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Improve Productivity and Fruit Quality of Florida Prince Peach Trees Using Foliar and Soil Applications of Amino Acids

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Abstract: Florida Prince peach trees grown under calcareous soil conditions were treated with amino acids (in form of Pepton as a commercial product) as foliar and/or soil application. The treatments were arranged as follows: (1) control (spraying water only) (2) soil application at 0.25% (3) Foliar spray at 0.25% (4) Soil application at 0.50 % (5) Foliar spray at 0.50 % (6) Soil application at 0.25% + foliar spray 0.25% (T2+T3) (7) Soil application at 0.50% + foliar spray at 0.50% (T4+T5). All treatments were applied after fruit set and repeated four times at 15 days intervals. The results indicated that, foliar and/or soil application of amino acids had a positive effect on productivity and fruit quality, leaf mineral content and chlorophyll contents. Application of amino acids as foliar spray combined with soil application at 0.50% for both is the promising treatment for improving growth and fruit characteristics of 'Florida Prince' peach.

Key words: Peach · Amino acids · Yield · Fruit quality · Foliar and Soil applications · Calcareous soil

INTRODUCTION

Peach is one of the most important deciduous fruit trees in Egypt. The harvested area in Egypt reached 33017 ha produced 273256 Tons [1]. Peach's cultivation spreads in many areas in Egypt especially in the newly reclaimed lands which include many types of soil. Under calcareous soil conditions, fruit trees cultivation needs special treatments to improve the productivity and fruit quality. Calcareous soil has a free calcium carbonate ($CaCO_3$) in the profile more than 8 %. The carbonates, due to their relatively high solubility, reactivity and alkaline character, buffer the pH of most calcareous soils within the range of 7.5 to 8.5. Therefore, the practices for fruit trees in calcareous soils are differ than those in non-calcareous soils due to the effect of soil pH on soil nutrient availability and chemical reactions that affect the loss or fixation of almost all nutrients [2]. The amino acids play an important role in reducing pH of the soil when they were conducted directly as the soil application. Therefore, uses of the amino acids improve nutrient availability especially microelements in calcareous soils by decreasing soil pH. Also, foliar application of the amino acids is very necessary for plants under calcareous soil conditions because they considered as precursors and constituents of proteins [3] which are important for stimulation of cell growth due to they contain both acid and basic groups and act as buffers, which help to maintain favorable pH value within the plant cell [4]. Amino acids can directly or indirectly influence the physiological activities in plant growth and development. Moreover, the exogenous application of amino acids have been reported to modulate the growth, yield and fruit quality of Perlette, Red Globe and Red Roomy grapes [5-7], Williams pears [8] and they are used to improve the growth of Kronaki olive seedlings [9]. Florida Prince Peach is an early cultivar that adapt to Egypt's local environmental conditions. It appears in the markets before the other fruits due to its low chilling and temperature requirements that achieve early flowering and fruit maturation. Therefore, Florida Prince Peach is considered as promising cultivar in Egypt [10].

The aim of this study is to investigate the effect of exogenous application of amino acids on productivity and fruit quality of 'Florida Prince' peach trees under calcareous soil conditions.

MATERIALS AND METHODS

Plant Materials and Treatments: The present study was conducted during the two successive seasons; 2009/2010 and 2010/2011 at Al-Nobaria district near Alexandria,

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Table 1: Physical and chemical properties of the experimental soil

Particle size distribution (%)							Available nutrients: Cations (meq/L)				Available nutrients: Anions (meq/L)			
Sand	Silt	Clay	Texture	Ca CO_3 (%)	EC(1:1)	pH	K^+	Na^+	Mg^{++}	Ca^{++}	SO_4^{--}	Cl^-	HCO_3^-	CO_3^{--}
72.12	17.46	9.42	Sandy loam	14	2.00	7.52	0.74	4.0	7.5	10	17.74	2.0	2.5	0

Egypt on eight years old Florida Prince Peach trees (*Prunus persica*) budded on Nemaguard rootstock and grown in calcareous soil under drip irrigation system. The soil physical and chemical properties are shown in Table 1. The trees were planted at 4 x 5 m spacing, pruned on November and the selected trees were chosen in similar figure. In October before pruning, the trees were fertilized with organic manure (0.2 % N) and elemental sulfur (90 % S) at a rate of 10 and 1.5 kg per tree, respectively. Also, 1kg Ammonium nitrate (33% N) and 1.5 kg potassium sulphate (48% K_2O) per tree were mixed with the organic matter then the mixture was added to the soil in two holes for each tree which were dug on both sides of the tree and those located beside the shadow of the tree (at depth of 50 cm) then the holes were covered with sand and irrigated to provide adequate moisture for the degradation of organic fertilizers. In the first week of December for both seasons, the trees were sprayed with potassium nitrate 7% of the compound fertilizer (6:6:42 N:P:K) plus 0.5% mineral oil to break the bud dormancy. After fruit set when the fruits reached pea size, fruitlets were thinned (15 cm apart on the same branch to leave 300 fruitlets per tree). All trees of this experiment were received the same recommended fertilization through the drip irrigation and also received the regular fungi, pest and weed control treatments. Trees were arranged in randomized complete block design (RCBD) and the following seven treatments were done with three replicates for each treatment (1 replicate = 3 trees):

- Control (spraying water only).
- Soil application of Pepton at 0.25% (Amino acids).
- Foliar spray of Pepton at 0.25%.
- Soil application of Pepton at 0.50 %.
- Foliar spray of Pepton at 0.50 %.
- Soil application of Pepton at 0.25% + foliar spray of Pepton at 0.25% (T2+T3).
- Soil application of Pepton at 0.50% + foliar spray of Pepton at 0.50% (T4+T5).

Pepton 85/16 is a commercial product of mixture of 18 amino acids. The total percent of amino acids in the product is 85% (16% as free amino acids in L-á type) + 12% organic nitrogen + 3% potassium oxide. All Treatments were applied after fruit set and repeated four times at 15 days intervals. Tween-20 (0.1%) as surfactant was added to the foliar solution then the foliar application was applied directly to trees with a handheld sprayer until runoff in the early morning.

Yield: In both seasons, the yield of fruits from each tree was harvested at maturity stage on April and all the harvested fruits were weighed and the yield was recorded as kg/tree.

Fruit Characteristics at Harvest

Physical Characteristics: At harvest, a sample of 10 fruits for each replicate was randomly collected to use for determining the following physical characteristics: fruit weight (g), fruit length (cm), fruit width (cm), fruit volume (cm^3), flesh firmness ($lb/inch^2$) using fruit pressure tester.

Chemical Characteristics: Another sample of 10 fruits for each replicate was randomly chosen in both seasons to determine the following chemical characteristics: total soluble solids % (TSS) using a hand referctometer, fruit acidity % (TA) as malic acid was determined by titration using 0.1 N of Na OH according to A.O.A.C [11] and maturity index (MI) defined as the TSS/TA ratio was estimated. Total anthocyanins content was determined according to Abd El-Razek [12] where, four fruits from each sample were weighed, homogenized in a solution of MeOH: formic acid (95:5) under cooling, put in ultrasonic bath at 4°C for 30 min., centrifuged at 5000 rotation/min for 10 min. at 4°C, filtered through a folded filter paper 595½ (Whatman®, Germany), then refilled to 25 ml., shaked well, absorbance at 520 nm by Spectrophotometer and the obtained data were compared with the standard curve of cyanidin and expressed as mg cyanidin/100 g fresh weight.

Leaf Content of Macro-Nutrients: Macro-nutrients were determined in dry leaf samples which collected at the second week of July of each season and were taken from the sixth node from the base of shoots. Nitrogen % was measured by Micro-Kjeldahl according to Pregel [13].

Also, phosphorus % was determined as described by Chapman and Parker [14], while potassium % was measured according to Brown and Lilleland [15].

Leaf Content of Chlorophylls: Forty leaves were collected on 1st May for each season, then chlorophylls (a) and (b) and (a+b) were determined spectrophotometrically at 660, 640 mm wavelength for chlorophyll (a) and (b), respectively, against the blank methanol using the method described by Beckett *et al*. [16].

Statistical Analysis: Data were analyzed by analysis of variance (ANOVA) and means were compared using Duncan's test at $p<0.05$ to determine the significance of differences between the conducted treatments [17].

RESULTS AND DISCUSSION

Results presented in Table 2 shows the effect of amino acids treatments on fruit weight and yield of Florida Prince Peach trees as production parameters during the two seasons of this study. All treatments increased fruit weight in both seasons compared with the control. The mean of two seasons indicate the combination between soil and foliar application at either 0.25 or 0.5% (T6 and T7) gave heavier fruit weight (65.07 and 65.79 g, consecutively) than T2, T3, T4 and the control (T1) (57.55, 60.61 59.03 and 45.19 g, respectively). On the other hand, there was no significant deference between T5 (62.28 g) and T6&T7. All treatments enhanced the yield than the control in the two seasons. The mean of both seasons clear that treatments included the combination between soil and foliar application (T6 and T7) had higher yield (58.56 and 59.21 Kg/tree consecutively) than T2, T3, T4 and the control (T1) (51.78, 54.55, 53.13 and 40.67 Kg/tree, respectively). However, there was no significant value between T5 (56.05 Kg/tree) and T6 & T7.

The increment in the yield could be explained as a result of increasing fruit weight and other physical parameters which were higher than the control during the two seasons of this study. Similar results were observed when some foliar treatments were applied to enhance fruit quality of Florida Prince peach trees. Where, amino acids treatment alone or combined with the other chemical stimulators achieved heavier fruit weight and higher yield than the control [18]. Furthermore, foliar applications of mixture of amino acids were conducted on Perlette grapes at different growth stages of grapevine. They improved the cluster weight and yield [5]. The same result was noticed when amino acids were applied as foliar spray on Williams pears [8], Red Roomy and Red Globe grapes [6, 7]. Also, application of bio-stimulants improved the cluster weight and yield of Roomy Red, Thompson Seedless, Superior and Flam Seedless grapes [19-22]. The same trends were observed on Keitte and Kensington Pride mango trees [23, 24].

Data in Table 3 present the effect of amino acids treatments on fruit length, width, volume and firmness of Florida Prince peach trees as fruit physical characteristics. Concerning fruit length and width, all treatments enhanced them compared with the control in both seasons of this study. Furthermore, mean of the two seasons pointed out that there was significant deference in fruit length and width between treatments T7 and T2. In this respect, T7 (soil application 0.50% + foliar application 0.50 %) enhanced fruit length and width than T2 (soil application 0.25%). All treatments enhanced fruit volume than the control in the two seasons of this research. Mean of the two seasons indicated that there were significant differences between treatments where, T7 produced the largest volume compared with all other treatments except T6. Moreover, T6 had higher fruit size than T2, T2, T4 and the control (T1). Furthermore, Flesh firmness was affected by all treatments during the two studied seasons and this character is considered evidence of maturity.

Table 2: Effect of amino acids treatments on fruit weight and yield of Florida Prince peach trees as parameters of prod3uctivity during the two seasons

	Fruit weight (g)			Yield (kg\tree)		
Treatments	First season	Second season	Mean	First Season	Second Season	Mean
T1= Control	45.70 d	44.67 d	45.19 d	41.13 d	40.20 d	40.67 d
T2= 0.25 % soil application	57.01 c	58.09 c	57.55 c	51.31 c	52.25 c	51.78 c
T3= 0.25 % foliar application	59.74 abc	61.48 abc	60.61 bc	53.77 abc	55.33 abc	54.55 bc
T4= 0.50 % soil application	56.88 c	61.18 abc	59.03 bc	51.19 c	55.06 bc	53.13 bc
T5= 0.50 % foliar application	57.72 bc	66.83 a	62.28 ab	51.95 bc	60.15 a	56.05 ab
T6=T2+T3	64.41 ab	65.73 ab	65.07 a	57.97 ab	59.16 ab	58.56 a
T7=T4+T5	65.61 a	65.79 ab	65.79 a	59.05 a	59.37 ab	59.21 a

Means within a column followed by different letter (s) are statistically different at 5 % level

Table 3: Effect of amino acids treatments on fruit length, width, volume and firmness of Florida Prince peach trees during the two seasons

	Fruit length (cm)			Fruit width (cm)			Fruit volume (cm^3)			Fruit firmness ($lb/inch^2$)		
Treatments	1st season	2ndseason	Mean	1st season	2ndseason	Mean	1st season	2ndseason	Mean	1st season	2ndseason	Mean
T1= Control	4.28b	4.27b	4.28c	4.23b	4.22b	4.23c	46.0c	45.3d	45.7d	7.30 a	7.08a	7.19a
T2= 0.25 % soil application	4.96a	4.98a	4.97b	4.93a	5.07a	5.00b	58.0b	59.0c	58.5c	5.16 b	4.95b	5.06b
T3= 0.25 % foliar application	5.06a	5.18a	5.12ab	5.00a	5.15a	5.08ab	61.5ab	63.0c	62.3bc	4.33c	3.97c	4.15c
T4= 0.50 % soil application	5.02a	5.01a	5.06ab	4.96a	5.11a	5.04ab	58.0b	63.0c	60.5c	4.32c	4.4 bc	4.29c
T5= 0.50 % foliar application	4.98a	5.02a	5.05ab	4.93a	5.22a	5.08ab	57.7b	69.7ab	63.7bc	4.18c	3.98c	4.15c
T6=T2+T3	5.12a	5.02a	5.11ab	5.11b	5.30a	5.21a	68.7a	63.7bc	66.2ab	4.10c	3.93c	4.07c
T7=T4+T5	5.22a	5.01a	5.16a	5.19a	5.23a	5.21a	69.0a	71.0a	70.0a	3.35d	3.02d	3.18d

Means within a column followed by different letter (s) are statistically different at 5 % level.

Table 4: Effect of amino acids treatments on fruit total soluble solids (TSS %), acidity, TSS/acid ratio and total anthocyanins in fresh fruit weight of Florida Prince peach trees during the two seasons

	TSS (%)			Acidity (%)			TSS/acid ratio			Total anthocyanins (mg/100 g fresh fruit weight)		
Treatments	1st season	2ndseason	Mean	1st season	2ndseason	Mean	1st season	2ndseason	Mean	1st season	2ndseason	Mean
T1= Control	5.73d	5.85d	5.79c	0.48b	0.44b	0.46b	12.09e	13.18d	12.58e	3.11d	3.18d	3.15c
T2= 0.25 % soil application	7.47bc	7.70bc	7.58b	0.52a	0.38c	0.45b	14.25de	20.16b	16.74c	4.06bc	4.18bc	4.11b
T3= 0.25 % foliar application	7.97ab	7.90bc	7.93ab	0.44c	0.49a	0.46b	18.32c	16.13c	17.13c	4.33ab	4.29bc	4.31ab
T4= 0.50 % soil application	7.00c	8.2ab	7.60b	0.51ab	0.48a	0.49a	13.72e	17.34c	15.38d	3.80c	4.45ab	4.13b
T5= 0.50 % foliar application	8.2 ab	7.37c	7.78ab	0.49ab	0.43b	0.46b	16.91cd	17.20c	17.04c	4.45ab	4.00c	4.23ab
T6=T2+T3	8.73a	7.43c	8.08ab	0.30e	0.34d	0.32d	29.02a	21.68ab	25.10a	4.74a	4.04c	4.39ab
T7=T4+T5	8.00ab	8.63a	8.32a	0.38d	0.38c	0.38c	21.68b	23.10a	21.95b	4.35ab	4.69a	4.52a

Means within a column followed by different letter (s) are statistically different at 5 % level.

The results indicated that all treatments accelerated fruit maturation than the control (T1) in the two seasons. Also, the treatments varied in this parameter. The mean of the two seasons confirmed that T7 was the lowest one (3.18 $lb/inch^2$), followed by T3, T4, T5 and T6 (4.15, 4.29, 4.15 and 4.07 $lb/inch^2$, consecutively), then T2 came in the next order (5.06 $lb/inch^2$) in comparison to the control (7.19 $lb/inch^2$).

Increase fruit length, width and volume explain the increment in fruit weight that reflected on the yield. Also, the increase in physical fruit parameters improved the quality. Similar trends were observed about the effect of amino acids treatments and bio-stimulants on fruit length, width, volume and firmness on Perlette, Red Globe, Superior, Flam Seedless, Roomy Red and Thompson seedless grapes [5,6,7,19-22], Florida Prince Peach [18], Keitte and Kensington Pride mango trees [23,24] and Williams pears [8]. Fruit firmness is good guide for fruit maturity. The acceleration of fruit maturation is marketing's benefit for early cultivars such as Florida Prince. In this respect, all amino acids treatments accelerated the fruit maturity than the control especially T7 (soil application 0.50% + foliar application 0.50 %) which was the accelerated one. Therefore, the use of amino acids are consider a good practice for early marketing of Florida Prince due to their acceleration for fruit maturity and their providing for the markets with the fruits earlier than the untreated orchards. This result is consistent with Ola [25], who determined maturity and beginning of ripping and extending shipment period of some peach cultivars. Moreover, Florida Prince Peach was described as a promising cultivar when it was introduced

in Egypt due to its exhibition for high adaptation with the local environmental conditions and it is expected that the appearance of Florida Prince peach very early in the markets in the case of use treatments that accelerate fruit maturity [10].

The present data in Table 4 demonstrated the effect of amino acids treatments on total soluble solids % (TSS), acidity %, TSS/acid ratio and total anthocyanin in fresh fruit weight of Florida Prince Peach trees. Concerning TSS %, all amino acids treatments significantly increased T.S.S in comparison with the control during the two seasons. Mean of the two seasons pointed out that there was significance in the value of T.S.S related with the amino acids treatments. In this respect, the highest value of TSS % was achieved by T7 (8.32%) followed by T4 (7.58%) and T2 (7.60%). While, there were no significance between the other amino acids treatments.

Regarding the fruit acidity %, all treatments were varied significantly in the two seasons. Mean of the two years cleared that there were no significant differences between control and T2, T3 and T5. The soil application at 0.50% of amino acids (T4) increased significantly the acidity% (0.49%) than the control, T2, T3, T5 (0.46, 045, 046 and 0.46%, respectively). While, T6 (soil application + foliar application at 0.25 %) was recorded the lowest acidity (0.34 %), followed by T7 (soil application + foliar application at 0. 50 %) that was 0.38 %. As for the maturity index (MI) defined as the TSS/TA ratio, all amino acids treatments affected significantly TSS/acid ratio in comparison with the control during the two seasons. Moreover, mean of both seasons of this study reported significant differences between amino acids treatments. In this trend, T6 had the greatest TSS/acid ratio which was 25.10 followed by T7 which was 21.95 then T2, T3 and T5 came in the next order which were 16.74, 17.13 and 17.04, respectively, followed by T4 which was 15.38 and the control came in the last order which was 12.58.

Regarding total anthocyanins in fresh fruit weight, all treatments increased significantly the content of anthocyanins in fruits compared with the control during the two seasons of this research. Mean of the both seasons indicated that there were significant differences between all amino acids treatments (4.11 to 4.52 mg/100 g fresh fruit weight) and the control (3.15 mg/100 g fresh fruit weight). Furthermore, there were significant differences among amino acids treatments since T7 increased the total anthocyanins (4.52 mg/100 g fresh fruit weight) than T2 and T4 (4.11 and 4.13, respectively). The results of this study confirmed that increase in TSS and TSS\TA ratio may be related with enzymes which are presented when amino acids enhanced the synthesis of different proteins, acids and sugars [5]. This explanation is in the line with using foliar application of green algae extract on Superior grapes which significantly improved T.S.S synthesis [21]. Similarly, application of bio-stimulants improved the TSS/TA ratios in Roomy Red and Thompson seedless grapes [19, 20]. All treatments increased acidity in fruits due to amino acids enhanced synthesis of different acids. This finding is in agreement with exogenous application of ascorbic acid which increased acidity of treated fruits [26]. Similarly, foliar application of mixture amino acids enhanced acidity in Perlette grapes [5].

The data in Table 5 present the effect of amino acids treatments on leaf mineral content of Florida Prince peach trees during the two seasons of this investigation. All treatments alter significantly NPK content than the control in the first and second seasons. Concerning leaf N%, mean of the two studied seasons showed that the amino acids treatments achieved higher content than the control. Meanwhile, there were significant differences among the treatments of amino acids. In this respect, T7 had higher content of N (2.77%) in comparison with T2 (2.41%) and T5 (2.43%).

Table 5: Effect of amino acids treatments on leaf mineral content of NPK of Florida Prince peach trees during the two seasons

	N (%)			P (%)			K (%)		
Treatments	1st season	2ndseason	Mean	1st season	2ndseason	Mean	1st season	2ndseason	Mean
T1= Control	1.77 c	1.85 c	1.81 c	0.22 d	0.24 c	0.23 d	1.16 e	1.19 e	1.18 e
T2= 0.25 % soil application	2.35 b	2.47 b	2.41 b	0.33 c	0.34 b	0.34 c	1.27 d	1.30 d	1.29 d
T3= 0.25 % foliar application	2.47 ab	2.61 ab	2.54 ab	0.35 c	0.37 b	0.36 c	1.33 c	1.36 cd	1.35 cd
T4= 0.50 % soil application	2.50 ab	2.56 ab	2.53 ab	0.34 c	0.36 b	0.35 c	1.38 c	1.42 c	1.40 c
T5= 0.50 % foliar application	2.40 ab	2.46 b	2.43 b	0.35 c	0.37 b	0.36 c	1.45 b	1.48 b	1.46 b
T6=T2+T3	2.60 ab	2.78 a	2.69 ab	0.41 b	0.43 a	0.42 b	1.47 b	1.51 b	1.49 b
T7=T4+T5	2.73 a	2.81 a	2.77 a	0.45 a	0.46 a	0.46 a	1.54 a	1.58 a	1.56 a

Means within a column followed by different letter (s) are statistically different at 5 % level.

Table 6: Effect of amino acids treatments on leaf content of chlorophyll (a) and (b) and (a+b) of 'Florida Prince' peach trees during the two seasons

	Chlorophyll (a) (mg/100 g FW)			Chlorophyll (b) (mg/100 g FW)			Chlorophyll (a+b) (mg/100 g FW)		
Treatments	First season	Second season	Mean	First Season	Second Season	Mean	First season	Second season	Mean
T1= Control	26.3 e	23.2 c	24.8 d	16.8 d	20.3d	18.6d	43.0e	43.5c	43.3e
T2= 0.25 % soil application	28.7 d	31.0 b	29.9 c	24.8 c	26.8c	25.8c	53.4d	57.8b	55.6d
T3= 0.25 % foliar application	29.9cd	32.8ab	31.4bc	26.5 c	27.8c	27.2c	56.3cd	60.5b	58.4cd
T4= 0.50 % soil application	31.2 c	32.2ab	31.7 b	25.5 c	27.3 c	26.4c	56.7cd	59.4b	58.1cd
T5= 0.50 % foliar application	32.6 b	31.0 b	31.8 b	26.5 c	29.5bc	28.0c	59.1c	60.5b	59.8c
T6=T2+T3	33.2 b	35.0 a	34.1a	30.8b	32.3ab	31.6b	64.0b	67.2a	65.6b
T7=T4+T5	34.7 a	35.3 a	35.0 a	33.5a	35.0 a	34.3a	68.2 a	70.3a	69.2 a

Means within a column followed by different letter (s) are statistically different at 5 % level.

Regarding leaf P content, the mean of the two seasons cleared that all amino acids treatments recorded higher leaf P than the control. Between the amino acids treatments, there were significant variations. In this concern, T7 achieved the highest P value (0.46%) followed by T6 (0.42%) and T2, T3, T4 & T5 came in the next order (0.34, 0.36, 0.35 and 0.36%, respectively). Leaf K content was increased by all treatments than the control during the two seasons of this study. The mean of both seasons pointed out that all amino acids treatments increased the leaf K content than the control. Moreover, there were significant differences through the amino acids treatments since T7 had the highest content of K (1.56%), followed by T5 & T6 (1.46 and 1.49%, respectively), T4 came in the middle level (1.40%) and T2 & T3 (1.29 and 1.35, respectively) came at the last level. Similar results were found on Eldorado and Andross peaches [27, 28], Red Globe and Perlette grapes [6,5] by foliar application of mixture amino acids alone or combined with other stimulation's compounds. Since, treated plants had higher content of leaf N, P, K than untreated ones. In general, organic and bio-stimulants treatments enhanced the leaf content of macro nutrients than the untreated trees. It was observed on Florida Prince and Desert Red peaches [29, 30, 31], Canino apricot trees [32], Valencia orange trees [33] and 'Flame Seedless' grapevines grown in calcareous soil [34].

Table 6 shows the effect of amino acids treatments on leaf content of chlorophyll (a) and (b) and (a+b) of Florida Prince Peach trees during the two seasons. All treatments increased chlorophyll (a) in the two seasons of this study. The mean of two years pointed out that there were significant differences between treatments since T6 and T7 gave the higher content of chlorophyll (a), followed by T3, T4 and T5. On the other hand, T2 was the lowest one. Concerning, chlorophyll (b), all amino acids applications enhanced it than the control during the two seasons. Mean of the two seasons confirmed that there were significant variations among the applications. However, T7 had highest content of chlorophyll (b), followed by T6 then the other treatments came in the next order. Regarding chlorophyll (a and b), they were increased by all amino acids applications in comparison with the control during two seasons. Among the treatments, there were significant differences. The mean of two years indicate that T7 was the superior in the content of chlorophyll (a and b), T6 came in the next level then came the other treatments in the last level.

In general, application of amino acids significantly improved leaf chlorophyll contents.

This increment in chlorophyll contents might be due to availability of higher levels of amino acids to the treated plants. Similarly, exogenous application of bio-stimulants resulted in increase of the chlorophyll contents in ‘Fuji’ apple leaves with a consequent increase in the photosynthesis and respiration rates [35].

CONCLUSION

Foliar and/or soil application of amino acids had a positive effect on productivity and fruit quality, leaf mineral content and chlorophyll contents. Application of amino acids as foliar spray combined with soil application at 0.50% for both is the promising treatment for improving growth and fruit characteristics of Florida Prince Peach.

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