Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 14(1), 337-347, 2006

EFFECT OF SPRAYING MAGNESIUM, BORON, ASCORBIC ACID AND VITAMIN B COMPLEX ON YIELD AND FRUIT QUALITY OF "CANINO" APRICOT

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ABSTRACT

Canino apricot trees received four sprays of magnesium sulphate at 0.5%, 1.0% and 3.0%, boric acid at 0.2, 0.5 and 1.0%, ascorbic acid at 250, 500 and 1000 ppm, Vitamin B complex at 100, 200 and 400 ppm and a combination of the medium concentrations of each substrate were evaluated during 2004 and 2005 seasons. Single or combined application of magnesium, boron, ascorbic acid or vitamin B complex was favourable for improving leaf area, leaf mineral content (N, P, K and Mg), yield as well as physical and chemical properties of the fruits compared to untreated trees. The promotion effect was associated with increasing the applied concentrations. Using magnesium, born, ascorbic acid and vitamin B complex, in descending order was very effective in improving growth, nutritional status, fruit quantity and quality. Carrying out four sprays at starting growth, after blooming, after fruit setting and at three weeks later with a combination of 1.0% magnesium sulphate, 0.5% boric acid, 500ppm ascorbic acid and 200 p.p.m vitamin B complex suggested to be beneficial in improving growth, nutritional status, yield and fruit quality of "Canino" apricot.

Keywords: Apricot, Boron, Ascorbic acid, Yield, Quality

INTRODUCTION

Improving productivity of "Canino" apricot trees growing under sandy soil could be achieved through supplying the trees with their requirements from nutrients and antioxidants at the optimum concentration.

It is well known that, vitamins act as co-enzymes in a number of enzymes and thus take apart in the regulation of metabolism. Recently, it was suggested that B-vitamins participate in plant growth and development indirectly by enhancing the endogenous levels of various growth factors such as cytokinins and gibberellins (**Kodendaramaiah and Gopala-Rao, 1985**). Most B- vitamins are synthesized in leaves and translocated in the phloem. For more than two decades, studies of role of B- vitamins groups in plants have attracted sporadic attention. These studies have indicated that various physiological processes e.g. nutrient uptake, respiration, photosynthesis as well as chlorohyll and protein synthesis de-

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(Received November 1, 2005)
(Accepted December 21, 2005)

pend more or less on the availability of B- vitamins (**Samiullah *et al* 1988**).

Vitamins with their antioxidative properties play an important role in plant defense against oxidative stress induced by surfactants and selected pesticides (**Orth *et al* 1993**). Application of vitamins was accompanied with enhancing growth and productivity of fruit crops (**Oertli 1987; Farag, 1999; Morsy & EL-Bana, 2000 and Nomier–Safaa, 2000**). Nowadays, there is awidespread use of the antioxidants especially ascrobic acid as natural and organic antioxidant compound has an auxinic action. It has synergistic effect on improving growth, flowering, yield and fruit quality of fruit crops (**Prusky, 1988; Ahmed *et al* 1997a, 1998a & 1998b and Khiamy, 1999**).

Canino apricot trees grown under sandy soil suffer from nutrients deficiencies particularly magnesium and boron due to the high fixing rate beside the low soil fertility. The continuous exhaustion due to the growth of the development of fruits can also aggrevate magnesium and boron deficiency symptom. As it is known, the nutritional status of the trees has a striking and important role in controlling fruiting. Application of born (**Abd-EL-Aziz, 1994; Mirabdulbaghi, 1996; Wojcik *et al* 1997; Ahmed *et al* 1997 and Ahmed & Morsy, 2001**) and Magnesium (**Yogaratnam & Greenham, 1982; Nijjar, 1995; Chekan, 1988 & 1989; Guo & Xu, 1998 and Ahmed & Morsy, 2001**).

Therefore, this study aimed to evaluate the role of in magnesium, boron, B-vitamins and ascrobic acid in improving growth, nutritional status, yield and fruit quality of canino apricot trees grown under reclaimed sandy soil.

MATERIAL AND METHODS

This study was established in 2004 and 2005 seasons on fourty- two Canino apricot trees grown in a private orchard located at Nobareia, EL Behera Governorate. The trees were 10 years old at the start of such study. They were grown in sandy soil and planted at 5 ×5 m apart. Trees were similar in growth vigour. regular agricultural practices such as hoeing, drip irrigation, fertilization and pest control management were done as usual to all the investigated apricot trees.

The experiment included the following fourteen treatments

1- Control (untreated trees).
2- Spraying magnesium sulphate (9.6% Mg) at 0.50%.
3- Spraying magnesium sulphate at 1.0%.
4- Spraying magnesium sulphat at 3.0%.
5- Spraying boric acid (17%B)at 0.20%
6- Spraying boric acid at 0.5%.
7- Spraying boric acid at 1.0%.
8- Spraying ascorbic acid at 250 p.p.m
9- Spraying ascorbic acid at 500p.p.m.
10- Spraying ascorbic acid at 1000 p.p.m.
11- Spraying vitamin B complex at 100 p.p.m.
12- Spraying vitamin B complex at 200 p.p. m.
13- Spraying vitamin B complex at 400 p.p.m.
14- A combination of 1% Mg SO4, 0.5% boric acid, 500 p.p. m ascorbic acid and 200 p.p. m vitamin B complex.

The all tested treatments were sprayed four times in the same trees

1-One at growth start (1st week of Feb).
2-Twice after blooming (3 rd week of March).
3-Three just after fruit setting (1st week of April).
4-Four at three weeks later (last week of April).

The experiment was designed in a completely randomized blocks with three replicates, each consisted of one tree. It is worthy to mention that, vitamin B complex consist from B2 (riboflavin), B3 (Aneurine hyrochloride) and B4 (nicotinamide). Triton B as a wetting agent was added at 0.1% for all spraying treatments. All trees were sprayed till run off (15 L/ tree), untreated trees was sprayed with tap water.

The results of the orchard soil analyses (according to **Wilde *et al* 1985**) are given in Table (1).

Samples of twenty leaves from the middle part of the shoots (According to **Chuntonaparb and Cummings, 1981**) were selected at random from each replicate (2nd week of July) to measure their area (cm.2) (According to **Ahmed & Morsy, 2001**) and to determine their content of N, P. K and Mg (According to **Wilde *et al* 1985**) on dry weight basis.

Yield expressed in weight (kg) and number of fruits per tree was recorded at harvest (last week of May and June).

Samples consisting of twenty fruits were randomly taken at harvest time from each replicate for determining average fruit weight (g), fruit diameter, total soluble solids %, total and reducing sugar % and total acidity % (expressed as g malic acid per 100g pulp) (**A.O.A.C., 1985**). All the obtained data were tabulated and statistically analyzed according to **Gomes and Gomes (1984)**. The differences among various treatment means were tested by New L. S. D parameter.

Table 1. Some characteristics of the soil at the trial location particle size distribution

Sand %	85.0
Silt %	13.2
Clay %	1.80
Texture grade	Sandy
PH (1 : 2.5 extract)	7.55
EC (1:2.5 extract) (mmhos/ cm/25°C)	0.69
Total Ca Co_3 %	5.2
O. M%	0.71
Total N	0.036
Available P	3.15
Available K (ammonium acetate, p.p.m)	189.3
Available Mg^{++} (p.p.m.).	1.72
DTPA extractable micronutrients (p.p.m)	
Fe	2.22
Mn	3.30
Cu	1.1
Zn	1.6

RESULTS AND DISCUSSION

1- Effect of spraying some nutrients on the leaf are

It is clear from the data in Table (2) that folair application of magnesium sulphate at 0.50 to 3.0% , boric acid at 0.20 to 1.0%, ascorbic acid at 250 to 1000 p. p. m and vitamin B complex at 100 to 400 p. p. m either singly or in combination significantly stimulated the leaf area compared to unspraying trees. The great promotion was occurred on trees received

Table 2. Effect of magnesium sulphate, boric acid, ascorbic acid and vitamin B complex on some physical properties and yield of "Canino" apricot trees during 2004 and 2005 seasons.

Treatment	Leaf area (Cm^2)		No. of fruits/trees		Yield (kg) per tree		Fruit weight (g)		Fruit diameter (Cm)		Pulp %		Seed %		Peel %	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Control	20.10	19.30	160 0	165.3	17.70	17.60	113.0	109.4	3.20	3.30	60.30	62.20	15.10	16.10	24.6	21.70
Magnesium sulphate at 0.5%	25.10	23.20	228.0	259.0	38.10	39.70	168.0	154.0	4.0	4.20	65.20	67.40	13.80	14.70	21.0	17.90
Magnesium Sulphate at 1.0%	25.60	24.0	249.0	279.0	44.6	45.6	179.60	163.8	4.20	4.43	66.30	68.30	12.20	13.30	21.50	18.40
Magnesium Sulphate at 3.0%	25.70	24.10	253.0	280.0	45.40	45.8	180.0	164.0	4.50	4.90	67.50	69.56	12.00	13.0	20.50	17.44
Boric acid at 0.20%	23.70	22.10	211.0	221.0	32.0	31.30	153.0	142.8	3.50	3.70	64.70	66.80	11.0	12.0	24.30	21.20
Boric acid at 0.5%	24.20	22.60	228.0	234.0	37.60	36.10	166.0	152.0	3.63	3.87	65.50	67.60	10.90	11.80	23.60	20.60
Boric acid at 1.0%	24.30	22.70	229.0	240.0	38.20	36.50	167.70	153.0	3.75	3.90	69.60	70.0	10.10	11.21	20.30	18.74
Ascorbic acid at 250 P.P.m	22.50	21.10	164.0	202.0	26.60	26.20	139.0	131.4	3.80	3.95	68.70	70.70	11.00	12.0	20.30	17.30
Ascorbic acid at 500 P.P.m	23 10	21.50	209.0	219.0	31.0	30.80	151.0	142.0	3.90	3 97	69.80	71.80	10.00	11.10	20.20	17.10
Ascorbic acid at 1000 P.P.m	23.20	21.60	211..0	220.0	31.80	31.10	152.0	142.7	4.10	4.30	70.0	72.00	10.20	11.30	19.80	16.70
Vitamin B complex at 100 P.P.m	21.10	19.80	177 0	183.0	21.70	21.60	125.0	119.9	4.34	4.45	71.30	73.30	9.50	10.50	19.20	16.2
Vitamin B Complex at 200 P.P.m	21.90	20.30	193.0	201.0	26.30	25.90	138.0	130.0	4.67	4.78	75.40	77.40	9.60	10.63	15.0	11.97
Vitamin B complex at 400 P.P.m	22.0	20.40	194.0	202.0	26.70	26.20	139.30	131.30	4.90	4.95	77.50	79.00	9.80	10.80	12.70	10.20
Combined treatments	26.30	24.80	289.0	300.0	55.50	52.90	192.30	177.0	5.20	5.50	85.60	85.60	9.30	9.50	5.10	4.90
New L.S.D at 5%	0.5	0.4	15.0	16.0	3.90	3.70	11.20	9.30	0.04	0.05	1.00	1.10	0.90	1.00	N.S	N.S

* Magnesium sulphate at 1.0%, Boric acid at 0.5%, Ascorbic acid at 500ppm, and Vitamin B complex at 200 ppm

magnesium sulphate, boric acid, ascorbic acid and vitamin B complex in descending order. The promotion was associated with raising concentration of each material. Combined application of all materials was preferable in improving the leaf area than single application of each compound. The maximum leaf area in both seasons (26.30 and 24.80 cm2) was recorded on the trees sprayed four times with a mixture containing all substances at the medium concentrations. Meanwhile, untreated trees produced the smaller leaves (20.1 and 19.3 cm2 in both seasons). These results were true in both seasons. The beneficial of Mg, B, ascorbic acid and B-Vitamins on the biosynthesis and movement of organic foods and natural hormones as well as the uptake of nutrients could explain the present results (**Samiullah *et al* 1988 and Nijjar, 1995**).

These results are in agreement with obtained by **Ahmed and Morsy (2001)** who worked on Mg, **Abd EL-Aziz (1994) and Ahmed *et al* (1997b)** who worked on Boron.

Ahmed *et al* (1997a) and Khiamy (1999) who worked on ascorbic acid and **Morsy and EL-Bana (2000)** who worked on vitamins B.

2- Effect of spraying some nutrients on yield characteristics

It is evident from the data in Table (2) that yield expressed in weight and number of fruits per tree was positively affected by spraying Canino apricot trees with magnesium sulphate, Boric acid, ascorbic acid and vitamin B complex either singly or at the medium concentrations compared to unspraying. There was a gradual promotion on the yield with raising concentration of each compound. Significant differences on the yield were observed between all concentrations and various compounds except between the medium and the higher concentrations. In ascending order, foliar application of vitamin B complex, ascorbic acid, boric acid and magnesium sulphate was very effective for promoting the yield expressed in weight and number of fruits per tree. Using all compounds at the medium concentrations was followed by obtaining the maximum tree yield (55.5 and 52.9 kg in both seasons, respectively). The minimum yield (17.7 and 17.6 kg in both seasons) was recorded in untreated trees. These results were true in both the two experimental seasons. The stimulation on growth and nutritional status of the trees surely reflected on improving the yield. Similar results were obtained by **Guo & Xu (1998) and Ahmed & Morsy (2001)** who worked on Mg **Abd–EL-Aziz (1994) and Ahmed *et al* (1997b)** who worked on Boric acid. **Ahmed *et al* (1997b) and Ahmed *et al* (1998 b)** who worked on ascorbic acid and **Nomier–Saffaa (2000)** who worked on vitamins B.

3- Effect of spraying some nutrients on Leaf mineral content (N, P, K and Mg)

Data in Tables (3) clearly show that foliar application of magnesium sulphate at 0.5 to 3.0%, boric acid at 0.20 to 1.0%, ascorbic acid at 250 to 1000 p.p.m, vitamin B complex at 100 to 400 p.p.m and all compounds at the medium concentrations significantly raised percentage of N, p, k and Mg in the leaves compared to unspraying. The promotion was associated with increasing the applied concentrations.

Table 3. Effect of magnesium sulphate, boric acid, ascorbic acid and Vitamin B Complex on leaf minerals content (%) of "Canino" apricot trees during 2004 and 2005 seasons.

Treatment	N%		P%		K%		Mg%	
	2004	2005	2004	2005	2004	2005	2004	2005
Control	1.01	1.18	0.18	0.20	1.02	1.06	0.26	0.27
Magnesium sulphate at 0.5%	1.47	1.55	0.33	0.37	1.36	1.43	0.49	0.43
Magnesium sulphate at 1.0%	1.53	1.61	0.36	0.39	1.40	1.48	0.52	0.45
Magnesium sulphate at 3.0%	1.54	1.62	0.37	0.40	1.41	1.49	0.53	0.46
Boric acid at 0.20%	1.35	1.45	0.28	0.32	1.24	1.33	0.41	0.39
Boric acid at 0.5%	1.40	1.50	0.30	0.34	1.28	1.38	0.45	0.41
Boric acid at 1.0%	1.40	1.51	0.31	0.35	1.32	1.39	0.46	0.42
Ascorbic acid at 250 ppm	1.22	1.34	0.23	0.26	1.16	1.22	0.34	0.36
Ascorbic acid at 500 P.P.m	1.28	1.39	0.25	0.28	1.20	1.27	0.37	0.39
Ascorbic acid at 1000 ppm	1.30	1.40	0.26	0.29	1.21	1.28	0.38	0.40
Vitamin B complex at 100 ppm	1.08	1.23	0.20	0.22	1.07	1.10	0.28	0.30
Vitamin B complex at 200 P.P.m	1.15	1.28	6.23	6.23	1.11	1.16	0.31	0.34
Vitamin B complex at 400 ppm	1.16	1.29	0.24	0.24	1.12	1.17	0.32	0.35
Combined treatments	1.59	1.68	0.40	0.42	1.45	1.56	0.56	0.50
New L.S.D at 5%	0.05	0.04	0.02	0.02	0.03	0.04	0.02	0.02

- Magnesium sulphate at 1.0%, Boric acid at 0.5%, Ascorbic acid at 500ppm. and Vitamin B complex at 200 ppm

Table 4. Effect of magnesium sulphate, boric acid, ascorbic acid and Vitamin B Complex on Some Chemical Characters of "Canino" apricot Fruits during 2004 and 2005 seasons.

Treatment	T. S. S.%		Total acidity%		Total Sugars%		Reducing Sugars%		Vitamin C (mg/100g pulp)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Control	13.6	14.00	0.499	0.491	10.10	10.40	4.11	4.05	11.0	11.10
Magnesium sulphate at 0.5%	15.20	15.40	0.345	0.340	11.40	11.80	4.38	4.36	12.30	12.40
Magnesium sulphate at 1.0%	15.40	15.60	0.320	0.318	11.70	11.90	4.39	4.40	12.50	12.60
Magnesium sulphate at 3.0%	15.40	15.70	0.317	0.314	11.70	12.10	4.41	4.42	12.60	12.70
Boric acid at 0.20%	14.70	15.10	0.395	0.381	11.10	11.40	4.30	4.27	13.00	13.30
Boric acid at 0.5%	15.10	15.30	0.370	0.361	11.30	11.60	4.34	4.32	13.50	13.60
Boric acid at 1.0%	15.10	15.30	0.370	0.360	11.40	11.60	4.35	4.33	13.56	13.61
Ascorbic acid at 250 P.P.m	14.30	14.70	0.410	0.420	10.60	12.0	4.23	4.20	14.30	14.50
Ascorbic acid at 500 P.P.m	14.50	15.0	0.395	0.400	10.80	11.20	4.26	4.22	14.60	14.65
Ascorbic acid at 1000 P.P.m	14.50	15.00	0.394	0.406	10.90	11.20	4.27	4.23	14.50	14.60
Vitamin B complex at 100 P.P.m	13.80	14.30	0.470	0.470	10.40	10.70	4.15	4.13	15.10	15.30
Vitamin B complex at 200 P.P.m	14.0	14.50	0.447	0.440	10.50	10.80	4.19	4.16	15.20	15.50
Vitamin B complex at 400 P.P.m	14.10	14.60	0.445	0.447	10.50	10.90	4.20	4.17	15.60	15.70
Combined treatments	15.70	16.00	0.296	0.294	11.90	12.30	4.45	4.52	16.30	16.50
New L.S.D at 5%	0.02	0.02	0.022	0.018	0.02	0.02	0.03	0.03	0.20	0.20

* Magnesium sulphate at 1.0%, Boric acid at 0.5%, Ascorbic acid at 500ppm. and Vitamin B complex at 200 ppm

Insignificant increase on these nutrients was observed among the medium and higher concentration of each material. Treating Canino apricot trees with vitamins B complex, ascorbic acid, boric acid and magnesium sulphate, in ascending order was responsible for maximizing these nutrients in the leaves. The maximum values were detected on the trees received all compounds at the medium concentrations. The untreated trees produced the leaves with the lowest values. These results were true in both experimental seasons. The effect of these nutrients on enhancing the uptake of N, P, K, and Mg could explain the present results. These results are in conordance with those obtained by **Ahmed and by Morsy (2001)** who worked on

Mg and B, **Khaimy (1999)** who worked on scorbic acid and **Nomier- Saffaa (2000)** who worked on vitamins B.

4– Effect of spraying some nutrients on fruit quality

Single or combined application of Mg, B, ascorbic acid and vitamin B complex was significantly effective in improving fruit quality in terms of increasing fruit weight, diameter or dimesions, pulp weight %, total soluble solids % and vitamin C as well as and reducing sugars and decreasing total acidity % and seed weight % compared to non application. The beneficial of these compounds in improving fruit quality could be arranged as follows in descending order Mg, B, ascorbic acid and vitamin B complex. Increasing concentrations was followed by a gradual promotion on fruit quality. Insignificant promotion on fruit quality was detected between the medium and higher concentrations. The best results with regard to fruit quality were obtained due to spraying Mg, B, Ascorbic acid and vitamin B complex at the medium concentrations. The untreated trees failed to produce fruits with the higher quality. Similar trend was observed in both the two experimental seasons (Tables 2 & 4). The improvement occurred in the fruit quality due to supplying the trees via leaves with Mg, B, ascorbic acid and vitamin B complex could be attributed to their effect on enhancing the biosynthesis and translocation of carbohydrates and advancing fruit maturity **(Nijjar, 1995).** These results were supported by the results of **Ahmed and Morsy (2001)** who worked on Mg and B, **Ahmed *et al* (1998a) and (1998b)** who worked on ascorbic acid and **Farag (1996)** and **Nomier–Safaa (2000)**, who worked on vitamin B complex. According to the aforementioned enclosed data, spraying 1.0% magnesium sulphate, 0.5% boric acid, 500 ppm ascorbic acid and 200 ppm vitamin B complex four times caused great beneficial in improving growth and productivity of Canino apricot trees.

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تأثير الرش بالماغنسيوم والبورون وحمض الأسكوربيك وفيتامين B المركب على المحصول وخصائص الجودة فى ثمار المشمش الكانينـــو

[٢٢]

إلهام زينهم عبد المعطى داود[١]- محمد فتحى محمد شاهين[١]

١- قسم بحوث الفاكهة - المركز القومى للبحوث - الدقى - القاهرة - مصر

تم رش أشجار المشمش الكانينو أربعة مرات بكبريتات الماغنسيوم بتركيز ٠,٥%، ١%، ٣%، حمض البوريك بتركيز ٠,٢%، ٠,٥%، ١%، حمض الأسكوربيك بتركيز ٢٥٠، ٥٠٠، ١٠٠٠ جزء فى المليون وفيتامين ب المركب بتركيز ٤٠٠،٢٠٠،١٠٠ جزء فى المليون إلى جانب المعاملة المركبة من كل هذه المواد مجتمعة بالتركيز الأوسط وذلك خلال موسمى ٢٠٠٤-٢٠٠٥ .

وكان الاستخدام الفردى أو المشترك للماغنسيوم، البورون، حمض الأسكوربك وفيتامين ب المركب مفيدا فى تحسين مساحة الورقة، المحتوى المعدنى للورقة (النيتروجين، الفوسفور، البوتاسيوم، الماغنسيوم)، المحصول وكذلك الخصائص الطبيعية والكيميائية للثمار وذلك مقارنة بعدم الاستخدام وكان التحسن مرتبطا بزيادة

التركيز المستخدم، وكان استخدم الماغنسيوم، البورون، حمض الأسكوربيك وفيتامين ب المركب مرتبة ترتيبا تنازليا فعالا جدا في تحسين النمو والحالة الغذائية للأشجار والمحصول وخصائص الجودة للثمار وقد كانت أحسن معاملة يمكن التوصية بها في تحسين النمو الخضرى والحالة الغذائية للأشجار والمحصول وجودة الثمار في أشجار المشمش الكانينو هي التي تضمنت رشة مركبة من ١% كبريتات ماغنسيوم، ٠,٥% حمض البوريك، ٥٠٠ جزء في المليون حمض الأسكوربيك، ٢٠٠ جزء في المليون فيتامين ب المركب ٤ مرات في بداية النمو، بعد التزهير، بعد مرحلة عقد الثمار وبعدها بثلاثة أسابيع.

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ا.د بطرس نصر بطرس