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Effect of Yeast, Humic Acid, Fulvic Acid, Citric Acid, Potassium Citrate and Some Chelated Micro-Elements on Yield, Fruit Quality and Leaf Minerals Content of "Canino" Apricot Trees.

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Abstract: This investigation was carried out during 2013 and 2014 growing seasons on "Canino" apricot trees grown in sandy soil conditions under drip irrigation located at El-Galatma, Berkash, Giza Governorate, Egypt. Aiming to study the effect of foliar sprays with active dry yeast at the concentration of 0.1%, 0.2, 0.3% and "mega power-x" as liquid organic fertilizer (19% Humic acid, 5% Free amino acids, 2% Fulvic acid, 2% citric acid, 2% potassium citrate and some chelated micro-elements) at concentrations 0.5, 1.0 and 1.5cm/L on yield, fruit quality; leaf minerals content leaf area and leaf pigments content.

Obtained results indicated that all treatments used were effective in increasing yield and fruit physical and chemical characteristics such as weight, dimensions and firmness, as well as TSS%, TSS/acid and total sugar %, were improved by different treatments used than the control. Whereas total acidity and number of fruit/one kilogram were decreased.

Furthermore leaf minerals content were significantly increased by different treatments than the control. Also, it was noticed that all treatments increased leaf area and leaf pigments content (chlorophyll a, b and carotenoids).

The best yield; fruit quality of canino apricot trees were obtained due to application of mega power-x at 1.5 cm/L at three times during full bloom, after fruit set and 3 weeks after fruit set.

Key words: Active dry yeast, liquid organic fertilizer, Humic acid, Fulvic acid, citric acid, potassium citrate, Amino acid, canino cv. Apricot fruit quality, leaf mineral content.

Introduction:

Apricot (*Prunus armeniaca* L.) is classified under the Prunus species of Prunodae, sub-family of the *Rosaceae* and family of the Rosales group. Apricot trees can grow over the five continents of the world and production level exceeds 3 million tons[1].

Apricot is one of the most important crops in Egypt, where the total cultured area is 18061 Feddans produced about 6.81 Tons/Feddan with total production 106165 Tons according to statistics of Ministry of Agriculture, Egypt[2]. Canino apricot is considered one of the important commercial cultivar planted in Egypt.

Some investigation studied the effect of yeast application on different fruit trees, they all found that yeast enhanced growth and fruit quality on red roomy[3], Valencia orange[4], Thompson seedless[5] and flame seedless[6].

The various positive effects of applying active dry yeast to different plants were attributed to its properties as it contain different nutrients, higher percentage of proteins, large amount of vitamin B and the natural plant growth hormones[7] yeast also contains cytokining thus delays the aging of leaves by the way of retardation of chlorophyll and enhancing the synthesis of protein and RNA[8, 9].

Humic acid (HA) and related products have been investigated in several crops for their ability to enhance growth. Some studies suggested that there compound (HA) have been shown to induce bioassay effects similar to there of cytokining and gibberellin on olive trees[10], and le-conte pear trees[11].

The objective of the present study was add more light on the effect of foliar sprays of active dry yeast and Humic acid (mega power-x) on yield, fruit quality, minerals content in leaf and leaf pigment content of canino apricot trees grown in reclaimed sandy soil.

Materials and Methods

This investigation was carried out through two successive seasons (2013 and 2014) on 12-year-old trees of canino apricot grown in a private orchard at El-Galatma (Berkash), Giza Governorate Egypt. Trees were grown in sandy soil and planted at 5x5m apart under drip irrigation system. Trees sprayed with two organic compounds: active dry yeast and mega power-x, the organic compounds used as foliar application during three stages. Forty two tree, nearly uniform in vigor, were selected and randomly shard between seven treatments including the control and arranged in a randomized complete block design. Each treatment was replicate three times with two trees for each replicate.

The different treatments were applied as follows.

1- Control (untreated trees).
2- Spraying with active dry yeast at 0.1%.
3- Spraying with active dry yeast at 0.2%.
4- Spraying with active dry yeast at 0.3%.
5- Spraying with mega power-x at 0.5cm/L water.
6- Spraying with mega power-x at 1.0cm/L water.
7- Spraying with mega power x at 1.5cm/ L water.

Trees were sprayed with the above treatment, during three stages, (a) at full bloom, (b) after fruit set (fruit diameter 3cm) and (c) three weeks after fruit set, foliar sprays were applied using a hand pressure sprayer. Super film as a wetting agent was added at 0.1% to all spraying solutions. Each tree received 6 liter of spraying solution; each treatment was surrounded with two rows as guard trees.

Analysis of the tested soil according to[12] and the results are shown in Table (1)

Table (1): Soil physical and chemical analysis

Sand %	88.3
Silt %	5.2
Clay %	6.5
Trxture	Sands
PH.	7.6
EC. $(dsm)^{-1}$	1.39
O.M. %	0.29
Total Ca Co_3 %	1.86
Total N %	1.78
Available p (ppm)	0.06
Available k (ppm)	1.53
Fe	2.33
Mn	8.11
Zn	1.3

Active dry yeast was activated by dissolving the definite amount in warm water (38C°), adding sugar at the same rate and left for 2 hours before spraying. Dry yeast contained 33.89% protein, 7.56 Nitrogen, 33.27% polysaccharides, 2.31% fat, 1.61% fiber and 6.83% Ash.

Mega power-x (liquid organic fertilizer) composition: It contain of Humic acid 19%; free Amino acids 5%; chelated microelements (Fe 0.025%; Zn 0.5%; Mn 0.05%) and fulvic acid 2% and potassium citrate 2%.

The following parameters were determined:

The total yield of each tree was determined as fruits number and weight in are kg at harvest time 1st week of June.

A sample of 10 fruit was taken at random from each tree to study fruit quality (physical and chemical characteristics).

I. Fruit physical characteristics:

a) Fruit weight.
b) Fruit length.
c) Fruit diameter.
d) Fruit shape index (L/D).

II. Fruit firmness was determined as Lb /inch^2 by using Magness-Taylor pressure tester 5/16 inch Plunger.

III. Fruit chemical characteristics:

a) Total soluble solids (TSS) percentage was determined by a hand refractometer.
b) Total acidity % expressed as gm molic acid pre 100g pulp[13].
c) T.S.S/acid ratio was calculated.
d) Total sugar % in the fruit pulp tissues were determined by phenol sulfuric method according to[14].

Samples of twenty leaves from the middle part of the shoots according to[15] were selected at random from each replicate (2nd week of July) to measure their leaf area according to[16] and to determine their content of N, P and K (as percentage on dry weight basis) was and Fe, Zn and M (as PPM) was determined according to[12].

Total chlorophyll (chlorophyll a and b and carotenoids (mg/1g fresh weight) in the same leaves was determined according to[17].

All the obtained data were tabulated and statistically analyzed according to[18] using the new L.S.D. at 5% test for comparing the differences between various treatments in means.

Results and Discussions

1- Yield

Data from Table (2) presented that all treatments were effective in increasing yield per tree than the control. Also, accompanied by reduction in the number of fruits /1 kilogram, this effect was significant.

Table (2): Effect of spraying with active dry yeast and liquid organic fertilizer (mega power-x) on yield and number of fruits per one kilogram of Canino apricot trees.

Treatments	Fruit yield/tree (kg.)		Number of fruits / 1 kg.	
	2013	2014	2013	2014
Control	19.16	21.33	39.52	41.10
Active dry yeast at 0.1%	26.11	28.90	34.12	33.16
Active dry yeast at 0.2%	27.92	29.31	32.15	31.92
Active dry yeast at 0.3%	28.14	30.02	28.65	27.69
Mega power-x at 0.5 cm/L	30.86	32.16	27.69	26.12
Mega power-x at 1.0 cm/L	31.58	33.12	25.54	24.19
Mega power-x at 1.5 cm/L	33.30	36.10	25.32	24.08
New L. S. D at 5%	3.20	3.11	2.30	3.10

Concerning the effect of active dry yeast concentrations, data indicated that with increasing concentrations used of the active dry yeast significantly increased yield per tree and the reduction of the number of fruits in one kilogram. As well as mega power-x (Humic acid) showed the some trend of active dry yeast effects on yield per tree and number of fruit per one kilogram.

In comparing active dry yeast with mega power-x it could be noticed that mega power-x was superior to active dry yeast treatments. Generally, it was obviously that the highest concentrations of either yeast or mega power-x gave the heaviest yield per tree. Thus, the highest yield was recorded from tree sprayed with mega power-x at 1.5cm/L (33.30 & 36.10 kg/ tree) in both seasons, respectively. Meanwhile, the lowest yield was recorded from the control (treatment trees (19.16 & 21.33kg/tree) in both seasons, respectively. In this respect, [19]reported that yeast via its cytokinins content might be play role in initiation and translocation of metabolites from leaves into the reproductive organs. Also, it might be play a role in the synthesis of protein and nuclic acid and minimized their degradation[9, 20].

As well as[11] found that spraying Humic acid + De, Za and Mn induced highly significant increase in yield/tree of Le-Conte pear trees.

2- Fruit physical characteristics:

Results of various fruit characteristics as affected by different studied treatments are presented in Table (3) for the two seasons 2013 and 2014. The results showed significant increase in fruit weight, length, diameter and firmness than the control.

Table (3): Effect of spraying with active dry yeast and liquid organic fertilizer (mega power-x) on fruit physical characteristics of Canino apricot trees.

Treatments	Fruit weight (gm)		Fruit length (cm)		Fruit diameter (cm)		Fruit shape		Fruit firmness	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	25.30	24.33	3.51	3.55	3.48	3.51	1.01	1.01	12.63	12.68
Yeast at 0.1%	29.31	30.16	3.81	3.88	3.83	3.81	1.02	1.02	13.11	13.36
Yeast at 0.2%	31.10	31.33	3.85	3.93	3.81	3.89	1.01	1.01	13.35	13.58
Yeast at 0.3%	34.90	36.11	3.88	3.98	3.83	3.93	1.01	1.01	13.79	13.78
Mega power-x at 0.5 cm/L	36.11	38.30	4.01	4.11	3.93	4.01	1.02	1.02	13.50	13.90
Mega power-x at 1.0cm/L	39.16	41.33	4.16	4.23	4.00	4.10	1.04	1.03	13.90	13.98
Mega power-x at 1.5 cm/L	39.50	41.53	4.20	4.26	4.11	4.16	1.02	1.02	14.16	14.66
New L.S.D. at 5%	2.8	2.9	0.2	0.3	0.3	0.2	N.S	N.S	0.3	0.3

Concerning the effect of active dry yeast concentrations it was clearly observed that with increasing concentrations used of yeast significantly increased fruit weight; length, diameter and firmness. As well as, mega power-x showed the same trend of yeast effects on the same parameters, during the two studied seasons.

Regarding the effects of yeast might be play a role in the synthesis of protein and nucleic acids which enhance cell division and enlargement leading to weight, length, diameter of fruit increases. There obtained finding of this study are on line with those results found by[9, 20].

Concerning the effects of mega power-x (Humic acid) in this respect, could be attributed to its content of deferent chelated micronutrient (Fe, Zn and Mn), amino acids, potassium citrate and fulvic acid. These results are in agreement with those obtained by[21] on Desert Red peach.

On the other hand, fruit shape index (L/D) ratio was not affected significantly by different treatments in both seasons of 2013 and 2014.

3- Fruit chemical characteristics:

- **TSS%:**

Data presented in Table (4) cleared that all treatments with either of active dry yeast or mega power-x significantly increased TSS% in fruit juice of Canino apricot in both seasons in comparison with untreated trees.

Table (4): Effect of spraying with active dry yeast and liquid organic fertilizer (mega power-x) on fruit chemical characteristics of Canino apricot trees.

Treatments	TSS%		Acidity%		TSS/acid ratio		Total sugar %	
	2013	2014	2013	2014	2013	2014	2013	2014
Control	12.80	13.11	1.23	1.36	10.41	9.64	9.6	9.9
Yeast at 0.1%	13.70	14.30	0.98	0.91	13.98	15.71	10.45	10.76
Yeast at 0.2%	13.90	14.88	0.90	0.86	15.44	17.30	10.73	10.93
Yeast at 0.3%	14.33	14.91	0.88	0.81	16.28	18.41	11.66	11.81
Mega power-x at 0.5 cm/L	14.55	15.30	0.85	0.80	17.11	19.13	11.99	12.01
Mega power-x at 1.0cm/L	15.33	15.83	0.80	0.79	19.16	20.04	12.11	12.36
Mega power-x at 1.5 cm/L	15.58	16.31	0.76	0.73	20.50	22.34	12.33	12.55
New L.S.D. at 5%	0.3	0.3	0.08	0.09	0.5	0.6	0.4	0.3

Furthermore, it is clear evident that TSS% significantly increased with increasing concentrations of yeast (0.3%) produced the highest value of TSS%.

With regard to the effect of mega power-x on TSS% it could be noticed that was almost similar to the effect of active dry yeast treatment.

In comparison yeast with mega power-x effects on this connection generally, it could be noticed that mega power-x applications were more effective in increasing TSS% than yeast.

The above mentioned results are nearly similar to those obtained by[5] on Thompson seedless grapevines; [22]on Anna apple trees; [23]on pomegranate trees and [24]on Balady mandarin trees who found that yeast applications increased TSS% in fruit juice.

The same results were obtained by[11] on Le-conte pear trees as affected by application of Humic acid solution.

- **Total acidity %:**

In regard to the effect of these treatments on total acidity % data presented in Table (4) show clearly that all treatments reduced total acidity**%** in fruit juice than the untreated trees. Moreover, it could be noticed that mega power-x concentrations gave the best results obtained in this respect.

- **TSS/acid ratio:**

It is clear from Table (4) that all treatment significantly increased TSS/acid ratio in fruit juice than the control. While, mega power-x application at 1.5cm/L significantly increased this ratio than the other treatment and the control.

- **Total sugar %:**

Data presented in Table (4) it could be noticed that all treatment with yeast or mega power-x resulted in significant increases in total sugar % in fruit and showed the same trend of TSS% in comparison with untreated trees, in both seasons moreover, mega power-x applications induced more positive effective in improving total sugars rather than yeast.

4- Leaf minerals contents

As shown in Table (5) it is obviously clear that all yeast concentrations as well as mega power-x concentrations applied to Canino apricot trees resulted in significantly improved the leaf content of N, P, K, Fe, Zn and Mn compared with control.

Table (5): Effect of spraying with active dry yeast and liquid organic fertilizer (mega power-x) on leaf minerals content of Canino apricot trees.

Treatments	N%		P%		K%		Fe (ppm)		Zn (ppm)		Mn (ppm)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control	1.85	1.79	0.25	0.27	1.19	1.23	75.00	96.00	23.00	20.11	19.33	20.32
Yeast at 0.1%	2.51	2.33	0.26	0.28	1.23	1.30	96.00	115.0	25.00	24.18	23.10	22.81
Yeast at 0.2%	2.56	2.51	0.27	0.28	1.26	1.35	98.00	120.0	27.00	26.33	24.11	24.31
Yeast at 0.3%	2.61	2.58	0.27	0.29	1.31	1.36	115.0	121.0	27.16	26.66	24.63	24.76
Mega power-x at 0.5 cm/L	2.56	2.53	0.28	0.30	1.36	1.46	117.0	125.0	28.18	38.10	26.16	25.38
Mega power-x at 1.0cm/L	2.76	2.71	0.30	0.31	1.45	1.48	130.10	138.0	31.33	31.36	26.38	25.78
Mega power-x at 1.5 cm/L	2.93	2.90	0.31	0.33	1.56	1.61	138.33	141.0	32.10	33.18	26.51	25.86
New L.S.D. at 5%	0.25	0.26	0.02	0.02	0.06	0.06	9.11	8.31	1.66	1.90	1.11	1.00

In comparison between yeast and mega power-x it was obviously that mega power-x showed positive effective on leaf menials content specially Fe, Zn and Mn. There positive effects of mega power-x in this respect could be attributed its content of Fe, Zn and Mn. These results are in harmony with those obtained by[6] who indicated that leaves of flame seedless grapevines generally contained high of Fe, Zn and Mn using foliar spray of active dry yeast and micro-nutrients (Fe, Zn and Mn) in both seasons.

5- Leaf area and leaves pigments content:

Data presented in in Table (6) indicated that all treatments with active dry yeast and mega power-x induced significantly increased in both leaf area and leaf pigments content compared with control.

Table (6): Effect of spraying with active dry yeast and liquid organic fertilizer on leaf area and leaf pigments control of Canino apricot trees.

Treatments	Leaf area (cm2)		Chlorophyll (a)		Chlorophyll (b)		Carotenoids	
	2013	2014	2013	2014	2013	2014	2013	2014
Control	21.30	20.68	0.96	1.11	0.38	0.41	0.36	0.33
Yeast at 0.1%	22.16	21.56	1.16	1.23	0.41	0.46	0.45	0.43
Yeast at 0.2%	22.90	22.56	1.41	1.48	0.45	0.47	0.47	0.48
Yeast at 0.3%	22.63	22.96	1.43	1.51	0.46	0.47	0.46	0.45
Mega power-x at 0.5 cm/L	24.36	23.96	1.36	1.41	0.48	0.51	0.58	0.57
Mega power-x at 1.0cm/L	25.50	24.56	1.68	1.73	0.51	0.56	0.61	0.63
Mega power-x at 1.5 cm/L	25.01	24.48	1.70	1.70	0.52	0.55	0.60	0.61
New L.S.D. at 5%	1.16	1.23	0.31	0.25	0.02	0.03	0.05	0.06

- **Leaf area:**

Concerning the effect of yeast concentrations on leaf area (cm^2) it was observed that increasing the rates applied of yeast resulted in significantly increased in leaf area, where the middle rate used of yeast (0.2%) gave the highest value of leaf area, followed by the 3rd rate of yeast (0.3%) than the lowest rate 1st of yeast (0.1%) gave the lowest value of leaf area. These results are in parallel to those of [5, 22, 23]. In this connection, [25]demonstrated that the enhancing effect of yeast preparations might be due to that yeast as a natural source of cytokinins enhanced cell division and cell enlargement so far increasing the extended of leaf surface area as well as enganced the accumulation of soluble metabolistes as maintained about the role cytokinins.

Regarding the effect of mega power-x on leaf area it was noticed that mega power-x gave the same trend of yeast effects on leaf area.

- **Leaves pigments content:**

It is clear from Table (6) that all rates of both yeast or mega power-x induced significantly increased in leaf pigments content of Chlorophyll a & b and carotenoids as compared with the untreated trees.

In comparison yeast with mega power-x effects on this connection generally it could be noticed that mega power-x application was more effective in increasing leaf pigments content than the yeast.

These results are in line with those reported by [26, 23].

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