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Effects of Silicon and Yeast Extract on Growth, Flowering and Yield of Banana (*Musa cavendishii* L.)

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ABSTRACT

Field experiments were carried out during the two growing seasons of 2014/2015 and 2015/2016 on 1st and 2nd ratoons of Williams banana plants irrigated with saline water and received potassium silicate and/or yeast extract. Growth, flowering as well as yield and fruit quality were evaluated. The data indicated that both materials were very effective in increasing salt tolerance, all growth parameters studied, earliness flowering and maturity, bunch weight and improving fruit quality compared with the control. Yeast extract showed additive effects to the potassium silicate in this respect. Thus, it could be recommended that supplementations of K_2SiO_3 to the saline irrigation water accompanied with spraying yeast extract four times, 4 weeks intervals, from the middle of April induced salt tolerance and productivity of Williams banana plants, irrigated with pumped saline water. Potassium silicate at 3% combined with yeast at 20 g/l gave the best results with regard growth, flowering as well as yield and fruit quality.

Keywords: Yeast extract, potassium silicate, salt tolerance, banana (*Musa cavendishii* L.) Williams cv

INTRODUCTION

Global constraints on fresh water supplies and the need to dispose of agriculture, municipal, and industrial waste waters have intensified interest in water reuse options. The extension of irrigated agriculture and the intensive use of water recourses combined with high evaporation rates in arid and semi arid areas, have drawn attention to the problems of salinity in the soil and in ground water (Hu and Schmidhalter, 2005). Not only uncontrolled irrigation but also poor-quality water may cause salinity problems (Tuna *et al,* 2008). Moreover, in many instances, the value of the water is decreased solely because of its higher salt levels. Therefore many of the irrigation water pumped from the present wells in the reclaimed desert soil in Egypt become salinized due to its expensive and huge utilization. In addition, the limited water resources and the cost of pumping irrigation water are the most important factors that force many farmers to reduce irrigation. Abiotic stress are the main factor negatively affecting crop growth and productivity worldwide. Stress injury depends on several factors like species, cultivar, growth stage and other environmental factors while several physiological processes have been observed to be affected by high salinity (Chen *et al* 2008). Results of most studies have shown that the resistance to stress is usually with a more efficient antioxidant system. Plants posses antioxidant defense system which normally maintain reactive oxygen species (ROS) balance within the cell (Helaly *et al* 2017). Moreover, salinity stress exposes to secondary osmotic stress, which is involved by drought stress and the capacity of crops to tolerant salinity is a key factor in successful crop productivity (Helaly *et al* 2016). Moreover, the relationships between salt stress and mineral nutrition in crops is a complex phenomenon and its complete understanding is essential.

Banana (*Musa sp.*) is an important tropical crops that can tolerance short period of water deficit (Surendar, *et al,* 2013). However, its productivity is greatly affected. Most of the research studies have shown that, the plant growth rate as well as biochemical and physiological processes were directly changed proportional to the availability of water in the soil (Hu and Schmidhalter, 2005). Plants respond survive, and adapt to stress condition at the molecular and cellular levels ranging from photosynthesis to protein synthesis and also solute accumulation (Surendar *et al*, 2013). Salt stress has been shown in some investigation to be mitigated by Si. (Zhu *et al,* 2004). Silicon is the second most abundant elements in the surface of the soil and has not been as essential elements while it has been shown to be beneficial for the plant growth. It has been shown that added Si can increases salinity tolerance as well as improves photosynthetic activity of leaf cells (Liang *et al*, 2007). However, the role of Si in alleviating both environmental (heavy metal and salinity) and biotic (diseases and pests) stresses in some crops has been reported (Zhu *et al,* 2004) Si alleviates salt stress and increases antioxidant enzymes activity in leaves of salt stressed cucumber reflected in reduces the translocation of Na^+ to the shoots and increase dry matter productions (Surendar *et al*, 2013).

On the other hand, good attention has been paid on the possibility of using natural and safety biostimulant substances which are rich sources of phytohormons in order to improve plant growth under stress condition (Mahmoud, *et al*, 2010). Yeast extract as a biostimulants is rich with a mixture of amino acids, peptides, sources of B-complex such as B_1, B_2, B_6, and B_{12}, carbohydrates, sugars, vitamins, enzymes and minerals (Marzouk *et al*, 2014). In this context, In this context, El-shazly and Mustafa (2013) reported that biostimulation like yeast extract are very safe for human, animal and environment to get lower pollution and reduce soil salinity *via* decreases mineral usage fertilization as well as saving fertilization cost. However, the mode of action of biostimulatns is poorly understood and has been variously attributed to hormone composition, presence of plant signaling materials or presence of molecules that responsible for transport and uptake of mineral nutrients (Calvo *et al,* 2014).

Therefore, the objectives of this study are to investigate whether Si and/or yeast extract are involved

in regulation of growth and productivity of banana irrigated with saline water. The experiments were designed to detect the influences of different levels of Si and/or yeast extract on vegetative growth, flowering, yield and fruit quality of banana plants Williams cv hoping to reduce the adverse effect of salted irrigation water.

MATERIALS AND METHODS

Two field experiments were carried out during the growing seasons of 2014/2015 and 2015/2016 on 1st and 2nd ratoons of Williams banana (*Musa Cavendishii* L.). Healthy suckers free from any symptoms of deceases were chosen and planted on the 1st week of July in both seasons at 3x3.5m apart similar as far as possible in sandy soil of a private orchard. It located at El-Khatatba region, Menofia Governorate Egypt 30°23'18.1"N latitude, 30°50'30.8"E longitude and the altitude is 28m above the sea level. Soil samples from surface layer (0-30) were collected from different locations, mixed, analyzed physically and chemically according to Wilde *et al* (1985) and the data are presented in Table 1

Table 1. Certain physical and chemical analyses of the soil used (combined analysis of the two growing seasons).

A-Physical characters			**Soil texture**	**pH (1:5 extract)**	**EC (dSm-1) 1:5 extract)**	**Organic matter%**	**$CaCO_3$%**
Coarse+fine sands%	**Silt %**	**clay %**					
89.7	6.0	4.3	sandy soil	7.7	1.0	0.65	1.15
B-Chemical Characters (1:20 extract)							
Anions meq/ l					Cations meq/ l		
CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+
0	2.1	0.6	2.8	1. 8	0.8	1.8	1.1
Bulk denesty g/cm3 1.55			Moisture content by volume %				
C-Nutrients content		Field Capacity 11.7			Wilting point 4.1		
N%	P%	K%	Zn ppm	Fe ppm	Mn ppm		
0.88	0.25	0.41	0.23	2.5	1.58		

Irrigation available water used in the experiment was pumped from a well, which its have EC value 4.02 EC (dSm^{-1}) and the chemical analysis of it according to A.O.A.C(2000) is given in Table 2.

Table 2. Chemical analysis of the pumped irrigation water

EC (dSm^{-1})	**pH**	**C/N ratio**	**ESP%**	**SAR mg/l**	**Anions meq/ l**			**Cations meq/ l**			
					CO_3^{--}	**HCO_3^-**	**Cl^-**	**$SO4^{--}$**	**Ca^{++}**	**Mg^{++}**	**Na^+**	**K^+**
4.02	8.17	10.9	10.9	5.3	0	1.34	9.93	22.53	2.75	2.24	18.08	1.18

The experimental plants were received the normal horticulture practices as recommended by Agriculture Research Center; (ARC), Egypt except for the treatments examined.

Randomized complete block design was used with 3 replicates (3 hools per each) in both experimental seasons. Each experiment represented a combination treatments, among two doses of potassium silicate and/or 2 levels of yeast extract (YE) in addition to the control. Nitrogen (800g actual N/plant) and potassium (1000g K_2O/plant) were added in the form of ammonium nitrate (33.5%N) and potassium sulphate (48% K_2O) respectively with the irrigation system. They were used 8 times during the vegetative growth period from March to October for each season. Phosphorus (100g P_2O_5/plant) in the form of phosphoric acid 80% 15.5% P_2O_5 and the organic fertilizers (50 m^3/fedden) was added during soil preparation The two doses of potassium silicate (K_2SiO_3 25%Si and 10%K_2O_3) evaluated (1.5 and 3% Si) were added with the regular irrigation pumped water and the pH after their addition was adjusted to 6.9 with H_2SO_4 supplementation.

Yeast extract was obtained commercially as powder from Electro Sciente Company, Egypt which was imported from Lab M. limited company. UK. It prepared by autolysis of *Saccaronyces cerevisiae* which provides amino acids, peptides, vitamins and carbohydrates, making it for many application and the typical analysis as follows:

Appearance: yellow powder. Solubility : Total. Clarity: clear; pale yellow. pH of 2% solution : 7.0±0.2. Total N:10.5±0.5. Amino-N: 5.3±0.5

The chemical analysis of yeast extract in the following was given by Lab M Company:

Total N: 10.5%. Total Amino- N: 5.3 %. Amino N/ total N: 50.4%

Total amino acid assay (mg/g):

Lysine: 49.0, Histidine: 14.0, Arginine: 27,Aspartic acid: 52,0, Theonine: 33, Serine: 34, Glutamic acid: 73, Proline: 26, Glycine: 25, Alanine 51, Gystine: 6, Valine: 37, Methionine: 9, Isolencine: 73, Leucine: 73, Tyrosine: 12, Phenylalanine: 25,and Tryptophane: 9.

The natural yeast extract (YE) was dissolved in distilled water and the tested doses (0,10 and 20g/l) were sprayed four times, 4 weeks intervals, with tween 20 as a wetting agent using atomizer sprayer till dripping. The first application was took place at the middle of April in both seasons.

Data recorded:

1-Vegetative growth parameters and earliness:

At bunch shooting stage, pseudostem height, circumference, number of leaves/plant, were evaluated. Leaf area of the 3rd full expended leaf from the plant top was estimated using the formula of Murry (1960) (leaf area = length x width x 0.86). Assimilation leaf area (ALA) was calculated according to Ibrahium (1993) using the formula: ALA= leaf area x number of leaves/plant.

The period elapsed from emergence to bunch shooting stage (time to flowering) and the period from bunch shooting to date of harvesting in day (time to harvest) were calculated.

2- Yield and its components,

Harvesting was took place in both seasons, when the fingers reached to the full maturation. At harvesting, bunch weight (kg), number of hands /bunch, average hand weight (kg), and average finger weight (g) were estimated.

3- Fruit quality

Physical and chemical parameters of the banana fruits were estimated. These included measurements of length and diameter of finger as well as percentages of pulp/fruit peels, TSS%, Total sugars, Total acidity, (g malic acid/100g pulp) according to A.O.A.C (2000).

Statistical analysis

Data were subjected to analysis of variance for factorial plot design in randomized complete blocks (Snedecor and Cochran 1980). Differences between treatments means were separated by the (New L.S.D) (Waller and Duncan 1969) least significant differences (LSD) test at a 0.05 probability level.

RESULTS AND DISCUSSION

1: Vegetative growth and flowering:

Table 3 shows that treatments of silicon, yeast extract, and their combinations significantly increased pseudostem height, circumference, and number of leaves of Williams banana plants at bunch stage compared to the control. ALA (leaf area x number of leaves/plant) was also increased (data not presented). All increases were a concentration dependent. However, the differences between the two high levels of yeast extract were insignificant. The interaction treatments showed best results in this respect. It recorded at the two highest levels the maximum values of pseudostem height circumference leaf area and number of green leaves. The control plants showed minimum values in this respect.

Table 3. Effect of potaassium silicate,(Si) and/or yeast extract (YE) on pseudostem height (cm), circumference (cm), leaf number and Leaf area (m^2) as well as days till flowering and maturity of Williams banana plants irrigated with saline water and grown during the two growing seasons (2014/2015 and 2015/2016).

Potaassium silicate treatments (%) A	YE g/l B	pseudostem height (cm)		Circumference (cm)		Leaf number		Leaf area (m2)		days till flowering		Maturity	
		2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
0 control	0	205.5	206	70	71	23	23	1.67	1.66	416	413	119	117
	10	218	219	75.9	77	27	28	1.995	1.93	412	400	117	116
	20	220.5	221	78	78	28	29	1.96	1.95	410	407	116	115
	Mean	214.7	215.3	74.63	75.33	26	26.67	1.875	1.85	412.7	406.7	117.3	116
1.5%	0	214	208	73.5	74.8	25	26	1.82	1.83	413	410	118	116
	10	218	219.5	80.8	80.5	28.7	29.8	1.98	1.99	409	407	116	115
	20	219.5	221	81.5	81	29	29	1.97	1.97	407	406	115	113
	Mean	216	216.2	78.6	78.77	27.57	28.27	1.923	1.93	409.7	407.7	116.3	114.7
3%	0	216.5	220	75	75.5	26	27	1.84	1.85	411	408	117	115
	10	224	226.7	84	84.7	30.5	30.8	2.22	2.22	407	405	115	113
	20	226	227.5	84.2	84.8	31	31	2.23	2.24	404	402	113	111
	Mean	222.2	224.7	81.07	81.67	29.17	29.6	2.097	2.103	407.3	405	115	113
overall mean	0	212	211.3	72.83	73.77	24.67	25.33	1.78	1.78	413.3	410.3	118	116
	10	220	221.7	80.23	80.73	28.73	29.53	2.065	2.046	409.3	404	116	114.7
	20	222	223.2	81.23	81.27	29.33	29.67	2.053	2.053	407	405	114.6	113
New LSD at 5% for:													
A		1.21	1.03	0.66	0.39	0.76	0.66	0.07	0.09	3.61	4.33	2.51	3.01
B		2.51	2.66	1.62	1.33	1.66	0.99	0.63	0.51	2.51	1.33	2.01	1.99
AxB		2.99	3.03	1.96	1.66	2.00	1.11	0.51	0.63	3.98	5.11	2.67	3.63

On the other hand, the data in the same table show that treatments of silicon, yeast and their interaction enhanced earliness in blooming and maturity compared to the control. Using both silicon and yeast extract together at the highest level was significantly preferable than using each of them alone on decreasing time of blooming and maturity. Plants treated with silicon at 3% and sprayed with yeast at 20g/l level, bloom earlier by about 20 days compared to the control. These results are in agreement with those obtained by Abd-El- Hamied (2015), Ahmed *et al,* 2013 and Roshdy (2014) and El-Boray *et al*, (2015) on other plant species.

The positive effects of silicon on vegetative growth parameters and plant earliness may be attributed to its role in protecting plants agenest salt stress, alleviating unfavorable condition (biotic and abiotic stress including heavy metals toxicity and others) and improving root development, uptake of water as well as nutrients and plant pigments (Ma *et al,* 2001, Qin and Tain, 2009and Helaly *et al*, (2016).

The stimulating effects of yeast extract on alleviating unfavoring condition (saline irrigation water) and increasing vegetative growth parameters may be due to its essential action on enhancing cell division and elongation. This action may be attributed to its effects on nutrient availability. El-Boray (2015) attributed the promoting effects of yeast as a biostimulats to its content of different minerals, some common amino acids and some natural growth substances. It also contains proteins and large amount of vitamins which play a key role in improving growth, development and controlling stresses productivity healthier plants and

increasing yield and fruit quality (Barakat *et al* 2012). In addition, it was found that application of biostimulats is very effective in improving physiological and biochemical processors in fruit trees. Consequently increasing net photosynthetic rate, and directing trees to flowering and fruiting earlier, and improving fruit quality. Similar results were reported by Mostafa (2015) who mentioned that foliar application of yeast (5-25g/l)on fennel plants irrigated with water have EC 7.12 dSm^{-1} increased plant height, stem diameter, dry weight of the vegetative growth and these traits were increased gradually with increasing yeast levels. He added that yeast at 20 and 25 g/l were most effective for overcoming the negative effects of salinity.

The additive effects of silicon and yeast combination on flowering and maturity (earliness) may be due as reported by Abou El-Yzied and Mady (2012) to their vital balancing between carbohydrate and N favoring flowering. They added that yeast act as natural safety biofertilize and rich source of phytohormones especially cytokinines, sugars, vitamins, enzymes, amino acids and minerals. They added that yeast has stimulating effects on cell division and enlargement, synthesis of protein and nucleic acids as well as chlorophyll formation.

2- Yield and its components

Data in Table 4 show that silicon, yeast extract and their interaction treatments significantly increased bunch and hand weight of Williams banana plants. The increasing effect was a concentration dependent. The highest values were recorded in plants treated with both of silicon and yeast extract together at the high levels (3% Si+20g/l YE) whereas, the lowest values were recorded in the control. Similarly, finger length and its diameter were also increased due to the application of silicon and/or YE.

On the other hand, number of hands/bunch and number of finger/hand (data not presented) was not affected significantly due to silicon and/or yeast extract treatments. Similar results were reported by **Roshdy (2014)** on Grandnaine banana plants treated with Si who reported that the increase on the bunch and hand weight did not correlate with the increase in both number of hands and fingers. He added that such two characters are genetically affected and were associated with the type, done a variety while the increase on the bunch and hand weight with the increase in finger weight. The beneficed effects of silicon and yeast extract on increasing banana yield may be due to their promoting effects on growth in relative to the control (Table 5) and to the nutritional status of the plants surely reflected on improving bunch and hand weights.

Table 4. Effect of potaassium silicate(Si) and/or yeast extract(YE) on bunch weight(kg), number of hands/bunch, average hand weight and average finger weight(g), as well as finger length and its diameter (cm) of Williams banana plants irrigated with saline water and grown during two growing seasons (2014/2015 and 2015/2016).

Potaassium silicate treatments (%) A	YE g/l B	Bunch weght(kg)		Number of hands/bunch		Average hand weight (kg)		Average finger weight(g)		Length of finger (cm)		Diameter of finger (cm)	
		2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
0 control	0	11.6	10.9	8.3	8.7	1.03	1.02	52.5	52.7	12.7	12.9	1.8	1.9
	10	18.2	18.3	11.7	11.3	1.86	1.84	96.8	96.5	19.2	19.3	3	3.1
	20	20.7	20.6	12	12.3	2.25	2.24	102.6	99.5	19.6	19.6	3.1	3.1
	Mean	16.83	16.6	10.67	10.77	1.71	1.7	83.97	82.9	17.17	17.27	2.63	2.7
1.5%	0	17.3	17.1	10.7	11	1.82	1.8	93.7	91.8	18.9	19.1	2.9	3
	10	19.3	19.2	12.3	12	2.18	2.1	108.6	107.5	19.7	19.8	3.2	3.3
	20	23.5	22.6	13	13.7	2.25	2.18	112.5	112	20.1	20.2	3.4	3.4
	Mean	20.033	19.63	12	12.23	2.08	2.03	104.93	103.77	19.57	19.7	3.177	3.23
3%	0	18.1	18	11	11	1.96	1.94	97.8	96.5	19.1	19.3	3.1	3.2
	10	23.2	23.2	12.7	11.33	2.35	2.28	116.8	115.2	20	20.1	3.3	3.3
	20	25.2	25	13	11.3	2.52	2.5	118.6	117.5	20.3	20.4	3.5	3.6
	Mean	22.17	22.07	12.23	11.21	2.28	2.24	111.07	109.73	19.8	19.93	3.3	3.36
overall mean	0	15.67	15.33	10	10.23	1.60	1.59	81.33	80.33	16.9	17.1	2.6	2.7
	10	20.23	20.23	12.23	11.54	2.13	2.07	107.4	106.4	19.63	19.73	3.17	3.23
	20	23.13	22.73	12.67	12.43	2.34	2.31	111.23	109.67	20	20.07	3.33	3.37
New LSD at 5% for:													
A		1.11	1.36	0.66	0.96	0.31	0.26	2.70	3.60	1.66	1.33	0.27	0.19
B		2.76	2.50	0.53	0.99	0.21	0.27	2.97	3.33	1.50	1.60	0.25	0.17
AxB		2.90	2.96	NS	NS	0.42	0.31	3.06	4.33	1.96	1.90	0.76	1.10

The interaction treatments indicated that using silicon at the level of 3% together with yeast extract 20g/l was significantly superior than using either of them alone in improving weight of bunch under the same condition. Thus, it should be recommended to use both substances at the level of 2mM Si+20g/l yeast to alleviate salt stress in banana.

Improving growth and productivity of different plant species by application of either Si or yeast extract were recorded with different investigators. El-Boray *et al*, (2015) on orange reported that the positive effects and benefits of applying yeast extract as a natural biofertilizers were attributed to its own different nutrients, greater amounts of vitamins and cytokinins as natural plant hormones. They added that it is very effective as shown with orange in releasing carbon dioxide as well as stimulating photosynthesis, yield and fruit quality physically and chemically.

3- Fruit quality

Tables 4 and 5 show that silicon and/or yeast extract each at both levels significantly increased fruit quality physically and chemically represented by weight, length and diameter of finger (Table 4), total soluble solids (TSS) and total sugar (T.S) whereas decreasing both fruit pulp/peel% and total acidity (Table 5) compared to the control. However, using yeast extract was significantly favorable than using silicon in

this respect. In addition, using both silicon supplemented with yeast at the levels of surpassed the application of each of them alone and the increase was a concentration dependent. Therefore, the best treatments for fruit quality in banana plants irrigated with pumped saline water were achieved with silicon interacted with yeast each at the highest level during both growing seasons.

The beneficial effects of silicon on protecting the plants from unfavorable condition during maturity surely reflected an improving fruit quality (Ma *et al*, 2001). The promoting effect of Si on fruit quality was emphasized by the results of Al-Wasfy (2013) on date palm. The high own content of yeast extract from nutrients as well as amino acids, vitamins and phytohormones surely reflected on enhancing the biosyntheses of pigments and total carbohydrates consequently advancing fruit quality (Soliman *et al* 2000). These results are in agreement with those reported by El-Shazly and Mustafa (2013) and El-Boray *et al* (2015) with Neval orange who reported that active dry yeast caused a significant increases in T.S. and vitamin C content of fruits. Similarly Abd El-Hamid (2014) on sukkary mango trees recorded a positive role of yeast extract as a biostmulates an increasing, total and non-reducing sugar.

Table 5. Effect of potaassium silicate(Si) and/or yeast extract(YE) on % of pulp/fruit peels, total soluble solids (TSS)%, Total sugars (TS) % and Total acidity (mg malic acid/100g pulp) of Williams banana plants irrigated with saline water and grown during the two growing seasons (2014/2015 and 2015/2016).

Potaassium silicate treatments (%) A	YE g/l B	Fruit pulp / peels %		Total soluble solids %		Total sugars %		Total acidity g malic acid/100g pulp	
		2014 /2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016
0 control	0	1.86	1.83	17.8	17.7	15.2	15.1	0.354	0.358
	10	1.97	1.98	18.4	18.2	16.3	16.1	0.315	0.311
	20	2.35	2.37	18.7	18.6	16.6	16.3	0.286	0.282
	Mean	2.06	2.06	18.3	18.17	16.03	16.03	0.32	0.317
1.5 %	0	1.92	1.93	18.1	18	16.2	16	0.325	0.328
	10	2.46	2.49	18.9	18.7	16.8	16.6	0.292	0.287
	20	2.65	2.68	19.7	19.6	17	16.8	0.246	0.243
	Mean	2.34	2.37	18.9	18.77	16.67	18.77	16.67	16.47
3 %	0	2.1	2.3	18.6	18.3	16.6	16.4	0.294	0.298
	10	2.75	2.77	19.8	19.6	17.2	17	0.221	0.217
	20	2.96	2.97	20.1	20	17.4	17.1	0.206	0.202
	Mean	2.603	2.68	19.5	19.3	17.07	16.83	0.24	0.239
overall mean	0	1.96	2.02	18.16	18	16	15.83	0.32	0.328
	10	2.39	2.41	19.03	18.83	16.77	16.56	0.28	0.27
	20	2.65	2.67	19.5	19.4	17	16.73	0.246	0.242
New LSD at 5% for:									
A		00.63	0.51	0.02	0.13	0.11	0.11	0.011	0.009
B		0.21	0.26	0.11	0.16	0.14	0.16	0.009	0.008
AxB		0.96	0.89	0.31	0.21	0.22	0.22	0.025	0.012

It could be recommended for increasing yield and fruit quality of banana Williams cv. irrigation with saline water up to 4.02dSm^{-1} (Table 2) to use both potassium silicate and yeast extract together each at 3% and 20g/l respectively.

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تأثير اضافة السيليكون ومستخلص الخميرة على النمو والإزهار والمحصول لنباتات الموز صنف ويليامز

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أجريت تجربتين حقليتين خلال موسمى الزراعة ٢٠١٤/٢٠١٥ و ٢٠١٥/٢٠١٦ على الخلفات الأولى و الثانية من نباتات الموزصنف ويليامز و المروية بماء بئر مالح (EC (dSm^{-1})=4.02) مع اضافة سيليكات البوتاسيوم مع او بدون مستخلص الخميرة بتركيزات متباينة.(٠و١٠ و ٢٠ جم /لتر) و قد تم تقييم صفات النمو والازهار وكذلك المحصول وجودة الثمار. و أوضحت النتائج أن كلا المادتين كانتا فعالتين جدا في زيادة تحمل النبات للاجهاد الملحى بالاضافة الى تحسين جميع خصائص النمو المدروسة، و أفادت كثيرا فى التبكير فى الازهار والنضج، مع زيادة المحصول متمثلا فى وزن السوباطة وتحسين جودة الثمار مقارنة بالكنترول. كما أوضحت النتائج أن مستخلص الخميرة سبب تأثيرات إضافية لما سببته سيليكات البوتاسيوم في تحسين هذه الصفات. ولذا توصى الدراسة باءضافة سليكات البوناسيوم لمياه الري المالحة مع الرش بمستخلص الخميرة أربع مرات كل أربعة أسابيع ، بدءا من منتصف أبريل و ذلك لدفع نباتات الموز لتحمل ملوحة ماء الرى. و كانت افضل النتائج هى استخدام سيليكات البوتاسيوم عند ٢مللى مول جنبا إلى جنب مع مستخلص الخميرة عند ٢٠ غرام / لتر فقد حسنت هذه المعاملة من صفات النمو و أسرعت من الازهار و النضج فضلا عن تأثيراتهما فى زيادة المحصول و تحسين جودة الثمار.