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EFFECT OF SILICON, GLUTAMIC ACID AND SELENIUM ON THE YIELD OF WILLIAMS BANANA CV. AND ITS COMPONENT.

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ABSTRACT

The present study was carried out during the two seasons 2015/2016 and 2016/2017 in Minia governorate to study the effect of silicon, selenium and glutamic acid on the yield of Williams banana CV. and its physical and chemical properties. Four sprays was annually added to Williams banana plants from silicon (250ppm or 500ppm), glutamic acid (50ppm or 100ppm) and selenium (50ppm or 100ppm). The results indicated that all treatments were effective in increasing the yield than the control. Glutamic acid was more effective in this connection than silicon or selenium. The combination of treatments was in most cases more effective than using any of these chemicals solely. Moreover, all treatments with only few treatments improved the fruit quality in the two experimental seasons.

INTRODUCTION

Several investigators reported that silicon, glutamic acid and selenium were of positive effect on the yield of different plants. Moreover, they also improved the physical and chemicals properties of the fruits. Gad El-Kareem (2012) found that spraying of Timor mango trees three times at growth start, just after fruit setting and at one month later with potassium silicate at 0.1% was very effective in improving the yield and fruit quality (T.S.S. and sugars) over the check treatment. Fathallah (2013) showed that spraying kite and Tommy Atkins mango trees with amino acids (tryptophan, methionine and arginine) at 0.05% was accompanied with improving yield, fruit weight, T.S.S. and total sugars and reducing total acidity over the check treatment. Haggag – leila *et al*. (2013), Ahmed *et al*. (2013_a) and Hassan (2014) indicated that spraying amino acids namely tryptophan, methionine and arginine were responsible for increasing yield, bunch weight, fruit weight, T.S.S. % and total sugars. Gad-El-kareem *et al*. (2014) found that zaghloul date palms

received four sprays of selenium (Se) at 0.01 to 0.02% was very effective in enhancing the yield, bunch weight as well as physical and chemical characteristics of the fruits in compared to the check treatment. Ibrahiem and Al-Wasfy (2014) carried out four sprays of boric acid at 0.05%, potassium sulphate at 0.5%, potassium silicate at 0.1% and sodium selenite at 50 ppm was accompanied with enhancing both physical and chemical characteristics of the fruits of Valencia orange trees relative to the check treatment. Roshdy (2014) demonstrated that spraying of Grandnaine banana plants with potassium silicate at 0.05 % and 0.1 % concentration increase bunch weight and physical and chemical characteristics. Sayed-ola (2014) stated that spraying of El-Saidy date palms three times with the three amino acids namely (tryptophan, methionine and arginine) enriched with N, P, K, Mg, Zn, Fe, B and Mn at 0.1 % effectively maximized the yield, bunch weight. Furthermore, improved both physical and chemical characteristics of fruits rather than non-application. Ravishankar and jagadeesh (2016) showed that silicon increased bunch weight and had positive role on the quality parameters such as total sugars, acidity, total soluble solids and starch content of the fruits of banana cv. Neypoovan. Recently, Helaly and Hanan (2017) demonstrated that potassium silicate 3% increased bunch weight and improved fruit quality of Williams banana cv.

Several authors showed that selenium used either separately or combined with other amino acids positively increased the yield per plant. At the same time improved the physical and chemical properties of the fruits.

This investigation aimed to study the effect of silicon, glutamic acids and selenium on the yield and its quality of Williams banana cv.

MATERIALS AND METHODS

The present study was carried out in 2015/2016 and 2016/2017 seasons on Williams banana cv. grown under Minia Governorate conditions to investigate the effect of silicon, glutamic acids and selenium on the yield and its components.

For achieving the above goal thirty three ratoons each with three plants were selected and devoted for this study. The experiment was designed in complete Randomized block design (C.R.B.D).

Eleven treatments were carried out as follows:-

- control
- potassium silicate at 250 ppm
- potassium silicate at 500 ppm
- glutamic acid at 50 ppm
- glutamic acid at 100 ppm
- selenium at 50 ppm
- selenium at 100 ppm
- Potassium silicate(250) ppm plus glutamic acid (50) ppm
- Potassium silicate (250) ppm plus selenium (50) ppm
- Selenium (50) ppm plus glutamic acid (50) ppm
- Potassium silicate (250) ppm plus selenium (50) ppm plus glutamic acid (50) ppm

Spraying of the above treatments was carried out four

times per year at mid of April, May, June and July. Each treatment contained three replicates of stool per each.

At the end of the experimental season the following parameters were estimated on ripened fruits (bunch weight, number of hands per bunch, hand weight, number of fingers per hand, finger weight and finger dimensions). In addition the chemical parameters including total soluble solids acidity, and reducing sugars were estimated according to Lane and Eynone volumetric method as outlined in A.O.A.C (2000).

The yield data were tabulated and statistical analysis was done according to Snedecore and Cochran (2011).

RESULTS AND DISCUSSIONS

1- Effect of potassium silicate, glutamic acid and selenium on the bunch weight and number of hands per bunch of Williams banana cv. during 2015/2016 and 2016/2017 seasons.

The data presented in Table (1) showed the effect of potassium silicate, glutamic acid and selenium on bunch weight and number of hands per bunch of Williams banana cv.

Results indicated that all treatments were of positive effect in increasing the bunch weight of Williams banana cv. during the two experimental seasons over the control. This difference was statistically assured. Results also showed that Williams banana plants sprayed with glutamic acid either at 50 or 100 ppm had presented the heaviest bunch weight in the two experimental seasons. The difference between them was statistically significant. The highest bunch weight was due to spraying Williams banana plants with glutamic acid at 50 ppm plus selenium at 50 ppm. The above treatment showed highly significant effect compared with the other treatments including the control in both seasons of the study.

The effect of glutamic acid, selenium and k-silicate in increasing bunch weight of Williams banana cv. might be attributed to their effect in enhancing the biosynthesis of carbohydrates and proteins. at the same time maintaining plant water balance, photosynthetic activity, erectness of leaves and structure of xylem vessels under high transpiration rates.

These results are in agreement with those of Brian and Peter (2007), Mateja et al. (2007), Mateja and Vekoslava (2007), Balakhnina and Borkowska (2013), Rejane and Guillaume (2014), Apolonia et al.(2015) and Meetu and Shikha (2017).

Concerning the effect of the treatments on number of hands per bunch results in the same Table (1) didn't show any significant difference between any treatment and the control.

These results are in agreement with those of Haggag-Leila et al. (2013), Ahmed et al (2014a), Hassan (2014), Helaly and Hanan (2017). Results are also in agreement with the finding of Helaly and Hanan (2017) who demonstrated that k-silicate 3%increased bunch weight and

improved fruit quality of Williams banana Cv.

2- Effect of k-silicate, glutamic acid and selenium on the hand weight, number of fingers per hand and finger weight of Williams banana cv. during 2015/2016 and 2016/2017 seasons.

Results in Table (2) indicated that k-silicate didn't show any significant effect on the hand weight, only in the first experimental season. Results in the same table showed that glutamic acid at 50 or 100 ppm was more effective than potassium silicate and selenium concerning their effect on hand weight of Williams banana. Combination treatments seems to be more effective than any other treatment except those treated with glutamic acid concerning their effect on hand weight in the two experimental seasons.

Regarding to the effect of different treatments on the number of fingers per hand in Williams banana results in the same table showed that the most treatments were of positive effect in increasing the number of fingers per hand. The combination treatments and the glutamic acid either at 50 or 100 ppm were of more superior than any other treatment in this respect.

Concerning finger weight most treatments increased the finger weight as compared with the control. Combination treatments represented the highest weight of finger in the two experimental seasons. The increase in hand weight, number of fingers per hand and finger weight due to the different treatments explain their influence on increasing the bunch weight.

The present results are confirmed by the results of Fathalla (2013), Roshdy (2014) and Sayed – ola (2014).

3- Effect of k-silicate, glutamic acid and selenium on the finger length and finger diameter of Williams banana Cv. during 2015/2016 and 2016/2017 seasons.

It's clear from the results in the Table (3) that k-silicate at 250 or 500 ppm didn't affect the finger length of Williams banana in the first and second experimental seasons. The rest of treatments significantly affected the Williams banana finger length than the control. Spraying with glutamic acid and the combination between it and selenium each at 50 ppm were more superior than the other treatments in this concern. Similar results could be noticed concerning the effect of the different treatments on finger diameter. Results also showed that k-silicate was also of positive influence in increasing finger diameter than the control.

The present results are in harmony with the findings of Roshdy (2014), Ravishankar and jagadeesh (2016).

4- Effect of k-silicate, glutamic acid and selenium on the total soluble solids%, total acidity % and reducing sugars % of Williams banana cv. during 2015/2016 and 2016/2017 seasons.

The effect of k-silicate, glutamic acid and selenium on the T.S.S. %, total acidity % and reducing sugars % are shown in Table (4).

Table (1): Effect of K-Silicate, Glutamic acid and Selenium as well as their combinations on the bunch weight (kg) and number of hands per bunch of Williams bananas cv. in 2015/2016 and 2016/2017, seasons.

Treatments	Bunch weight (kg)		No. of hands per bunch	
	2015/2016	2016/2017	2015/2016	2016/2017
Control	22.6	23.1	10.0	11.0
K-Silicate at 250 ppm	23.8	25.7	11.0	11.0
K-Silicate at 500 ppm	24.7	25.4	11.0	11.0
Glutamic acid at 50 ppm	29.9	30.1	11.0	11.0
Glutamic acid at 100 ppm	30.2	29.0	11.0	11.0
Selenium at 50 ppm	26.5	27.3	11.0	11.0
Selenium at 100 ppm	28.9	28.4	11.0	11.0
K-Silicate at 250 ppm + Glutamic at 50 ppm	30.4	31.3	11.0	11.0
K-Silicate at 250 ppm + Selenium at 50 ppm	27.8	31.5	11.0	11.0
Selenium at 50 ppm + Glutamic at 50 ppm	31.1	32.0	11.0	11.0
K-Silicate at 250 ppm + Selenium at 50 ppm+ Glutamic at 50 ppm	30.5	31.7	11.0	11.0
L.S.D. 5 %	0.3	0.9	NS	NS

*N = Not significant ($p > 0.05$)

Table (2): Effect of K-Silicate, Glutamic acid and Selenium as well as their combinations on hand weight (kg), Number of fingers per hand and Finger weight of Williams bananas cv. in 2015/2016 and 2016/2017, seasons.

Treatments	Hand weight (kg)		No. of fingers per hand		Finger weight	
	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017
Control	1.8	1.8	16.0	17.0	107.0	104.0
K-Silicate at 250 ppm	1.9	1.9	17.0	16.0	114.0	112.0
K-Silicate at 500 ppm	1.8	2.0	17.0	17.0	106.0	113.0
Glutamic acid at 50 ppm	2.4	2.4	18.0	18.0	130.0	133.0
Glutamic acid at 100 ppm	2.4	2.4	19.0	19.0	129.0	121.0
Selenium at 50 ppm	2.1	2.0	16.0	17.0	126.0	114.0
Selenium at 100 ppm	2.1	2.4	17.0	18.0	120.0	129.0
K-Silicate at 250 ppm + Glutamic at 50 ppm	2.4	2.3	19.0	19.0	126.0	120.0
K-Silicate at 250 ppm + Selenium at 50 ppm	2.4	2.5	19.0	19.0	129.0	128.0
Selenium at 50 ppm + Glutamic at 50 ppm	2.5	2.7	19.0	19.0	136.0	140.0
K-Silicate at 250 ppm + Selenium at 50 ppm+ Glutamic at 50 ppm	2.4	2.5	18.0	18.0	130.0	136.0
L.S.D. 5 %	0.23	0.1	1.0	1.2	11.8	12.9

Table (3): Effect of K-Silicate, Glutamic acid and Selenium as well as their combinations on Finger length (cm) and Finger diameter (cm) of Williams bananas cv. in 2015/2016 and 2016/2017, seasons.

Treatments	Finger length (cm)		Finger diameter (cm)	
	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017
Control	16.7	15.5	3.3	2.9
K-Silicate at 250 ppm	17.0	16.6	3.5	3.5
K-Silicate at 500 ppm	16.8	16.6	3.3	3.5
Glutamic acid at 50 ppm	17.8	19.6	3.9	3.8
Glutamic acid at 100 ppm	17.7	17.8	3.9	3.7
Selenium at 50 ppm	17.4	16.7	3.6	3.5
Selenium at 100 ppm	17.1	19.0	3.7	3.8
K-Silicate at 250 ppm + Glutamic at 50 ppm	17.4	17.6	3.7	3.8
K-Silicate at 250 ppm + Selenium at 50 ppm	17.6	18.7	3.8	3.8
Selenium at 50 ppm + Glutamic at 50 ppm	17.8	20.0	4.0	4.0
K-Silicate at 250 ppm + Selenium at 50 ppm+ Glutamic at 50 ppm	17.6	20.3	3.9	4.0
L.S.D. 5 %	0.4	1.7	0.2	0.3

Table (4): Effect of K-Silicate, Glutamic acid and Selenium as well as their combinations on percentages of T.S.S., percentages of total acidity and reducing sugars of Williams bananas cv. in 2015/2016 and 2016/2017, seasons.

Treatments	T.S.S. %		Total acidity %		Reducing sugars	
	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017	2015/ 2016	2016/ 2017
Control	17.1	17.3	0.381	0.380	5.4	5.3
K-Silicate at 250 ppm	17.4	17.8	0.317	0.317	5.7	5.9
K-Silicate at 500 ppm	19.0	19.1	0.315	0.301	5.9	6.1
Glutamic acid at 50 ppm	21.2	21.1	0.250	0.153	7.0	6.8
Glutamic acid at 100 ppm	21.4	22.2	0.241	0.238	7.2	7.6
Selenium at 50 ppm	19.5	20.2	0.287	0.175	6.2	6.2
Selenium at 100 ppm	20.0	20.4	0.172	0.173	6.2	6.3
K-Silicate at 250 ppm + Glutamic at 50 ppm	21.3	21.7	0.180	0.173	6.6	6.4
K-Silicate at 250 ppm + Selenium at 50 ppm	19.8	20.1	0.293	0.288	6.2	6.2
Selenium at 50 ppm + Glutamic at 50 ppm	22.0	22.8	0.225	0.253	7.6	7.6
K-Silicate at 250 ppm + Selenium at 50 ppm+ Glutamic at 50 ppm	22.1	22.7	0.215	0.255	7.1	7.4
L.S.D. 5 %	0.9	0.8	0.010	0.014	0.5	0.3

Data showed that all treatments were of more T.S.S than the control in the two season of the experiment with only one exception (k-silicate at 250 ppm).The highest T.S.S. was of those treated by glutamic acid at 50 or 100 ppm. The treatment of selenium plus glutamic acid each at 50 ppm. represented the previous results. The vice versa was existed concerning the effect of the different treatments on total acidity. It means that as total soluble solids increased as the total acidity decreased. Data in the same table (4) also declared that reducing sugars of the pulp took the same trend of T.S.S. in each season.

The present results are in agreement with those of Haggag-Leila *et al*. (2013), Ahmed *et al*. (2014a), Hassan (2014), Roshdy (2014), Ravishankar and Jagadeesh (2016) and Helaly and Hanan (2017).

As a conclusion and on the light of the present results one can state that spraying Williams banana cv. with glutamic acid at 50 or 100 ppm. or the combination between glutamic acid and selenium at 50 ppm. gave the best results concerning their effect on the yield of Williams banana cv. and its quality.

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تأثير السيلكون وحمض الجلوتاميك والسيلينيوم علي المحصول وجوده الثمار في الموز الوليامز

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اجريت هذه الدراسه خلال موسمي 2016/2015م و 2016/م2017 وذلك لدراسه تأثير السيليكون وحمض الجلوتاميك والسيلينيوم علي انتاجيه الموز الوليامز وصفات الجوده في ثماره.لتحقيق هذا الغرض تم اختيار مزرعه موز وليامز في قريه الجنديه مركز بني مزار محافظه المنيا ولقد اجريت التجربه علي الخلفات الثالثة والرابعة حيث تم اختيار 33 جورة تحتوي كل منها علي ثلاث نباتات وقد تم تصميم التجربة بقطاعات الكاملة العشوائية وتم اجراء احدي عشرة معاملة علي النحو التالي :-

- الكنترول
- الرش بسليكات البوتاسيوم بتركيزي 250–500 جزء في المليون
- الرش بحامض الجلوتاميك بتركيز 50–100 جزء في المليون
- الرش بالسلينيوم بتركيز 50–100 جزء في المليون
- الرش بسليكات البوتاسيوم بتركيز 250 جزء في المليون + حمض الجلوتاميك 50 جزء في المليون
- الرش بسيليكات البوتاسيوم 250 جزء في المليون + السيلينيوم 50 جزء في المليون
- الرش بالسيلينيوم والجلوتاميك كل منهما بتركيز 50 جزء في المليون
- الرش بسليكات البوتاسيوم بتركيز 250 جزء في المليون + السيلينيوم والجلوتاميك كل منهما بتركيز 50 جزء في المليون.

وكان يتم الرش 4 مرات سنويا في منتصف (ابريل–مايو–يونيو–يوليو).وفي نهايه الموسم بعد اجراء الانضاج الصناعي للثمار تم تقدير القياسات التاليه:-

وزن السوباطة – عدد الكفوف في السوباطه – وزن الكف – عدد الاصابع في الكف – وزن الاصبع – ابعاد الاصبع – المواد الصلبه الذائبه الكليه – النسبه المئويه للحموضه – النسبه المئويه للسكريات المختزله . وكانت اهم النتائج كالتالي :-

- ادت جميع المعاملات الي زياده معنويه في وزن السوباطه وذلك بالمقارنه بالكنترول وكانت افضل النتائج المتحصل عليها في هذا الصدد ناتجه عن رش نباتات الوليامز بحامض الجلوتاميك سواء بتركيز 50 او 100 جزء في المليون كما ادي رش النباتات بالسلينيوم والجلوتاميك معا كل بتركيز 50 جزء في المليون الي الحصول علي أعلي وزن للسوباطات.
- لم تكن للمعاملات المختلفه اي تأثير معنوي علي عدد الاصابع في السوباطه.

- وجد ان وزن الكف وعدد الاصابع في الكف ووزن الاصبع يتأثر معنويا بالرش بأي من المواد المستخدمة تحت الدراسه وكان أكثرهم فاعليه في هذا الصدد تلك التي رشت نباتاتها بالسلينيوم والجلوتاميك كل بتركيز 50 جزء في المليون.
- في معظم الحالات تأثر كل من طول الاصبع وقطره تأثيرا معنويا بالرش بالمواد السابق ذكرها.
- كان لجميع المعاملات تأثيرا إيجابيا علي جوده الثمار وذلك نتيجه زياده المواد الصلبه الذائبه الكليه والنسبه المئويه للسكريات المختزله وتقليل النسبه المئويه للحموضه.

التوصية

علي ضوء النتائج السابقه فإنه لزياده كميه محصول الموز الوليامز وتحسين خصائصه فإنه يوصي برش حامض الجلوتاميك بتركيز 50 او 100 جزء في المليون أو رش النباتات بالسيلينيوم والجلوتاميك كل منهم بتركيز 50 جزء في المليون.