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Effect of Different Potassium Fertilizer Sources and Antioxidant Application on Vegetative Growth, Nutrient Status and Fruiting of Balady Mandarin Trees.

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Abstract

This study was carried out in the experimental orchard, Faculty of Agriculture, Assiut University, Egypt, to study the influence of organic and spraying K fertilizers and antioxidant on growth vigour and fruiting of Balady Mandarin trees during three successive seasons. Results indicated that Citrine spraying had improved the shoot and leaf traits and yield compared to untreated one. Using Vinasse as a potassium fertilizer was effective in improving the shoot and leaf traits and yield components compared to fertilization by potassium sulphate (check treatment). All combinations of used Vinasse spraying on the Citrine treated trees results in a significant increased in shoot length and leaf area as well as fruit retention and yield/trees. No significant influence was detected on fruit quality except V.C due to using Citrine spraying compared to unsprayed ones. Fertilization by Vinasse gave the best values of fruit weight and its chemical properties, whereas, using potassien spraying unsignificant affected on these traits compared to the Fertilization by potassium sulphate. It is evident from the foregoing results that using Vinasse as a source for potassium Fertilization improved the vegetative growth and yield of Balady Mandarin trees, as will as fruit quality. In addition it minimized the production costs and environmental pollution.

Key words: citrine, environmental pol-
lution, fruit quality, Organic, vinasse, yield.

Introduction

Citrus is one of the most important cash crops all over the world, especially in U.S.A. and warm temperature regions. It is well known that the largest fruit trees area in Egypt, citrus is considered among the principal and strategic fruit crops. Mandarin ranks second crop after oranges in Egyptian citrus industry. It is considered the most popular citrus fruits owing to its nutritive value and is easy to peel. Fertilization is one of the important management tools in increasing crop yield. Trees may have the problem of low productivity due to the suffering of some macro

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and micro nutrients deficiencies.

Using micronutrients significantly increased final yield through increasing efficiency of fruiting, also this treatment improved physical and chemical fruit properties as well as nutrient status of trees (Abdel-Migeed, 1996; El-Saida, 1996; Dawood *et al.*, 2000; El-Baz, 2003; Abd-Allah, 2006; Hafez-Omaima and El-Metwally, 2007).

Potassium is a macro nutrient plays a great regulatory role in many physiological and biochemical processes of plant. It is important in the formation and function of proteins, fats, carbohydrates and chlorophyll and maintaining the balance of salts and water in plant cells (Achilea, 1998). The rate of weathering and dissolution reaction releasing K from the add mineral particles are influenced by soil pH, temperature, moisture and biological activity and by the reactive surface of the mineral particles (Lasage, 1995). So, there are increasing interest and demand for organic, bio and slow releasing-K sources for both conventional and organic forming. Vinasse has high levels of potassium, calcium and organic matter in its chemical composition as well as moderate amounts of nitrogen and phosphorus and could be represent an alternative to supply such nutrients in crop production while alleviating environmental pollution (Gomez and Rodriguez, 2000). Application of vinasse significantly increased the sugarcane, wheat, pigeon, pea and maize yield as well as N, P, K, S and Ca uptake, however, the predominant effect was mainly to K and S (Korndorfer and Anderson, 1993). Using vinasse was more effective in improving the vigour, nutritional status and berry quality of grapevines (Hussein, Maha, 2008). Application of potassium increased mineral contents and crop yield, as well as improved fruit quality (Ibraheim *et al.*, 1993; Achilea, 1998; EL-Safty *et al.*, 1998; Wei *et al.*, 2002; Hafez, Omaima and El-Metwally, 2007 and Ali, 2010).

So, the present study aims to throw light on the beneficial effect of using foliar spray of citrine, vinasse and potassien on vegetative growth, tree nutritional status, yield and fruit quality of Balady mandarin orchards.

Material and Methods

This study was carried out during 2008 to 2010 seasons on 40 years old Balady mandarin trees budded on sour orange rootstock and planted 5x5 m apart. They grown on the Experimental Orchard of Faculty of Agriculture, Assiut University, Egypt, where the texture of soil is clay (Table 1). The experiment, which included two factors, was set a completely randomized block design in split plot arrangement with four replicates, one trees each (24 trees). The two factors involved this experiment and their level were arranged in the experimental plots as follows:

Table (1): Some physical and chemical properties of the used soil.

Soil property	Value*	Soil property	Value*	Soil property	Value*
Sand %	20.21	EC (dSm^{-1})	2.26	NH_4OAC-extractale K (ppm)	332.23
Silt %	31.60	$CaCO_3$ %	3.66	DTPA-extractable Fe (ppm)	25.74
Clay	48.19	Organic matter	1.16	„ „ Mn (ppm)	20.31
Texture	Clay	Total N %	0.14	„ „ Zn (ppm)	4.19
pH (1:2.5)	8.06	Na HCO_3 + extractable P (ppm)	18.22	„ „ Cu (ppm)	3.81

- Each sample represents the mean of three replicates.

The first factor (A) which occupied the main plots comprised from the following two citrine, as antioxidants and micro nutrient complex treatments

A1- spraying citrine (citric acid plus chelated Zn, Fe and Mn each at 2%) at 0.5% twice at pre-flowering and fruit setting.

A2- Control (water spraying) and Triton B as wetting agent was added.

The second factor (B) which occupied the sub-plots consisted from the following three potassium treatments.

B1- Potassium sulphate (48% K_2O) 1000 g/tree as soil dressing in two equal batches on the first week of March and August.

B2- spraying Vinasse (2.02% K_2O) at 10%.

B3- Spraying Potassien (30% K_2O) at 0.7%.

Therefore the experiment included six treatments, each treatment was replicated four time, one tree per each. All solutions of citrine, vinasse and potassien were water based. Both vinasse and potassien were applied three times on mid of March, June and August, where solutions sprays were done till runoff (10 L/tree).

Other horticulture practices were carried out as usual. The following parameters were measured during the three growth scasons.

A- Vegetative Growth and nutrient status:

Four main branches which nearly uniform in growth, diameter and foliage density and distribution around the periphery of each tree were chosen and labeled in February. In the autumn growth cycle, the following vegetative characters were measured:

1- Shoot length (cm).

2- Leaf number/shoot.

3- Leaf area (cm^2), where thirty full mature leaves/tree (from the 4th to 5th leaf of the labeled shoot base) were randomly taken and weighing 90 sections

of 1 cm^2 (2 sections of 1 cm^2/leaf) and then the average leaf area was determined as follows:

$$\text{The average leaf area } (cm^2) = \frac{\text{Leaves weight (g)}}{\text{Sections weight (g)}} \times 2$$

B- N, P and K in leaves:

Samples of fifty mature leaves were randomly selected from the non fruiting shoots of the spring in mid September to determine N, P and K in leaves. Percentage of N, P and K were determined according to Wilde *et al.* (1985).

C- Yield and Its Components:

Ten distributed fruiting shoots around the trees were chosen and labeled before the beginning of treatments. The number of flowers per each shoot was counted. Before harvest, the fruit retention for each branch was calculated as:

$$\text{Fruit retention (\%)} = \frac{\text{Total number of fruits}}{\text{Total number of flowers}}$$

At harvesting time, in the last week of December, the number of fruit per tree was counted and then, the yield per tree was calculated.

D- Fruit properties:

Samples of 10 fruits were randomly taken from each tree to estimate the fruit properties. The fruit weight and the chemical fruit properties such as total soluble solids, ascorbic acid (mg/100 ml juice) and sugar contents were determined according to A.O.A.C. methods (1985).

The obtained data were statistically analyzed according to Gomez and Gomez (1984) and Mead *et al.* (1993) using the L.S.D. test for compared the significance of the differences between various treatment means.

Results

1- Vegetative growth:

Data in Table (2) showed the effect of citrine and potassium application and their interaction on shoot length and leaf parameters. It is obvious from the data that the results took similar trend during the three studied seasons.

Data indicated that citrine spraying significantly increased the shoot length, leaves number and leaf area compared with untreated one.

In relation to the effect of different potassium application, date showed that the shoot length and leaf traits were significantly affected by various sources of potassium fertilization. Vinasse spraying led to a significant increase in such growth traits compared to that fertilized by potassium sulphate (check treatment). Contrarly, potassien spray significantly decreased the shoot growth and leaf traits as compared to check treatment. All potassium fertilization in the presence of citrine application significantly increased the shoot length and leaves number and their area compared to untreated ones. Using vinasse on the citrine treated trees gave the highest growth traits values, whereas potassion spraying on untreated trees gave the least one. These results emphasized the important

of using vinasse foliar as a K-fertilization to improve the vigour of trees.

It could be concluded from the obtained data that foliar application either citrine or vinasse singly or incombination were effective in increase the number and area of leaves, such effect gave a pronounced increase in leaf surface expansion.

Table (2):Effect of antioxidant and potassium fertilization sources on vegetative growth of Balady mandarin trees during 2008,2009 and 2010 seasons.

Treat. / Char. / season	Shoot length(cm)			Numbers of leaves			Leaf area(cm^2)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
Anti[1]									
A1	53.05	46.55	52.58	35.08	37.87	41.36	9.35	9.24	9.21
A2	51.64	42.63	49.47	33.60	36.49	37.52	8.53	8.79	8.80
L.S.D	*	*	*	*	*	*	*	*	*
K-sources[2]									
B1	52.20	44.80	50.18	34.76	36.82	39.22	8.91	9.00	8.94
B2	54.87	47.75	54.70	35.36	39.87	41.68	9.82	9.44	9.50
B3	49.91	41.23	48.21	32.89	34.91	37.43	8.09	8.60	8.57
L.S.D	1.47	1.29	1.84	1.43	1.30	1.57	0.15	0.16	0.25
Anti x K-S[3]									
A1B1	53.08	46.10	51.50	35.83	37.26	42.07	9.28	9.11	9.07
A1B2	55.35	49.40	55.90	36.28	40.96	43.50	10.17	9.75	9.77
A1B3	50.73	44.17	50.35	33.13	35.41	38.52	8.60	8.87	8.79
A2B1	51.33	43.50	48.85	33.70	36.38	36.37	8.55	8.90	8.82
A2B2	54.50	46.10	53.50	34.45	38.78	39.85	9.47	9.13	9.23
A2B3	49.10	38.30	46.07	32.66	34.31	36.35	7.58	8.34	8.35
L.S.D	2.10	1.67	2.62	2.02	1.85	2.24	0.22	0.23	0.37

1, 2 and 3 = Each value represents the mean of 12, 8 and 4 replicates, respectively. * = Significant.

2- Leaf nutrient composition

Table (3) revealed that N, P and K concentrations in mandarin leaves significantly increased with citrine, as micro nutrients (Zn, Fe & Mn) and vinasse as an organic source of potassium spraying and their interaction. Nitrogen, phosphorus and potassium were significantly increased by citrine spraying comparison with unsprayed one (control). Such results may be due to role of Zn, Fe and Mn in plant photosynthesis reactions, nucleic acid metabolism, protein and carbohydrate biosynthesis which due to increase of leaf mineral content.

Regarding, the different potassium fertilization sources, it is clear that the percentage of N, P and K in the leaves were significantly increased due to using vi-

nasse as foliage spray compared to potassium sulphate fertilization (check treatment). Furthermore, potassien spray led to unsignificant increase in percentage of N and significant increase in P in leaves compared to check treatment. Whereas, such treatment significantly decreased the percentage of K in leaves than check treatment. Thus, it could be concluded that using vinasse as foliar spray improved the vigor and nutritional status of Balady Mandarin trees.

As interaction, data showed that all combinations of citrine spraying increased the N, P and K% in leaves compared to other fertilization treatments. The maximum percentage of N, P and K was recorded in leaves of citrine treated trees followed by vinasse spray. On the other side, the lowest of leaf N and P% were recorded when trees were not citrine sprayed and fertilized with potassium sulphate (check treatment). Whereas, the least percentage of K found in leaves of untreated trees and spraying with potassien.

Therefore, using citrine as chelate micronutrient either only or combined with spraying vinasse as source of potassium was very effective in improving the nutritional status of trees.

Table (3):Effect of antioxidant and potassium fertilization sources on leaf N,P and K of Balady mandarin trees during 2008,2009 and 2010 seasons

Treat.Char. season	N%			P%			K%		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
Anti[1]									
A1	2.46	2.41	2.54	0.454	0.461	0.465	1.47	1.55	1.47
A2	2.26	2.23	2.36	0.433	0.439	0.431	1.40	1.42	1.38
L.S.D	*	*	*	*	*	*	*	*	*
K-sources[2]									
B1	2.18	2.14	2.26	0.400	0.413	0.398	1.44	1.51	1.41
B2	2.67	2.63	2.78	0.477	0.475	0.481	1.59	1.65	1.61
B3	2.24	2.20	2.32	0.454	0.463	0.452	1.29	1.30	1.27
L.S.D	0.19	0.16	0.14	0.014	0.022	0.025	0.07	0.13	0.10
Anti x K-S[3]									
A1B1	2.23	2.17	2.31	0.418	0.433	0.420	1.48	1.59	1.45
A1B2	2.83	2.76	2.93	0.486	0.482	0.491	1.62	1.68	1.66
A1B3	2.32	2.30	2.38	0.458	0.469	0.458	1.32	1.37	1.31
A2B1	2.12	2.10	2.21	0.381	0.393	0.376	1.39	1.43	1.36
A2B2	2.50	2.49	2.62	0.467	0.468	0.471	1.56	1.62	1.55
A2B3	2.16	2.10	2.25	0.450	0.456	0.446	1.26	1.22	1.23
L.S.D	0.27	0.23	0.20	0.020	0.031	0.036	0.10	0.18	0.14

1, 2 and 3 = Each value represents the mean of 12, 8 and 4 replicates, respectively. * = Significant.

3- Yield and its components:

Data illustrated in Table (4) indicated that fruit retention and number of fruits per tree were significantly increased by using citrine compared with the untreated one. Hence, the maximum yield/tree were recorded in trees that sprayed with citrine than unsprayed one. These findings might be due to the positive action of micro nutrient and citric acid in enhancement the activity of photosynthetic and protein synthesis in leaves, which in turn encourage plant growth. Also, the favourable effect of Zn, Fe and Mn on these characters may be attributed to their effect on growth parameters, which in turn improve yield and yield components.

Concerning the effect of different potassium fertilization sources, data in abovementioned table indicated that using vinasse spray significantly increased the yield components rather than potassium sulpahte fertilization (control). Meanwhile, potassin spray failed to show any significant effect on fruit retention, fruits number and yield/tree compared to control. Vinasse spraying improve the vigour and nutrient of trees, such improvement surely reflected on increasing yield and yield components.

Furthermore, all combination of citrine spray significantly increased the yield components. Vinasse spraying on the citrine treated trees gave the highest fruit retention, fruits number and yield/tree. However, the lowest these traits were recorded on untreated citrine trees that fertilized with potassien spraying. These results could be attributed to positive effect of vinasse and citrine on improving the nutrient status and vigour of trees.

Table (4):Effect of antioxidant and potassium fertilization sources on the yield components of Balady mandarin trees during 2008,2009 and 2010 seasons.

Treat.Char.	Fruit retention %			No. of fruits/tree			Yield/tree (kg)		
Season	2008	2009	2010	2008	2009	2010	2008	2009	2010
Anti[1]									
A1	1.51	1.91	1.86	102.9	322.4	284.8	15.28	42.34	43.19
A2	1.26	1.59	1.56	72.83	276.4	250.1	10.54	33.86	35.75
L.S.D	*	*	*	*	*	*	*	*	*
K-sources[2]									
B1	1.31	1.69	1.71	81.37	291.8	263.1	11.71	36.29	37.57
B2	1.63	1.94	1.83	105.6	327.7	299.7	16.47	44.27	46.28
B3	1.21	1.62	1.60	76.62	278.6	239.5	10.55	33.33	34.58
L.S.D	0.15	0.11	0.18	10.10	15.90	31.95	1.22	3.11	3.65
Anti x K-S[3]									
A1B1	1.38	1.85	1.88	92.75	310.5	282.5	13.50	38.75	41.68
A1B2	1.85	2.12	1.99	126.2	364.7	318.7	19.75	50.30	50.35
A1B3	1.30	1.76	1.73	89.75	291.9	253.2	12.60	37.16	37.55
A2B1	1.24	1.53	1.53	70.00	273.2	243.7	9.92	33.83	33.45
A2B2	1.41	1.76	1.76	85.00	290.7	281.0	13.20	38.25	42.20
A2B3	1.12	1.48	1.47	63.50	265.2	225.7	8.51	29.50	31.60
L.S.D	0.21	0.16	0.25	14.27	22.50	45.22	1.74	4.45	5.19

1, 2 and 3 = Each value represents the mean of 12, 8 and 4 replicates, respectively. * = Significant.

4- Fruit properties:

Results in Tables (5 & 6) showed that citrine application as antioxidant and micro nutrient (Fe, Zn & Mn) significantly increased the fruit weight and vitamin C contents compared to unapplicated one. Meanwhile, such treatment did not significantly affect soluble solids and sugar contents over untreated one (control).

Therefore, vinasse spraying improved the fruit quality in terms of increasing the fruit weight, total soluble solids (TSS), and sugar and vitamin C contents compared to fertilization by potassium sulphate (check treatment). Whereas, potassien spray significantly decreased the fruit weight and vitamin C contents and had insignificant effect on the other fruit traits compared to check treatment. Hence, the best fruit quality recorded on the trees that sprayed with vinasse. Such improving due to the role of vinasse as an important source of potassium that had a major physiological effects in improving the fruit quality.

In addition, all combinations of citrine spraying along with potassium sources improved the fruit quality as compared to check treatments. The heaviest and best fruit quality were found on the citrine treated trees that were fertilized with vinasse. On contrary, the lightest and least quality recorded on fruits from

untreated trees and fertilized by potassien spray.

So, it could be concluded that the best results regarding the fruit quality of Balady mandarin were obtained with citrine spraying accompanied spray vinasse as potassium source such treatment was more effective in improving the fruit quality than other treatments.

Table (5):Effect of antioxidant and potassium fertilization sources on fruit weigh, total soluble solids (TSS) and total acidity of Balady mandarin fruits during 2008,2009 and 2010 seasons.

Treat.Char.	Fruit weight (g)			TSS			Total acidity		
Season	2008	2009	2010	2008	2009	2010	2008	2009	2010
Anti[1]									
A1	141.9	131.0	149.3	11.57	11.66	11.08	1.43	1.47	1.48
A2	135.3	119.3	139.3	11.37	11.41	10.85	1.36	1.38	1.40
L.S.D	*	*	*	N.S	N.S	N.S	N.S	N.S	N.S
K-sources[2]									
B1	141.2	123.1	147.2	11.11	11.28	10.51	1.44	1.42	1.41
B2	145.3	132.1	152.5	11.98	11.83	11.64	1.26	1.20	1.32
B3	128.8	117.8	133.2	11.33	11.50	10.75	1.48	1.53	1.62
L.S.D	6.56	3.07	3.42	0.26	0.31	0.28	0.09	0.12	0.11
Anti x K-S[3]									
A1B1	142.0	124.2	151.5	11.25	11.36	10.60	1.47	1.48	1.50
A1B2	146.2	136.0	157.5	12.10	12.00	11.78	1.30	1.35	1.36
A1B3	137.5	128.0	138.7	11.35	11.62	10.86	1.54	1.58	1.65
A2B1	140.5	122.0	142.8	10.97	11.20	10.42	1.41	1.36	1.32
A2B2	145.2	128.2	147.5	11.85	11.66	11.50	1.23	1.30	1.28
A2B3	120.2	107.7	127.7	11.30	11.38	10.63	1.43	1.48	1.59
L.S.D	9.30	4.02	4.85	0.37	0.44	0.40	0.14	0.17	0.16

1, 2 and 3 = Each value represents the mean of 12, 8 and 4 replicates, respectively. * = Significant.

Table (6): Effect of antioxidant and potassium fertilization sources on total, reducing sugars and vitamin C (V.C) of Balady mandarin fruits during 2008,2009 and 2010 seasons.

Treat. Char. Season	Total sugars			Reducing sugars			V.C (mg/g)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
Anti[1]									
A1	8.09	9.14	7.77	3.09	3.38	3.07	45.58	46.20	43.31
A2	7.80	8.94	7.54	2.94	3.20	2.90	44.82	43.52	41.97
L.S.D	N.S	N.S	N.S	N.S	N.S	N.S	*	*	*
K-sources[2]									
B1	7.78	8.88	7.34	3.16	3.19	2.88	44.59	44.75	42.64
B2	8.30	9.44	7.87	2.94	3.21	3.19	47.29	46.82	44.72
B3	7.75	8.78	7.57	2.93	3.47	2.91	43.72	43.01	41.07
L.S.D	0.36	0.25	0.28	0.18	0.22	0.23	0.52	0.55	1.07
Anti x K-S[3]									
A1B1	7.80	8.85	7.46	2.91	3.34	2.89	44.39	46.00	43.36
A1B2	8.60	9.53	8.13	3.13	3.24	3.39	48.45	49.50	45.76
A1B3	7.87	9.02	7.62	3.22	3.56	2.97	43.90	43.10	41.82
A2B1	7.76	8.92	7.40	3.42	3.04	2.86	44.79	43.50	41.92
A2B2	8.00	9.36	7.61	2.75	3.18	3.00	46.13	44.14	43.68
A2B3	7.63	8.55	7.52	2.65	3.28	2.84	43.55	42.93	40.33
L.S.D	0.51	0.36	0.39	0.26	0.31	0.33	0.76	0.79	1.53

1, 2 and 3 = Each value represents the mean of 12, 8 and 4 replicates, respectively. * = Significant.

Discussion and Conclusion

Micronutrients play a great regulatory role in many physiological and biochemical processes of plant. Iron (Fe) complexes with proteins to form important enzymes in the plant and associated with chloroplasts, where it has some roles in the synthesizing chlorophyll. Zinc (Zn) has been identified as component of almost 60 enzymes, therefore, it has a role in many plant functions and it has a role as an enzyme in producing growth hormone (IAA). Manganese (Mn) participates in several important processes including photosynthesis and metabolism of both nitrogen and carbohydrate. Foliar fertilizers as chelate should be easily absorbed by plants, rapidly transported and easily released their ions to affect the plant (Nijjar, 1985 and Marschner, 1996).

In addition, citrine as antioxidant compound has auxinic action, since it contain citric acid. It also, has synergistic effect on the biosynthesis of carbohydrates, flowering and productivity of fruit trees as well as controlling the incidence of most fungi of fruit trees. In general, the use of antioxidant is safe for human, animal and environment (Elade, 1992). The status of nutrient in the tree resulted from spraying different solutions might be attributed to quick absorption via leaves and the lim-

ited loss of the nutrients when they were sprayed.

All these effects improve vegetative vigour and nutritional status of trees induce an increasing photosynthesis, nutrient uptake and synthesis of total carbohydrates and proteins. As well as, maintaining a good balance between total carbohydrates and N in favour improving floral bud induction and fertility coefficient which inducing an increase in the yield.

Hence, it could be concluded that citrine spraying effective in improving the tree vigour expressed as an increase in shoot growth and leaf surface expansion and its nutrient status and yield.

The above mentioned findings are in accordance with those obtained by Abdel-Migeed (1996), El-Saida (1996), Dawood *et al.* (2000), El-Baz (2003), Abd-Allah (2006) and Hafez-Omaima and El-Metwally (2007). They revealed that micro nutrients foliar sprays enhanced nutritional status and improved the yield and fruit quality of orange and mandarin trees.

Potassium is important in the formation and function of proteins, fats, carbohydrates and chlorophyll and in maintaining the balance of salts and water in plant cell (Marschner, 1996). Crop demands for K become great expense due to lack of natural K resources. Exploration of alternative sources of potassium has been taken into consideration. In addition, there are increasing interest and demand for organic, bio and slow releasing-K sources to conventional and organic forming. Vinasse, as a sugarcane distillery wastes, has been used as soil amendment, since it contain important amounts of plant nutrients and organic matter. Vinasse contains high levels of organic matter, potassium, calcium and moderate amounts of nitrogen and phosphorus. It improved the structure moisture retentions and pH of soil and biological properties inducing an increase in availability of certain nutrients. Application of vinasse is a common practice in sugar cane cultivated areas and can fully substitute K and partially P on crops fertilization (Gomez and Rodriguez, 2000 and Resende *et al.*, 2006).

Therefore, it can be concluded that vinasse foliar as a K-fertilization was useful to improve the vegetative vigour and nutritional status of trees inducing an increase in fruit set %, yield and fruit quality.

These results emphasized the importance of potassium fertilization to get complete healthy trees. In addition, its usefulness in saving potassium fertilization cost and reducing environmental problems, since the vinasse has high density syrup waste from the sugar industry, which may cause environmental problems.

The promotive effect of potassium fertilization on growth nutrient status and fruiting of

citrus trees were emphasized by Ibraheim *et al.* (1993), Achulea (1998), El-Safty *et al.* (1998), Wei *et al.* (2002), Abd-Allah (2006), Mostafa and Saleh (2006), Hafez-Omaima and Metwally (2007) and Ali (2010). They concluded that using different forms of potassium fertilization had a positive effect on leaf mineral content, fruit set and yield as number or fruits weight of citrus trees.

Conclusion:

Therefore, it could be concluded that spraying trees with either 0.5% of citrine twice at pre-flowering and fruit set or vinasse at 10% three times at mid of April, June and August singly or incombination improve the tree nutrient status, yield and fruit quality. In addition, it minimize the production cost and environmental pollution which could be occurred by excess of industrial wastes.

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تأثير المعاملة ببعض المصادر المختلفة من التسميد البوتاسي ومضادات الأكسدة علي النمو الخضري والحالة الغذائية والاثمار علي أشجار اليوسفي البلدي

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أجريت هذه الدراسة خلال ثلاثة مواسم متتالية 2008 ، 2009 ، 2010 بمزرعة كلية الزراعة جامعة أسيوط – مصر . لدراسة تأثير رش الستزين (مضاد أكسدة وعناصر صغري Fe, Zn & Mn) بالإضافة للتسميد بمصادر مختلفة من البوتاسيوم (الفيناس ، البوتاسين وسلفات البوتاسيوم) علي النمو الخضر والحالة الغذائية وإثمار في أشجار اليوسفي البلدي وكان التصميم الاحصائي المستخدم هو القطاعات الكاملة العشوائية ذو القطع المنشقة مرة واحدة.

وقد أظهرت النتائج ما يلي :

- أدي الرش بالستزين (مضاد أكسدة وعناصر صغري مخلبية) إلي تحسين صفات النمو الخضري من حيث طول الأفرع ومساحة الأوراق وكذلك مستوي العناصر بالأوراق مقارنة بالأشجار التي لم ترش (المقارنة).
- أدي استخدام الفيناس كمصدر للسماد البوتاسي إلي تحسين النمو الخضري والحالة الغذائية والمحصول وذلك مقارنة بسلفات البوتاسيوم (معاملة الكنترول).
- أظهرت معاملة التفاعل أن رش الفيناس والستزين أدت إلي زيادة جوهرية في طول الأفرع ومساحة الأوراق وكذلك نسبة العقد والمحصول للأشجار مقارنة بباقي المعاملات.
- سجل رش الفيناس أفضل القيم الخاصة بوزن الثمار وكذلك خصائصها الكيماوية ، كما وجد أن الرش بالبوتاسين لم يعطي تأثيرات جوهرية علي هذه الصفات مقارنة بالتسميد بسلفات البوتاسيوم.

من نتائج هذه الدراسة يمكن التوصية باستخدام رش الستزين أو الفيناس أحداهما أو معا حيث يؤدي ذلك إلي تحسين النمو الخضري والحالة الغذائية للأشجار مع إنتاج محصول عال ذو خصائص ثمرية جيدة فضلاً عن تقليل تكاليف التسميد البوتاسي والتلوث البيئي الناشئ عن مخلفات الصناعة (الفيناس).