animals (Singh and Rana 2007). Ascorbic acid application led to increase tolerance to salinity in maize (Khodary 2004). Ascorbic acid and its associated enzyme ascorbate peroxidase play diverse roles in several physiological processes in plants (Smirnoff and Wheeler 2000). El- Kobisy *et al.,* (2005) reported that ascorbic acid is synthesized in the higher plants and affects plant growth and development; it is product of D-glucose metabolism which affects some nutritional cycle's activity in higher plants and plays an important role in the electron transport system. Some bacterial specie mostly associated with the plant rizosphere, have been tested as pre-sowing seed treatment and found to be beneficial for plant growth and yield (Esitken *et al* 2010). Hamada (2013) found that germination is a crucial stage in seedling establishment and plays a key role in crop production. The germination process comprises two distinct phases the first is imbibitions, mainly dependent on the physical characteristics of the seeds and the second is a heterotrophic growth phase between imbibitions and emergence.

Application of ascorbic acid in addition to hydropriming of seeds may be enhance germination under salt stress and increased germination % condition (Tavili *et al* 2009). Rapid and uniform field emergence is two essential prerequisites to increase yield, quality and ultimately profits in crops. Uniformity and percentage of seedling emergence of direct –seeded crops have a major roll on finial yield and quality, slow emergence results in smoller plant and seedling, which are more vulner able to soil-borne diseases (Tzortzakis 2009).

Bio-fertilizer plays a substantial role in chemical and biological transformations in soil and maintains soil fertility. The major biological elements, carbon, nitrogen, oxygen and sulphur are subjected to comparable cyclic processes. Nevertheless, on top of them is the nitrogen, from both ecological and economic viewpoints (Idriss 2004). Salama (2006) found that application of bio-fertilizer significantly increased the N, P and K content in grains and straw of wheat plant as compared with uninoculated plants. Shaban and Omar (2006) reported that N_2-fixer strains in combination with 164 kg urea ha^{-1} showed an effective role for plant growth Shaban and Attia (2009) suggested that the application of bio-fertilizer combined with chemical fertilizers gave the highest N, P , K , Fe , Mn and Zn contents in maize grain under saline soil conditions. The increases of yield and yield components, 100 grain weight and weight of grains /ear, were found with soil treated with the bio-fertilizer combined with chemical fertilizers.

The aim of this study was to investigate the effect of ascorbic and humic acids combined with bio-fertilizer as a foliar application on nutrients concentration in grains, yield components and quality of maize grains under saline soils condition.

MATERIALS AND METHODS

A field experiment was conducted in the two summer successive seasons 2012and

2013 at Sahl-El-Taina (North Sinia), to study the effect of foliar humic , ascorbic acids and *Azospirillum brasilense NO 40* (Salt Tolerant plant growth promoting root zone bacteria PGPR), bio-fertilizer on yield, yield components, germination, seedling vigor and nutrients content of grains. The two organic acids were applied according to the factory recommendation (1.5 and 3.0 g / L) and grains were inoculated with *Azospirillum brasilense NO 40* (Salt Tolerant PGPR) at the rate 200g/1kg seeds before sowing. Bio-fertilizer obtained from Microbiology research Department in Soil, Water and Environment Research Inst. Agric. Res. Center, Giza, Egypt.

Laboratory test:

At Seed Technology Research Department, Field Crops Research, Institute, Agricultural Research Center during summer 2012 and 2013, laboratory experiments were carried out to assess seed quality from the field experiments. Germination percentage was expressed by the percentage of normal seedlings at the end of testing period according to the International Seed Testing Association I.S.T.A (1985). Three replicate of seeds were seeded in boxes of (40x20x20 cm) dimension, containing sterilized sandy soil. The boxes were watered and incubated at 25°C in germination chamber for 10 days. Normal seedlings were count and expressed as the germination percentage at the final count. Ten normal seedlings from each replicate were taken to measure shoot and radical length (cm) and seedling dry weight according to Kirshnasamy and Seshu (1990).

The Mean daily germination was according to (Fritz 1965)

$$\text{Mean daily germination (MDG)} = \frac{\text{Final germination percentage}}{\text{Number of days to final germination}}$$

Accelerated Ageing germination : the seeds were Kept in an Ageing chamber at 42 °C and 100% relative humidity for 92 hours .after ageing ,the seeds were dried ,seed survival percentage was determined by the standard germination test at 25°C and mean normal seedling percentage was calculated according to the rules of the association of official seed analysis (AOSA 1991).

For Electrical conductivity ($\mu scm/g^{-1}$) twenty five seeds per replicate were weighed and soaking in 250 ml of deionizer water at 20°C for 24 hours .Electrical conductivity of seed leachiest was estimated according to *I.S.T.A. (1985)*.

Surface soil samples (0 – 30 cm) were collected from the used soil, air – dried, grinded; good mixed, sieved through a 2 mm sieve and analyzed for some physical and chemical properties Pipette method to determine the particle size distribution as described by Piper (1950). Soluble cations and anions, pH, organic matter, calcium carbonate, electrical conductivity and available N, P and K, Fe, Mn, Zn and Cu were determined as described by Black (1965), Soltanpour and Schwab (1977) and Cotteine *et al* (1982).

Soil physical and chemical properties of the experimental site are presented in Table 1.

Table (1): Physical and chemical properties of the experimental site

Course sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture		O.M (%)		$CaCO_3$ (%)
12.14	72.63	5.14	10.09	Loamy sand		0.56		7.69
pH (1:2:5)	EC (dS/m)	Cations (meq/l)				Anions (meq/l)		
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO^{-}_3	Cl^{-}	SO^{--}_4
8.03	8.63	10.94	17.22	57.29	0.85	4.85	48.92	32.53
Available macronutrients ($mgkg^{-1}$)			Available micronutrients ($mgkg^{-1}$)					
N	P	K	Fe	Mn		Zn		
38.29	4.58	185	2.85	1.93		0.74		

Maize grains of Triple hybrid 310 , supplied by Mize Research Department , Field Crop Res Inst. Agriculture Research Center, Egypt. Sown was at 15 and 18 May in the first and second season, respectively. The experiment design was randomized completely block design with three replicates, the area of each plots was ($10.5m^2$). The studied treatments were:

1-control

2- Humic acid 1.5g/l + *Azospirillum brasilense NO 40*

3-Humic acid 3.0g/l+*Azospirillum brasilense NO 40*

4- Ascorbic acid 1.5g/l + *Azospirillum brasilense NO 40*

5- Ascorbic acid 3.0g/l + *Azospirillum brasilense NO 40*

6- *Azospirillum brasilense* NO 40 alone

Humic acid and Ascorbic acid were applied as foliar fertilization at three times at 21, 45 and 65 days after sowing.

Plant height (cm) , ear length (cm) ,ear diameter (mm), Number of grain /ear, weight of grains /plant,100- grain weight and yield ton/fed , were determined.

For chemical determinations.

Nitrogen percentage was determined in seeds by using microkjeldhal methods and crude protein percentage was estimated in such organ by multiplying N% by 6.25. Phosphorus, potassium percent, Total carbohydrates and some microelements in seeds were determined by using the procedure described by *A.O.A.C. (1990).* The atomic absorption spectrophotometer was used determine Fe, Zn, Mn and Cu concentration according by Cottenie *et al* (1982). Least significant differences test was used for comparing treatments means as described by Barabara and Brain (1994).

RESULTS AND DISCUSSION

Effect of ascorbic acid and humic acid combined with bio-fertilizer on yield and yield components.

Results presented in Table (2) show that the plant height (cm), ear length (cm), ear diameter, number of grains /plant, weight of grains/plant, 100- grains weight and grain yield ton/fed were significantly affected by all treatments. The highest values of Plant height was (202cm)under the application of Ascorbic acid 1.5g/l+*Azospirllim brasilense* followed by(198cm) when Ascorbic acid 3g/l+*Azospirllim brasilense* application compared to control(165cm). El- Kobisy *et al* (2005) stated that Ascorbic acid is synthesized in the higher plants and affected plant growth and development ,it is a product of D-glucose metabolism which affected some nutrition cycles activity in higher plants and play important role in the electron. On the other hand, yield components, the highest values were (19.0; 4.43; 46.3; 204.9; 36.6) for ear length , ear diameter, number of grain /ear, weight of grain/plant, 100-grain weight respectively, under ascorbic acid 1.5g/l + *Azospirllim brasilense* compared with other treatments. the increase of these values attributed to role of ascorbic acid on growth plant, grain yield,and pre sowing seeds coating by Bactrium, (Esitken *et al* 2010) *.* Bakry *et al (*2013*)* indicated that humic acid foliar spray enhanced growth and yield of wheat plant. Dolatabadian *et al (2010)* showed that effect of ascorbic acid on application was significant ear weight, plant height, 100 grain weights and grain yield of maize plant.

On the other hand, the highest values of grains yield 2.114 ton/fed tend to increase in plant treated with ascorbic acid applied at a rate 1.5 (g) combination with bio-fertilizer than the other tested treatments in both seasons. The increase of these values attributed to role of ascorbic acid on growth plant, grain yield, and pre sowing seeds coating by bacteria (*Esitken et al 2010*) , Moreover, the treatment of humic acid at a rate of 1.5 g/l + bio-fertilizer gave 2.058 ton/fed. Ashmaye *et al* (2009) suggested that the inoculation of maize plant seedling with Azospirllum brasilense NO40 tolerant alone or combined with different levels mineral nitrogen fertilizers increased yield and biomass yield. the increase of these values attributed to role of ascorbic acid on growth plant, grain yield,and pre sowing seeds coating by bacterium (*Esitken et al 2010*). The corresponding relative increase of values weight grain yield was 2.29 %; 11.23 % and 11.83 % as affected seed with bio-fertilizer; foliar spray of humic acid and ascorbic acid respectively, compared with control (untreated).

Table (2). Plant height and yield components under different treatments combined analysis for two seasons 2012-2013

Treatment	Plant height (cm)	Length of ear (cm)	Ear diameter / cm	No. of grains /ear	Weight of grains/ Plant (g)	100- grains weight (g)	Yield of grains ton/ Fed
Control	١٦٥.00	١٦.٣0	٤.٠0	٣٦.00	١٤٨.٤0	٢٧.٢0	1.834
Bio-fertilizer	١٨٥.00	١٥.٧0	٤.٢0	٤٢.00	١٨٤.٥0	٣٣.٩0	1.876
HA 1.5 g/L + Bio	١٩٠.00	١٨.٣0	٤.٣0	٣٨. 00	١٨٦.١0	٣٤.٧0	2.058
HA 3.0 g/L + Bio	١٨٥.00	١٨.٧0	٤.٣0	٤٢. 00	١٩٧.٩0	٣٤.٥0	2.030
Mean	187.50	18.50	4.30	40.00	192.00	34.60	2.040
ASA 1.5 mg/L+ Bio	٢٠٢.00	١٩.٠0	٤.٤0	٤٦. 00	٢٠٤.٩0	٣٦.٦0	2.114
ASA 3.0 mg/L+ Bio	١٩٨.00	١٦.٧0	٤.٢0	٤٢. 00	٢٠٠.٣0	٣٤.٨0	2.044
Mean	200.00	17.85	4.30	44.00	202.60	35.70	2.080
Mean general	193.75	18.17	4.30	43.00	200.25	34.25	2.055
LSD. 5 % T*	10.3	0.19	0.11	2.20	10.70	1.10	0.18
C.V**	14.50	16.07	12.33	12.97	18.43	11.98	22.69

* T = treatments ** C. V. = Coefficient Variation

Concerning, that the Data in Table (3) recorded that germination percentage, accelerated ageing germination, mean daily germination (MDG) and shoot and radical length were affected by treatments. Germination is the first step in the plant growth, which is one of the critical stage in the life cycle of plant and it is a key process in germination seed treatment, (De villiers *et al.,* 1994). For germination percentage, the low and high ascorbic acid level with bacterium gave a high germination. The values were (96 and 95%) under the application ascorbic acid at a rate 1.5g/l and 3g/l +*Azospirllim brasilense* respectively, compared to control (88%). While the lowest values were (90%) under *Azospirllim brasilense* alone .These results are in accordance with the finding of (Tavili et al 2009) who reported that ascorbic acid improve germination condition .The relative increase of mean values of Germination (%) was 2.27 %; 4.56 % and 8.52 % as affected by bio-fertilizer; humic acid and ascorbic acid respectively, compared with control. These results are in agreement by Beltagi, (2008) found that ascorbic acid also benefited growth and may be due to the antioxidant activity of ascorbic acid protecting plants from damage due to abiotic stress. *Happ et al (1993)* demonstrated that seedling growth, EC and accelerated ageing test could differentiate seed quality among commercially acceptable perennial ryegrass (Lolium perenne L) seed lots. Also, that high reduction in accelerated aging germination % the lower values were (65%) under humic acid 1.5g/l+*Azospirllim brasilense*, while the best value was (70.0%) under ascorbic acid 1.5g/l followed by (67.0%) under Humic acid 3.0g/l +*Azospirllim brasilense*. *Yoshida (1981)* stated that temperature change the rate of growth but not the efficiency while *Roberts (1981)*found that sever damage to seed during Ageing led to reduced vigor and production of abnormal seedling.For MDG and shoot length, the highest values were 7.8 (%) and 27.5 (cm) under ascorbic acid +*Azospirllim brasilense* compared to control 6.3 (%) and 23.2 (cm) respectively.

Table (3): Gemination and seedling vigor under different treatments combined analysis for two seasons. 2012-2013

Treatments	Germination (%)	Accelerated aging (%)	MDG*	Shoot length (cm)	Radical Length (cm)
Control	٨٨.٠0	٦٣.٠0	٦.٣0	٢٣.٢0	١٧.٦0
Bio-fertilizer	٩٠.٠0	٦٦.٠0	٧.١0	٢٤.٢0	١٨.٦0
HA 1.5 g/L + Bio	٩٢.٠0	٦٥.٠0	٧.٠0	٢٥.٦0	١٩.٢0
HA 3.0 g/L + Bio	٩٣.٠0	٦٧.٠0	٧.٣0	٢٦.٧0	٢٠.٣0
Mean	92.50	66.00	7.15	26.15	19.75
ASA 1.5 mg/L+ Bio	٩٦.٠0	٧٠.٠0	٧.٨0	٢٧.٥0	١٩.٠0
ASA 3.0 mg/L+ Bio	٩٥.٠0	٦٦.٠0	٧.٧0	٢٦.٨0	١٨.٧0
Mean	95.50	68.00	7.75	27.15	18.85
Mean general	94.00	67.00	7.45	26.65	19.30
LSD. 5 %	3.22	1.74	0.23	1.82	1.02
C.V.	1.87	1.46	1.86	1.24	2.43

* MDG= Mean daily germination

Increasing shoot growth with foliar application of ascorbic acid might be due to up regulation of photosynthetic capacity through protecting cell by enhancing SOD activity (*Ahmad et al 2012)* .All foliar sprays increased shoot and root length however maximum shoot length was recorded in plant spray with 40 mg/l ascorbic acid (Ljaz et al 2013 *).* Hamidah and Endang *(2010)* found that 55 mg /l ascorbic acid treatment increased the seedling height, number of leaves and leaf area but no effect on the water deficit and root length. On the other hand, the highest values for radical length were (20.3 and 19.2) under Humic acid 3.0 and 1.5 g/l +*Azospirllim brasilense compared* to control (17.6). The corresponding relative increase of mean values 4.76 %; 4.76 % and 7.93 % for accelerated aging (%) ; 12.70 %; 13.49 % and 23.02% for MDG (%) ; 4.31 % 12.71 % and 17.02 % for shoot length (cm) and 5.68 % ; 12.21 % and 7.10 % for radical length (cm) as affected with bio-fertilizer ; humic acid and ascorbic acid respectively compared with control.

Results in Table (4) show that fresh, dry seedling weight, protein, carbohydrate, oil % and electrical conductivity (EC) for seeds affected by all treatments were significant increase. The highest fresh seedling weights were 3.80 and 3.60 g under ascorbic acid at a rate 1.50 and 3.00 g + *Azospirllium brasilense* compared to control 2.00 g.

Hence, it is assumed that ascorbic and humic acids combined with bio-fertilizer improve fresh and, seedling and seed tolerance to salinity. These results are in agreement by Ahmed *et al* (2012) indicated that ascorbic acid (ASC) influence mitosis and cell growth in plants, affects phyto-hormone-mediated signaling processes during the transition from the vegetative to the reproductive phase as well as the final stage of development and senescence. The beneficial effect of ascorbic and humic acids with bio-fertilizer on protein and carbohydrate content in maize plant increased with treated a rate 1.5 g/l. The positive effect of the humic acid substances was also observed dry mater yield increased on corn seedling (Russo and berlyn 1992). The highest values of dry seedling weight were (0.46 and 0.41)under Humic acid 1.5 and 3.0 g/l followed by (0.39 and 0.38) under ascorbic acid 1.5 and 3.0 g/l compared to control (0.26) respectively

.Humic acid increased fresh and dry weight of crop plants (Chen et al 2004). (Ljaz et al 2012) found that maximum shoot dry weight was produced by crops seed priming with 40ml of Ascorbic acid. Ascorbic acid(vitamine C) is one of the most important water soluble anti oxidates in plant as a modulator of plant development through hormone signaling and as coenzyme in reaction by which carbohydrate ,Fates and protein are metabolized (Pastori et al 2003). For grain protein content the low acids level gave a highest values (13.4 and 13.3 %) under Ascorbic acid 1.5 g/l and Humic acid 1.5 g/l +Azospirllium brasilense respectively, compared to control (11.4). Bakry *et al* (2013) indicated that humic and ascorbic acids acid foliar spray enhanced of protein (%). Price (1966) reported that ascorbic acid increased nucleic acid content, especially RNA and protein content in wheat. On the other hand, the highest values carbohydrate were (76.7, 76.3 and 76.2 %) under humic acid 1.5g/l +*Azospirllium brasilense* alone and ascorbic acid 1.5g/l +*Azospirllium brasilense* respectively. Robinson (1973) reported that Ascorbic acid acts co-enzymatic reaction by which carbohydrate; protein are metabolized and involved in photosynthesis and respiration processes. (Khan et al 2011) reported that foliar spray of ascorbic acid encouraged synthesis of chlorophyll that involved in increased of photosynthetic metabolites, which lead to the accumulation of different fractions of soluble sugars and nitrogen content in plant tissues under saline condition. Or this could perhaps alleviate the inhibitory effect salinity on glucose incorporation to cell well polysaccharides. The highest values of oil percent were (4.9 and 4.8 %) under applied 1.5g/l and 3.0 g/l Ascorbic acid +*Azospirllium brasilense* followed by (4.5 %) under humic acid 30 g/l respectively compared to control (3.5 %). Dolatabadion *et al* (2010) reported that the highest corn oil percentage was achieved from stressed plant while ascorbic acid treatments decreased it .Farahat *et al* (2007)on *cupresses semperviren L.* ,reported that foliar application of ascorbic acid caused pounced increased in vegetative growth and chemical constituents as well as essential oil percent ,oil yield per plant.The lowest values of Electrical conductivity (EC) were (4.0 and 4.1) under ascorbic acid 1.5 and 3.0 g/l +*Azospirllium brasilense* respectively. The lower values of EC (4.1) under ascorbic acid at rate 3g/l +*Azospirllium brasilense* .

Table (4): Fresh and dry seedling, protein and carbohydrate and EC for seeds under different treatments combined analysis for two seasons 2012-2013

Treatments	Fresh seedling weight (g)	Dry seedling weight (g)	Protein (%)	Carbohy-drate (%)	Oil (%)	Electrical Conductivity µscm-1g-1
Control	٢.٠0	٠.٢٦	١١.٤	٧٣.٥	٣.٦	٦.٤
Bio-fertilizer	٢.٤0	٠.٣٥	١٣.٠	٧٦.٣	٤.٣	٤.٩
HA 1.5 g/L + Bio	٢.٥0	٠.٤٦	١٣.٣	٧٥.٦	٤.٢	٤.٤
HA 3.0 g/L + Bio	٢.٦0	٠.٤١	١٣.٠	٧٦.٧	4.5	٤.٦
Mean	2.55	0.44	13.15	76.15	4.33	4.50
ASA 1.5 mg/L+ Bio	٣.٨0	٠.٣٩	١٣.٤	٧٦.٢	٤.٩	٤.٠
ASA 3.0 mg/L+ Bio	٣.٦0	٠.٣٨	١٣.٢	٧٥.٦	٤.٨	٤.١
Mean	3.70	0.39	13.30	75.90	4.85	4.05
Mean general	3.13	0.42	13.22	76.03	4.59	4.28
LSD. 5 %	٠.٢٢	٠.٠١	٠.١٢	٠.١٦	٠.٠١	0.05
C.V.	4٨٤	٥.٢٤	2٥٢.	1١١.	٤.٣٢	5.8

Macro-Micronutrients concentration in maize grains.

Results presented in Table (5) show that the humic and ascorbic acids combined with bio-fertilizer or bio-fertilizer alone increase N and K concentration in maize grains plants. The obtained results in Table (5) revealed that N and K concentration were increased with increasing rate of humic and ascorbic acids , while , the highest increase of P concentration was 0.40 % in maize grain at rate of 1.5 g/l ascorbic acid combined bio-fertilizer while in the case of humic acid combined with bio-fertilizer was 0.38 % at a rate of 3.00 g/l.

The addition of humic and ascorbic acids combined with bio-fertilizer and for bio-fertilizer alone significantly increases N, P and K concentration in grains in both tested seasons. The relative increase of mean values for N, P and K were 3.14 %, 12.57 % and 11.32 for N; 11.76 %, 8.82 % and 14.71 % for P and 21.10 %, 8.97 % and 11.66 % for K as affected by bio-fertilizer; humic acid + bio-fertilizer and Ascorbic acid + bio-fertilizer, respectively, compared with control. It is evident from the distribution patterns of N, P and K concentration in grains of maize; it could be arranged according to their contents in the following orders:

Humic acid > Ascorbic acid > bio-fertilizer > control, for N

Ascorbic acid > bio-fertilizer > humic acid > control, for P and

Bio-fertilizer > Ascorbic acid > humic acid > control, for K, respectively the ascorbic and humic acids combined with bio-fertilizer. Salama (2006) found that application of bio-fertilizer significantly increased the N, P and K content in grain and straw in wheat plant as compared with un inoculated treatment (control).

Results presented in Table (5) show that the micronutrients Fe, Mn , Zn and Cu in maize seeds were affected by bio- fertilizer , humic and ascorbic acids combined with bio-fertilizer and markedly increase. The highest values of Fe and Zn were (261 and 39.5 mg kg^{-1}) as treated by humic acid at a rate of 3g/l and 1.5 g/l combined with bio-fertilizer respectively. The highest values in Mn and Cu were (220.4 and 5.30 mg kg^{-1}) treated with bio-fertilizer alone and Humic acid 1.5g/l + bio-fertilizer respectively. Also, the application of bio-fertilizer, humic and ascorbic acids combined with bio-fertilizer were significantly increased Fe, Mn, Zn and Cu concentration in maize grains respectively. These results are in agreement with Govindasamy and Chandrasekaran (2002) and Shaban and Attia (2009).

Table (5). Effect of studied treatments on macro-micronutrients concentration in grains.

Treatments	Macronutrients (%)			Micronutrients (mg/kg)			
	N	P	K	Fe	Mn	Zn	Cu
Control	1.59	0.34	2.23	254.9	216.4	35.6	4.50
Bio-fertilizer	1.64	0.38	2.70	255.5	220.7	36.2	4.50
HA.1.5 g/l + Bio	1.75	0.35	2.33	257.6	216.3	39.5	5.30
HA. 3.00 g/l +Bio	1.83	0.38	2.53	261.0	211.6	37.9	4.60
Mean	1.79	0.37	2.43	259.30	213.95	38.70	4.95
ASA. 1.5 g/l + Bio	1.74	0.40	2.40	257.9	213.7	37.0	4.70
ASA.3.00 g/l + Bio	1.79	0.37	2.57	259.7	219.7	37.2	4.60
Mean	1.77	0.39	2.49	258.80	216.70	37.10	4.65
Mean genral	1.87	0.38	2.46	258.50	214.80	36.40	4.80
LSD. 5 % T	0.002	0.08	0.004	0.99	0.43	0.74	0.09
C.V	1.25	1.91	0.60	0.21	0.63	0.18	1.06

It could be that maize plant productivity under newly reclaimed saline soil conditions should receive either two foliar applications of ascorbic and humic acid the at rates of 1.5 and 3.00 mg /l combined with bio-fertilizer or bio-fertilizer alone for raising the quantity, yield quality and to increase macro and micronutrients content in maize grains.

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تأثير الرش بحامضى الهيوميك والاسكوربيك مع التلقيح البكتيرى على مكونات المحصول والانبات وقوة البادرة ومحتوى العناصر لحبوب الذرة الشامية تحت ظروف الاراضى الملحية

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الملخص العربى

اجريت تجربة لموسمين زراعيين ٢٠١٢-٢٠١٣ بمنطقة سهل الطيينة شمال سيناء لدراسة تاثير الرش بحامضى الهيوميك والاسكوربيك مع التلقيح البكتيرى على مكونات المحصولوالانبات وقوة البادرات والتحليل الكيماوى لحبوب الذرة الشامية وقد استخدم تركيزين من الحامض ١.٥ و٣.٠ جرام /لتر مع معاملة الحبوب

بالازوسبيريليم قبل الزراعة بمعدل ٤٠٠ جرام لكل ٢كيلو تقاوى واستخدم تصميم القطاعات الكاملةالعشوائية فى ثلاثة مكررات كما استخدم الهجين الثلاثى ٣١٠ من الذرة وقد اوضحت النتائج ان مكونات المحصول ونسبة الانبات وطول الريشة والوزن الاخضر للبادرة قد زاد باستخدام المعاملة الرش بحامض الاسكوربيك ١.٥ حرام /لتر مع الا زوسبيريليم بينما زاد طول الجذير للبادرة باستخدام الرش بحامض الهيوميك ٣.٠ جرام/لتر مع ا لا زوسبيريليم . كما حدث انخفاض كبير فى نسبة الانبات نتيجة لتعرض الحبوب لاختبار الشيخوخة واوضحت النتائج التحسن فى نسبة البروتين فى الحبوب نتيجة للمعاملة بحامضاالاسكوربيك والهيوميك(١.٥ حم/لتر) + ا لا زوسبيريليم كما لوحظ زيادة فى نسبة الزيت نتيجة للمعاملة بحامض الاسكوربيك (١.٥ جم/لتر) + الازوسبيريليم.ووجد ان اضافة الحمضين العضوين متحدين مع التسميد الحيوى ادى الى زيادة تركيزالعناصر الكبرى والصغرى فى حبوب الذرة ومن النتائج السابقة يمكن ان نوصى باستخدام الاحماض العضوية (الا سكوربيك او الهيوميك) متحدين مع الايزوسبرليم للحصول على افضل انتاجية وجودة لمحصول الذرة هجين ثلاثى ٣١٠ تحت ظروف ا لاراضى الملحية بمنطقة شمال سيناء.