Effect of Potassium Levels and Methods of Applications on "Canino" Apricot Trees Grown in Sandy Soils

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ABSTRACT

Potassium fertilization was applied on 9 years old "Canino" apricot trees grown in sandy soil at different levels as soil application (at 0.5, 1.0 and 1.5 Kg/tree) or foliar application (at 0.5, 1.0 and 1.5%) during two successive growing seasons of 2008-2009 and 2009-2010. Generally, all potassium levels and methods of application significantly increased fruit set, yield, fruit weight, TSS and total sugars as compared with the control. However, potassium soil application at 1.5 Kg /tree was more effective than other soil or foliar applications and gave the highest values of fruit set, yield, fruit weight, TSS and total sugars and carotene contents as compared with the control and the other treatments. At the same time, all potassium levels and methods of application significantly increased N% and K% in leaves as compared to the control, while P content was not affected. Furthermore, all potassium treatments did not give clear trend for leaf content of Fe, Z, and Mn.

Keywords: Apricot, Canino, Potassium, Fertilization, Yield, Fruit quality.

INTRODUCTION

Apricot (*Prunus armeniaca* L.) is a deciduous fruit tree related to *Rosaceae* family, subfamily *Prunoideae*, which produces stone fruits. Apricot total area in Egypt reached 18559 feddans and fruiting area reached 15278 in 2008 and the total production recorded 101139 ton (Ministry of Agriculture Statistics, 2008). Apricot tree cultivation had spread extensively in the newly reclaimed sand soils in Egypt during the last decades. Many difficulties including nutritional problems have been met by the growers. Optimum rates and time of application of major elements are not exactly determined.

Moreover, apricot trees require large quantities of mineral nutrients for their growth and fruit production, such quantities must be applied either in soil or foliar spraying in order to maintain optimum levels of nutrients to get high yield. Potassium is important for fruit colour, winter hardiness, tree growth and disease resistanance. An excess amount of potassium can lead to deficiency of magnesium, (Kessel, 2006).

Potassium is the most appropriate univalent cation for enzyme activation, not only because of high concentration, but also due to its mobility in plant (Mengel and Krikby, 1978). It is one of the essential elements in plant nutrition which is added regularly in fertilization programs. It is important for structure and promotes formation of ATP (plant energy), oxidative polyphosphorelation (Yagodin, 1984), synthesis of amino acid proteins (Russell, 1978) and has important role in stomata movement, pH stabilization, cell extension and it is needed for enlargement of fruit (Faust, 1989).

The role of potassium element is essential to increase the fruit size as it preserves the water contents of cells. It is cofactor in chlorophyll production, photosynthesis process and improving the peel color of fruits. Many workers indicated that the application of potassium fertilization improved vegetative growth, increased the yield and improved fruit quality. El-Seginy (2006) stated that, potassium applications in the form of potassium sulphate on "Canino" apricot cultivar at 80, 100 and 120 Kg K_2O/Fed/year increased vegetative growth, yield and fruit weight, TSS and total sugars. Moreover, Kasssem and El-Seginy (2002) found that potassium application on "Florda Prince" peach cultivar increased leaf potassium and decreased manganese and phosphorus. In addition yield, fruit weight, TSS, acidity had increased during both seasons with potassium application. Mansour, *et al.* (1986) reported that potassium sulphate gave the best results for fruit weight, size and coloration in peach.

Kilany and kilany (1991) studied the effect of potassium nutrient applications on fruit quality of Anna apple trees. Potassium was applied as potassium sulphate as a soil application at the rate of 450 and 900 g/tree and as foliar application at 0.75 and 1.5%. They reported that potassium treatments increased yield/tree, average fruit weight and fruit firmness. Similar results were reported on "Anna" apple by Attala (1997) and Mostafa, *et al.* (1999). On the other hand, Awasthi, *et al* (1999) found that K fertilization increased the yield. Also, foliar application of K in two sprays further increased the fruit weight and TSS content. Soil application of K significantly increased leaf and fruit K concentration whereas; the concentration of N, P, Ca and Mg was decreased. Recently, Smith (2009) working on pecan, reported that K and P content in trees increased during the period from bud break until July, and then decreased until bud break of the following year.

The aim of the present research was to study the response of Canino apricot trees grown in sandy soil to different methods and rates of potassium applications.

MATERIALS AND METHODS

The present work was conducted during two growing successive seasons of 2008-2009 and 2009-2010 at a private orchard at El-Nubaria region, Behira Governorate. Twenty eight trees, 9 years old, of the "Canino" apricot (*Prunus armeniaca L.*) as uniform as possible were selected for this study. These trees were grafted onto seedling "Balady" apricot rootstock and planted in sandy soil at 5 x 5 m apart. The trees received the same horticultural practices as usually done in the orchard ($15m^3$ organic manure/fed/year +200Kg superphosphate, 80kg N/fed as ammonium sulphate, 60kg potassium sulphate, 35 L/fed orthophosphoric acid as a source of phosphorus and foliar sprays of chelated Fe, Zn and Mn in April and May). Leaf analysis for the N, P, K, Fe, Zn and Mn contents were determined at the end of June 2008 before the start of experiment. The results of such analysis are shown in Table (1).

The physical and chemical properties (Table 2) of the sandy soil of the experimental site had been analyzed according to Chapman and Pratt (1961).

For this study, 28 trees were chosen for 7 treatments. Each treatment was applied on four replicates (one tree for each replicate) according to the randomized complete block design. The applied treatments were as follows:

1)Control (sprayed with tap water).
2)0.5 Kg K_2SO_4/tree (0.24Kg K_2O, soil application).
3)1.0 Kg K_2SO_4/tree (0.48Kg K_2O, soil application).
4)1.5 Kg K_2SO_4/tree (0.72Kg K_2O, soil application).
5)0.5 % K_2SO_4 (2.4g/L K_2O, foliar application).
6)1.0 %. K_2SO_4 (4.8g/L K_2O, foliar application).
7)1.5 % K_2SO_4 (7.2g/L K_2O, foliar application).

The trees received the normal culture practice usually adapted for this farm except potassium fertilization which was in granular form of potassium sulphate (48% K_2O).

Potassium sulphate (48% K_2O) was applied triple to soil (at early of March, May and July in each season). Foliar potassium was applied triple (at full bloom, after fruit set and at start of coloration. As for potassium foliar application, each tree received five liters of solution containing 1.0% Tween 20 as surfactant agent (sprayed until run off to whole tree). As for vegetative growth parameters, twenty five shoots in the central part of the canopy of each tree were labeled in early April. Average shoot length was determined in October of every experimental season. To determine the leaf area, samples of 10 mature leaves were collected at random from each studied tree during August. The determination of leaf area was carried out using leaf area meter Model (1-203, CID, Inc., USA).

Two branches 1.5 inch. in diameter were tagged on each experimental tree in March every season. Both number of flowers and set fruitlets on the tagged branches were counted and recorded for all treatments, then percentages of fruit set were calculated by the following equation: (according to Westwood,1988).

$$\text{Fruit set (\%)} = \frac{\text{No. of set fruitlets}}{\text{No. of opened flowers}} X100$$

To estimate the effect of different fertilizer treatments on the leaf mineral contents, samples of twenty leaves from the middle part of the shoot, at late of June, in both seasons, washed several times with tap water, rinsed three times in distilled water, and then dried at 70-80 C° in an electric air-drying oven until a constant weight. The dried leaves of each sample were ground in porcelain mortar to avoid contamination with any minerals; 0.3 gm from the ground dried material of each sample was digested with H_2O_2 and H_2SO_4 according to Evenhuis and DeWaard (1980).

Total nitrogen and phosphorus were determined calorimetrically according to Evenhis (1976), and Murphy and Riley (1962), respectively. Potassium was determined against a standard curve by flame photometer (Chapman and Pratt, 1961). While Fe, Zn and Mn were determined by Perken Elemer Atomic Absorption Spectrophotometer. The concentrations of macro elements were expressed as percent (%) and micro elements as ppm on dry weight basis.

At harvest time, the total yield of each studied tree was determined on weight basis (Kg) at the last of June of both seasons. Twenty five mature fruits from each studied tree were taken at random to determine the fruit characteristics including the average fruit weight (gm.), fruit dimensions (cm) and fruit firmness at two opposite sides on the equator of each fruit (skin removed) using pressure tester at 5/16" Plunger (Magness and Taylor, 1925). In fruit juice, total soluble solids percentages (TSS %) were determined using a hand refractometer and the acidity percentage was determined according to AOAC (1990). Total sugars' content was determined according to the procedures outlined by Malik and Singh (1980). An addition, carotene pigment in fruit skin tissues was determined at harvest time and calculated as mg/100 g fresh weight according to Wensttein (1957). Appropriate analysis of variance was performed on results of both seasons. Comparisons among means of different treatments were performed using the least significant difference test at P=0.05 level as described by Steel and Torrie (1980).

Table 1: Leaf macro and micro element contents before starting of the experiment.

N (%)	P (%)	K (%)	Fe (ppm)	Zn (ppm)	Mn (ppm)
1.79	0.32	1.75	84	33	59

Table 2: The physical and chemical properties of the sandy soil of the experimental site before starting the experiment.

Soil Depth (cm)	Texture	pH	E.C. Ds/m	O.M (%)	Soluble cations (meq/l)			Soluble anions (meq/l)		
					Ca^{++}	Mg^{++}	K^{+}	HCO_3	Cl^-	SO4
0-30	Sandy	7.48	2.01	0.25	18.60	10.89	1.00	6.30	31.26	8.00
30-60	loam	7.59	2.12	0.29	19.11	11.21	1.31	6.39	33.31	8.90

RESULTS AND DISCUSSION

LEAF MACRO ELEMENTS CONTENT:

The effects of different potassium levels and application methods on macro elements' contents in "Canino" apricot leaves during 2009 and 2010 seasons are presented in Table (3). As regard to 2009 season, the highest level (1.5 Kg K_2SO_4/tree) as soil application or foliar application (1.5% K_2SO_4) gave the highest significant nitrogen content (%) as compared to the lowest nitrogen content resulted from the control treatment, but there were non-significant differences between the other potassium applications as compared to the control. In 2010 season, all potassium levels and methods of application significantly increased nitrogen (%) and the highest content was resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application or foliar application (1.5% K_2SO_4) as the same trend in 2009 season. Regarding to leaf phosphorus (P) content, all treatments were not effective and the obtained values did not differ significantly than the control treatment. Concerning to leaf potassium (K) contents (%), all potassium levels and methods of application increased significantly leaf potassium (%) and the highest content resulted from highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values of leaf potassium (%) which resulted from the control in the two studied seasons, and the highest level (1.5 Kg K_2SO_4/tree) as soil application is better than foliar spray. The results of kasssem and El-Seginy (2002) who found that potassium application on "Flord Prince" peach cultivar increased leaf potassium content, agree with the results of the present investigation.

LEAF MICRO ELEMENTS CONTENT:

Results in Table (4) show the effects of different potassium levels and application methods on leaf micro-elements' contents of "Canino" apricot during 2009 and 2010 seasons. As for to leaf Fe content (ppm), the highest values and significant leaf Fe contents (90 and 94 ppm) resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values (84 and 85 ppm) resulted from the control, in the first and second season, respectively. The other levels and methods of application recorded in between values. As regard to leaf zinc content (ppm), there were insignificant differences between all levels and methods of potassium application as compared with the untreated apricot trees (control). As regard to leaf Mn contents (ppm), the highest values of leaf Mn contents (61 and 62 ppm) resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application comparing with the control (59 and 58 ppm), in the first and second seasons, respectively. The other levels and methods of application recorded in between values.

Table 3: Effect of soil and foliar potassium application on leaf macro elements content (%) of "Canino" apricot trees in 2009and 2010 seasons.

Treatments	2009			2010		
	N (%)	P (%)	K (%)	N (%)	P (%)	K (%)
Control	1.79 b	0.34 ab	1.76 e	1.81 c	0.35 a	1.78 f
Soil application						
0.5 Kg K_2SO_4/tree	1.83 ab	0.34 ab	1.82 d	1.84 bc	0.35 a	1.84 e
1.0 Kg K_2SO_4/tree	1.87 ab	0.35 a	1.88 c	1.85 b	0.36 a	1.89 c
1.5 Kg K_2SO_4/tree	1.90 a	0.34 ab	1.99 a	1.90 a	0.36 a	2.03 a
Foliar application						
0.5 % K_2SO_4	1.84 ab	0.34 ab	1.82 d	1.83 bc	0.35 a	1.84 e
1.0 % K_2SO_4	1.87 ab	0.35a	1.89 c	1.85 b	0.36 a	1.87 d
1.5 % K_2SO_4	1.91 a	0.34 ab	1.94 b	1.89 a	0.36 a	1.91 b

Means not sharing the same letter (s) within each column for each year are significantly different at 0.05% level of probability.

Table 4: Effect of soil and foliar potassium application on leaf micro elements content (ppm) of "Canino" apricot trees in 2009and 2010 seasons.

	2009			2010		
Treatments	**Fe (ppm)**	**Zn (ppm)**	**Mn (ppm)**	**Fe (ppm)**	**Zn (ppm)**	**Mn (ppm)**
Control	84 c	33 ab	59 bc	85 f	33a	58 d
Soil application						
0.5 Kg K_2SO_4/tree	85 c	34 ab	59 bc	92 b	33 a	60c
1.0 Kg K_2SO_4/tree	88 ab	34ab	60 ab	93 ab	34 a	61 b
1.5 Kg K_2SO_4/tree	90 a	35a	61 a	94 a	34 a	62 a
Foliar application						
0.5 % K_2SO_4	84 c	33 ab	59 bc	86 ef	33 a	57 e
1.0 % K_2SO_4	86 bc	35 a	59 bc	88 d	34 a	56 f
1.5 % K_2SO_4	87 b	35 a	58 c	90 c	34 a	57 e

Means not sharing the same letter(s) within each column for each year are significantly different at 0.05% level of probability.

VEGETATIVE GROWTH PARAMETERS:

The effects of different potassium levels and application methods on some vegetative growth parameters (shoot length and leaf area) of "Canino" apricot during 2009 and 2010 seasons are shown in Table (5). Shoot length increased gradually with increasing the level of potassium as soil or foliar applications. The soil application of potassium at 1.5 Kg K_2SO_4/tree was more effective than foliar application and recorded the highest significant shoot length (56.62 and 59.05 cm) as compared with the lowest shoot length (46.83 and 48.75 cm) which resulted from the control treatment, in the first and second seasons, respectively. The other treatments recorded in between values of shoot length. In regard leaf area, the results revealed the same trend as the results regard to shoot length. All levels and methods of potassium application significantly increased leaf area as compared with the control. The highest leaf area (29.63 and 29.86 cm^2) resulted from the highest soil application level (1.5 Kg K_2SO_4/tree) as compared with the lowest values (23.06 and 23.61 cm^2) resulted from the control treatment. The other treatments recorded in between values.

The present results are in harmony with those obtained by Attala (1997) on "Anna" apple; kassem and El-Seginy (2002) working on "Florda Prince" peach; as well as El-Seginy (2006) who stated that potassium applications in the form of potassium sulphate on "Canino" apricot cultivar at 80, 100 and 120 Kg K_2O/Fed/year increased vegetative growth, yield and fruit weight in both seasons of study and by Smith (2009) working on pecan. On the other hand, Asma *et al.* (2007) found no effect for K application on vegetative growth of apricot.

FRUIT SET:

Fruit set percentages of "Canino" apricot during 2009 and 2010 seasons as affected by different potassium levels and application methods are presented in Table (6). All levels and methods of potassium application significantly increased fruit set (%) as compared with the control. The highest level (1.5 Kg K_2SO_4/tree) as soil application was more effective than the highest level of foliar application and recorded the highest fruit set percentages (29.87 and 29.36%) as compared with the lowest fruit set (22.03 and 21.13%) resulted from the control in the first and second seasons, respectively. The other treatments recorded in between fruit set values. The present results are in agreement with those obtained by El-Seginy (2006) who reported that potassium applications in the form of potassium sulphate on "Canino" apricot cultivar at 80, 100 and 120 Kg K_2O/Fed/year increased fruit set, yield and fruit weight in both seasons of study; similar results were also reported by kassem and El-Seginy (2002) on "Florda Prince" peach, and with Attala (1997) on "Anna" apple.

Table 5: Effect of soil and foliar potassium application on some vegetative growth parameters of "Canino" apricot trees in 2009 and 2010 seasons.

	Shoot length (cm)		Leaf area (cm^2)	
Treatments	**2009**	**2010**	**2009**	**2010**
Control	46.83 g	46.75 g	23.06 f	23.61 g
Soil application				
0.5 Kg K_2SO_4/tree	49.94 e	50.88 e	26.28 d	27.93 c
1.0 Kg K_2SO_4/tree	52.67 c	53.30 c	27.89 b	28.22 b
1.5 Kg K_2SO_4/tree	56.62 a	59.05 a	29.63 a	29.86 a
Foliar application				
0.5 % K_2SO_4	49.45 f	49.26 f	25.31 e	26.97 e
1.0 % K_2SO_4	51.46 d	52.40 d	26.93 c	26.42 f
1.5 % K_2SO_4	53.76 b	53.81 b	26.44 d	27.21 d

Means not sharing the same letter(s) within each column for each year are significantly different at 0.05% level of probability.

FRUIT YIELD:

The effects of different potassium levels and application methods on fruit yield (Kg/tree) of "Canino" apricot during 2009 and 2010 seasons are shown in Table (6). Fruit yield increased with increasing potassium level, however, the highest significant yield values (59.13 and 60.00 kg./tree) resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values (48.74 and 50.40 kg./tree) resulted from the control in the 1st and 2nd seasons, respectively. The other levels and methods of application recorded in between yield values. El-Sherif *et al.* (2008) found that, all potassium treatments significantly increased fruit set, yield, fruit weight, fruit size, fruit length, fruit diameter, total sugar and K (%) in both seasons, while they decreased fruit drop (%) compared with the control.The results of El-Seginy (2006) on apricot; Kassem and El-Seginy (2002) on peach and Attala (1997) agree with the present results as regard to fruit yield.

FRUIT PHYSICAL PROPERTIES:

Fruit physical properties (weight, length, diameter and firmness) as affected by different potassium levels and application methods are presented in Table (6). Fruit weight, length and diameter significantly increased with increasing the levels of potassium; however, the highest significant values resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values which resulted from the control in the 1st and 2nd seasons. As for fruit firmness, all levels and methods of potassium application decreased fruit firmness significantly as compared with the control. The control treatment recorded the highest fruit firmness (10.90 and 10.08 lb/In^2) in the first and second seasons, respectively. The same results were reported by Bussi *et al.* (2003) in apricot trees.

FRUIT CHEMICAL CHARACTERISTICS:

Results in Table (7) revealed that, the effects of different potassium levels and application methods on fruit chemical characteristics (TSS, Acidity, TSS/acid ratio, total sugars and carotene content) of "Canino" apricot during 2009 and 2010 seasons. TSS (%) increased significantly with increasing the levels of potassium; however, the highest significant values resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values which resulted from the control in the 1st and 2nd seasons. On the other hand, all treatments decreased acidity (%) as compared to the control, however, the lowest significant values resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the highest values which resulted from the control in the 1st and 2nd seasons. The other levels recorded in between values.

Table 6: Effect of soil and foliar potassium application on fruit set, yield and some physical fruit properties of "Canino" apricot trees in 2009 and 2010 seasons.

Treatments	Fruit set (%)	Yield (Kg/tree)	Fruit weight (g)	Fruit diameter (cm)	Fruit length (cm)	Fruit firmness (lb/In2)
				2009		
Control	22.03 g	48.74 d	35.23 g	3.55 g	3.54 g	10.90 a
Soil application						
0.5 Kg K_2SO_4/tree	27.17 c	49.85 cd	40.21 e	3.69 ef	3.65 e	10.87 b
1.0 Kg K_2SO_4/tree	27.74 b	56.85 b	42.88 c	3.91 b	3.85 b	10.66 e
1.5 Kg K_2SO_4/tree	29.87 a	59.13 a	46.54 a	3.97 a	3.89 a	10.73 d
Foliar application						
0.5 % K_2SO_4	25.17 f	49.44 d	39.52 f	3.68 f	3.59 f	10.85 c
1.0 % K_2SO_4	25.70 e	51.00 c	41.24 d	3.71 d	3.69 d	10.87 b
1.5 % K_2SO_4	26.33 d	55.25 b	44.90 b	3.78 c	3.73 c	10.86 bc
				2010		
Control	21.13 g	49.40 f	35.26 f	3.55 g	3.53 g	10.08 a
Soil application						
0.5 Kg K_2SO_4/tree	25.20 d	52.05 d	39.89 d	3.65 d	3.60 d	10.00 f
1.0 Kg K_2SO_4/tree	27.91 b	54.76 c	40.36 d	3.72 cd	3.70 c	10.04d
1.5 Kg K_2SO_4/tree	29.36 a	60.00 a	44.21 a	3.89 a	3.85 a	10.05c
Foliar application						
0.5 % K_2SO_4	22.21 f	50.99 ef	39.67 e	35.7 fg	35.6 f	10.06 b
1.0 % K_2SO_4	23.88 e	51.64 de	41.08 b	3.61 ef	3.59 e	10.04 d
1.5 % K_2SO_4	26.41 c	55.73 b	43.94 a	3.84 b	3.80 b	10.02 e

Means not sharing the same letter (s) within each column for each year are significantly different at 0.05% level of probability.

Table 7: Effect of soil and foliar potassium application on some chemical fruit properties of "Canino" apricot trees in 2009 and 2010 seasons.

Treatments	TSS (%)	Acidity (%)	TSS/acid ratio	Total sugars (%)	Carotene (mg/100 g f.wt)
			2009		
Control	11.55 f	0.55 a	21.00 g	6.59 e	2.97 e
Soil application					
0.5 Kg K_2SO_4/tree	11.60 e	0.53 bc	21.89 f	8.14 d	3.16 d
1.0 Kg K_2SO_4/tree	12.83 c	0.52 c	24.67 d	8.52 b	4.39 b
1.5 Kg K_2SO_4/tree	13.65 a	0.50 d	27.30 b	8.78 a	4.96 a
Foliar application					
0.5 % K_2SO_4	11.73d	0.50 d	23.46 e	8.28 c	3.18 d
1.0 % K_2SO_4	12.87 c	0.48 e	26.81 c	8.33 c	3.92 c
1.5 % K_2SO_4	13.37 b	0.44 f	30.39 a	8.74 a	4.42 b
			2010		
Control	11.63 g	0.51 a	22.80 g	6.65 f	2.99 g
Soil application					
0.5 Kg K_2SO_4/tree	11.70 f	0.49 b	23.88 f	8.46 e	3.25 f
1.0 Kg K_2SO_4/tree	12.93 b	0.48 c	26.94 d	8.78 c	4.54 b
1.5 Kg K_2SO_4/tree	13.97 a	0.46 d	30.37 a	8.95 a	4.70 a
Foliar application					
0.5 % K_2SO_4	11.87 e	0.49 b	24.22 e	8.40 e	3.29 e
1.0 % K_2SO_4	12.57 d	0.46 d	27.33 c	8.64 d	4.25 d
1.5 % K_2SO_4	13.73 c	0.43 e	31.92 b	8.85 b	4.36 c

Means not sharing the same letter (s) within each column for each year are significantly different at 0.05% level of probability.

All potassium levels and methods of applications increased TSS/acid ratio as compared with the control. Total sugars (%) increased significantly with increasing the levels of potassium; however, the highest significant values resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values which resulted from the control in the 1st and 2nd seasons. Carotene contents (mg/100 g f.wt.) values take the same trend as TSS contents, where, carotene contents increased significantly with increasing the levels of potassium, however, the highest significant values resulted from the highest level (1.5 Kg K_2SO_4/tree) as soil application as compared with the lowest values which resulted from the control in the 1st and 2nd seasons. The other levels showed in between values. The results of El-Seginy (2006) on apricot; Kassem and El-Seginy (2002) on peach and Attala (1997) are in harmony with the present result as regard to TSS and total sugars contents in fruit. Also, Bussi *et al.* (2003) found that increasing K fertilization enhanced fruit soluble solids and coloring.

CONCLUSION

It can be concluded from the above mentioned results that all potassium levels and methods of application under sandy soil conditions significantly increased fruit set, yield, fruit weight, TSS and total sugars as compared with the control. Potassium soil application at 1.5 Kg /tree was more effective than other soil or foliar applications and gave the highest values of fruit set, yield, fruit weight, TSS and total sugars and carotene contents as compared with the control and the other treatments.

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الملخص العربى

تأثير مستويات وطرق إضافة البوتاسيوم على أشجار المشمش صنف "كانينو" النامية في الأراضى الرملية

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تم تسميد أشجار مشمش صنف "كانينو" عمر ٩ سنوات منزرعة في تربة رملية بسماد البوتاسيوم كإضافة أرضية بمعدلات ٠,٥، ١,٠، ١,٥ كجم/شجرة/سنة أو رشاً على المجموع الخضري بتركيز ٠,٥، ١,٠، ١,٥ % خلال موسمين متتالين (٢٠٠٨-٢٠٠٩ و ٢٠٠٩-٢٠١٠).وبصفة عامة، فان كل مستويات البوتاسيوم وطريقتي الإضافة أدت إلى زيادة معنوية فى عقد الثمار والمحصول ووزن الثمرة والمواد الصلبة الذائبة والسكريات الكلية عند مقارنتها بالقيم الناتجة عن معاملة المقارنة(كونترول). ولكن وجد أن المعدل الأعلى من البوتاسيوم (١,٥كجم/شجرة/سنة) كإضافة أرضية كان أكثر تأثيراً من كل معاملات الرش الورقي، وقد أدى استخدام هذا المعدل إلى أعلى عقد ومحصول ووزن الثمرة ومحتوى الثمرة من المواد الصلبة الذائبة والسكريات الكلية والكاروتينات، وذلك عند مقارنتها بالكنترول والمعاملات الأخرى. في نفس الوقت، فأن كل معاملات البوتاسيوم سواء المستويات أو طريقة الإضافة أدت إلى زيادة محتوى الأوراق من النتروجين والبوتاسيوم بينما لم يتأثر مستوى الفوسفور وذلك بالمقارنة بمعاملة الكونترول. كذلك فان معاملات البوتاسيوم لم تعطي اتجاه محدد بالنسبة لمحتوى الأوراق من الحديد والزنك والمنجنيز.