Effect of Humic Acid Treatments on 'Canino' Apricot Growth, Yield and Fruit Quality

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Abstract: The effect of humic acid as Actosol® (contains 2.9 % humic acid + 10, 10, 10% NPK) treatments (soil, foliar or soil + foliar) on: growth parameters (shoot length, number of leaves/shoot and leaf area) of 'Canino' apricot trees were determined through 2008 and 2009 seasons. Moreover, fruit set percentage and yield of 'Canino' fruits as retained fruit; number of fruits / tree; number of fruits / kg; yield monetary value; net profit and percentage of benefit were assessed while physical and chemical properties of fruit quality (fruit size, firmness and dimensions, juice total soluble content, acidity and SSC / acidity ratio) were determined too. Also, yield economical records (yield monetary value, net profit and percentage of benefit) were studied. Humic acid applications enhanced most of the investigated parameters while not affected number of fruit / kg and polar / equatorial ratio, meanwhile juice acidity was decreased indicating fruit size increment with bitter fruit shape and quality. Soil treatments (37.5 or 75.0 cm^3 / tree) were more effective than spray ones (9 or 15 cm^3 / tree). Also, the effect of both soil and foliar applications increased with increasing of the humic acid doses. The treatment of humic acid foliar spraying with 15 cm^3 per tree and 75 cm^3 / 3 L as a weekly soil addition during the growth season improved the vegetative growth and increased most of yield determinations meanwhile enhanced fruit quality of 'Canino' apricots.
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1. Introduction:

With the successful introduction of the high yielding and good quality of 'Canino' apricot (*Prunus armeniaca* L.) cultivar in Egyptian desert culture, needs became apparent for the use of biostimulants in crop production to maintain proper plant growth in these sandy soils without excessive use of agricultural chemicals which are considered a menace to the environment. Biostimulants are known as the organic materials which promote plant growth and help plants to withstand hashed environments when applied in small quantities (Chen *et al*., 1994).

Benefits described to the use of humic acid and related products to increase nutrient uptake, tolerance to drought and temperature extremes, activity of beneficial soil microorganisms, and availability of soil nutrients particularly in alkaline soils and low organic matter (Senn and Kingman, 1973 and Russo and Berlyn, 1990). Also, humic materials may increase root growth in a similar manner to auxins (Senn and Kingman, 1973; O'Donnell, 1973 and Tatini, *et al*., 1991).

There is growing interest of the use of humic acid and K-humate as a substitute to chemical fertilizers which have potential polluting effects in the environment (Senn and Kingman, 2000). However, Chunhua *et al*. (1998) showed that it is not clear how these products induce their effect, whether it is due to their increase of cation exchange capacity which affects the retention and availability of nutrients, or due to a hormonal effect, or a combination of both. Also, humic materials significantly increased orange and grapefruit trees growth and fruit production (Alva and Obreza, 1998), enhanced apple fruit weight; yield and soluble solids content (Li, *et al*. 1999) increased yield, fruit quality and grower income of peach and apple (Fathi *et al*. 2002). Additionally, humic materials have a positive effect on rhizosphere count of various groups of determined organisms of 'Canino' apricot which reflects on growth, yield and fruit quality attributes (Eissa Fawzia, 2003), enhanced 'Canino' apricot growth, fruit yield, crop monetary value and fruit characteristics (Eissa Fawzia *et al*., 2007a). Shaddad *et al*. (2005) showed that 'Canino' apricot leaves contained more N; P and K nutrients as a result of soil application of humic acid which pressed the leaves to gain more chlorophyll and more dry matter, increased retained fruits, fruit yield and enhanced fruit quality. Also, Eissa Fawzia *et al*. (2007a, b & c) revealed that humic acid application (especially soil treatment with 20 ml/tree, every week from July 1st to October 15th) markedly minimized the harmful effect of salinity and enhanced apple, pear, peach and apricot salt tolerance.

This trial aims to study the response of 'Canino' apricot cultivar to different doses of foliar and soil applications of humic acid.

2. Materials and methods

This investigation was conducted during the 2008 and 2009 seasons in a private orchard in Wadi Elnatroon, Elbehira governorate. Eight years old 'Canino' apricot trees were planted 6 x 6 a part, budded on local apricot rootstock, grown in a sandy soil under drip irrigation system an received the common cultural practices. Trees used in the experiment were selected to be healthy and as uniform as possible. The trees were trained and pruned uniformly to an open center shape. Statistically, a split plot design was used with three replicates where each experimental unit consisted of one tree. The obtained data were subjected to analysis of variance according to Snedecor and Cochran, 1990. Means were compared using LSD test with level of significance at 5 %.

Foliar treatments were 0, 9 and 15 cm^3 of Actosol® (contains 2.9 % humic acid + 10, 10, 10 % NPK) in three liters of solution were sprayed on the tree. The same treatments were received 0, 37.5 and 75 cm^3 of Actosol® in three liters of solution were added to the tree soil. The foliar and soil treatments were frequently applied every week during the growth season. Tree measurements were determined on five nearly similar two years old branches around the each tree in both seasons. Data were recorded on shoot growth, number of leaves / shoot and leaf area during August.

Percentage of fruit set was estimated, while at picking date percentage of retained fruits was assessed, numbers of fruits per tree were counted, fruit yield per tree was weighted and numbers of fruits per kilogram were estimated. These data were used in estimating crop monetary value considering a farm-gate price of Egyptian pounds as 1.50, 1.75 and 2.00 £E for one kilogram of fruits weighting <50, 50 – 56 and >56 g. (>20, 20 – 17, & <17 fruits / kg), respectively.

The present result, used to calculate the net profit as cost price of treatment (10 liter of Actosol® = 275 £E, so 9.0 cm3 = 0.24 £E, 15.0 cm3 = 0.42 £E, 37.5 cm3 = 0.1.03 £E, 75.0 cm3 = 2.03 £E) subtracting from yield monetary value. Subsequently, net profit was used to calculate percentage of net benefit of the treatment than control.

Net benefit % = (net profit of treatment – net profit of control) / net profit of control x 100

Fruit quality attributes included fruit size, polar and equatorial diameters and their ratio, while fruit firmness was recorded by Magness – Taylor type pressure tester has a standard 7/16 of $inch^2$ plunger, and readings were recorded in / $inch^2$. Juice soluble solids content (SSC) was determined by using a hand refractometer and total acidity percentage was estimated according to (A.O.A.C., 1990), while SSC / acidity ratio was calculated.

3. Results

Response of growth parameters as shoot length, number of leaves / shoot and leaf area of 'Canino' apricot trees to foliar and soil treatments of humic acid is shown in table (1). Data showed that regardless of soil applications, treatment of foliar spraying by humic acid with 9 cm^3 per tree did not affect significantly any of growth parameters. In concerning with leaf area, data illustrated that there was no significant effect for both foliar treatments. Treatment of foliar spraying by high doses of humic acid (15 cm^3 per tree) significantly increased both shoot length and number of leaves / shoot. However, progressive increment of these parameters was parallel to the humic acid concentrations on foliar spraying solution, in both seasons.

Concerning of soil applications of Actosol®, data illustrated that both soil treatments significantly increased shoot length and number of leaves / shoot. Records of leaf area showed no significant difference among both applications, while significance was found between control and treatments. However, increment of these parameters was gradually increased as the humic acid doses of soil additions were increased, in studying seasons.

Referring to interaction between foliar treatments and soil applications, data in table (1) concerning shoot length of 'Canino' apricot trees showed that 15 cm^3 foliar spraying and 75 cm^3 soil addition of humic acid treatment had the highest significant records as gave 68.2 & 70.7 in both seasons, respectively. The same treatment gave the best values of number of leaves / shoot (73.5 & 75.9) and leaf area (41.2 & 40.9) in both seasons, respectively.

Data of humic acid foliar spraying influences on fruit set and yield of 'Canino' apricot trees were arranged in table (2). Data illustrated that regardless of soil treatments, both foliar spraying treatments of Actosol did not affect fruit set percentage and fruit yield per tree. Only, foliar spraying treatment by high doses (15 cm^3 / tree) increased percentage of retained fruits per tree and number of fruits per tree. It was clear that fruit set and yield determinations of 'Canino' fruits were gradually improved as humic acid doses were increased.

As for soil treatments, data showed that both treatments significantly increased all determined parameters when compared with control. Meanwhile, the high doses treatment (75 cm^3 soil addition of humic acid) had the highest significant records when compared with lowest one (37.5 $cm^{3)}$ or control.

Referring to interaction between foliar spraying and soil addition treatments, data in table (2)

concerned with fruit set and yield of 'Canino' apricots showed that treatment of foliar spraying with 15 cm^3 and 75 cm^3 soil addition of humic acid had the highest significant values of fruit set percentage, percentage of retained fruits per tree, numbers of fruits per tree and fruit yield per tree. On the other hand, there was no significant difference between foliar spraying with 9 cm^3 and 75 cm^3 soil addition treatment and treatment of foliar spraying with 15 cm^3 and 75 cm^3 soil addition.

Table (1): Effect of foliar (A) and soil (B) applications of humic acid on vegetative growth of 'Canino' apricot trees.

Treatments		Shoot length (cm)		Number of leaves / shoot		Leaf area (cm^2)	
Foliar (A)	Soil (B)	2008	2009	2008	2009	2008	2009
0.0	0.0	32.6	35.2	25.0	27.0	34.0	33.4
	37.5	57.0	59.6	60.7	63.2	38.6	37.7
	75.0	60.6	63.2	65.2	67.2	39.4	39.9
Average of (A)		50.1	52.7	50.3	52.8	37.3	37.0
9.0	0.0	35.0	37.6	28.0	30.5	33.3	32.7
	37.5	58.0	60.6	64.2	66.7	40.2	40.1
	75.0	64.4	66.9	68.8	71.3	40.4	41.3
Average of (A)		52.5	55.0	53.7	56.2	38.0	38.0
15.0	0.0	36.6	39.2	30.5	33.0	34.2	35.8
	37.5	61.0	62.7	70.6	73.0	41.0	40.2
	75.0	68.2	70.7	73.5	75.9	41.2	40.9
Average of (A)		55.3	57.5	58.2	60.6	38.8	39.0
Average of (B)	0.0	34.7	37.3	27.8	30.3	33.8	34.0
	9.0	58.7	61.0	65.2	67.6	39.9	39.3
	15.0	64.4	66.9	69.2	71.6	40.3	40.7
LSD at 5 % of (A)		2.96	2.41	4.02	3.73	2.02	3.07
LSD at 5 % of (B)		2.92	2.27	2.39	2.01	2.47	2.37
LSD at 5 % of (A x B)		5.06	4.82	4.15	3.85	4.28	4.11

Table (2): Effect of foliar (A) and soil (B) applications of humic acid on fruit set and yield of 'Canino' apricot trees.

Treatments		Fruit set %		Retained fruit / tree %		Number of fruits / tree		Fruit yield / tree (kg)	
Foliar (A)	Soil (B)	2008	2009	2008	2009	2008	2009	2008	2009
0.0	0.0	20.0	19.0	15.1	15.4	810	738	25.8	25.6
	37.5	27.3	25.0	21.5	21.8	998	987	32.0	31.4
	75.0	28.7	29.3	22.0	22.8	1093	1075	34.6	33.9
Average of (A)		25.3	24.4	19.5	20.0	967	933	30.8	30.3
9.0	0.0	23.0	20.0	16.2	16.9	821	805	26.5	25.8
	37.5	28.0	26.0	23.7	22.6	1012	981	32.2	31.1
	75.0	30.7	31.0	25.0	25.2	1057	1070	33.6	33.7
Average of (A)		27.2	25.7	21.6	21.6	964	952	30.9	30.2
15.0	0.0	21.0	22.0	19.6	18.8	880	900	26.5	27.3
	37.5	27.0	28.0	23.4	22.6	1117	1105	33.6	27.3
	75.0	30.3	31.0	25.1	25.8	1140	1155	34.2	34.0
Average of (A)		26.1	27.0	22.7	22.4	1046	1053	31.4	31.4
Average of (B)	0.0	21.3	20.3	17.0	17.0	837	814	26.3	26.2
	9.0	27.4	26.3	22.9	22.3	1042	1024	32.7	31.8
	15.0	29.9	30.4	24.0	24.6	1079	1100	34.1	33.9
LSD at 5 % of (A)		3.22	2.21	2.07	1.91	42.38	20.14	2.30	3.04
LSD at 5 % of (B)		1.86	2.43	1.98	2.37	37.44	42.81	1.88	2.02
LSD at 5 % of (A x B)		3.21	4.21	3.44	4.11	64.84	74.15	3.27	3.50

In concerning with foliar spraying influences on fruit size and shape of 'Canino' apricot fruits, data of table (3) cleared that regardless of humic acid soil application, treatment of foliar spraying of humic acid with 9 cm^3 per tree did not affect any of determined attributes. At the same time, treatment of foliar spraying with 15 cm^3 significantly increased the polar diameter and equatorial diameter of fruits in the second season which led to insignificant effect on polar / equatorial diameter ratio. So, it could be said that foliar spraying of humic acid not affected fruit size or shape of 'Canino' apricot fruits

As for soil additions regardless of foliar spraying of humic acid treatments data of table (3) showed that fruit size was not significantly affect with any of treatments. While, soil low doses of humic acid significantly increased equatorial diameter of fruits, the highest one increased the polar and equatorial diameter, without significant for both doses on polar / equatorial diameter ratio. It was clear that fruit size or shape of 'Canino' apricot fruits did not affected with soil applications of humic acid.

Table (3): Effect of foliar (A) and soil (B) applications of humic acid on size and shape of 'Canino' apricot fruits.

Treatments		Fruit size (cm^3)		Polar diameter (cm)		Equatorial diameter (cm)		Polar Equatorial ratio	
Foliar (A)	Soil (B)	2008	2009	2008	2009	2008	2009	2008	2009
0.0	0.0	50.3	48.7	3.40	3.61	3.22	3.19	1.06	1.13
	37.5	51.1	52.4	3.95	3.80	3.88	3.73	1.02	1.02
	75.0	52.0	52.3	4.10	4.00	4.12	4.02	1.00	1.00
Average of (A)		51.1	51.1	3.82	3.80	3.74	3.65	1.03	1.05
9.0	0.0	50.8	50.9	3.62	3.65	3.58	3.41	1.02	1.07
	37.5	51.9	51.6	4.22	4.10	4.16	4.06	1.02	1.01
	75.0	52.4	52.8	4.40	4.30	4.38	4.19	1.01	1.03
Average of (A)		51.7	51.8	4.08	4.02	4.04	3.89	1.02	1.04
15.0	0.0	51.3	51.6	3.85	3.90	3.72	3.68	1.04	1.06
	37.5	52.6	52.8	4.30	4.10	4.26	4.31	1.01	0.95
	75.0	53.0	53.4	4.45	4.60	4.50	4.42	0.99	1.04
Average of (A)		52.3	52.6	4.20	4.20	4.16	4.14	1.01	1.02
Average of (B)	0.0	50.8	50.4	3.62	3.72	3.51	3.43	1.04	1.09
	9.0	51.9	52.3	4.16	4.00	4.10	4.03	1.02	1.00
	15.0	52.5	52.8	4.32	4.30	4.33	4.21	0.90	1.02
LSD at 5 % of (A)		2.45	2.82	0.20	0.37	0.42	0.17	0.15	0.12
LSD at 5 % of (B)		2.21	2.78	0.32	0.34	0.31	0.21	0.09	0.09
LSD at 5 % of (A x B)		3.83	3.79	0.55	0.59	0.54	0.37	0.16	0.16

As respect of interaction between foliar spraying and soil additions of humic acid, data in table (3) concerning with fruit size and shape showed that all treatment increased the most of determined parameters at one season at least. On the other hand, humic acid treatments did not show a clear trend of their effect on polar / equatorial diameter ratio. At the same time, treatment of the most concentrate foliar spray and the biggest soil dose of humic acid (15 cm^3 + 75 cm^3) had the significant and highest values of polar diameter as gave 4.45 & 4.60 and equatorial diameter as gave 4.50 & 4.42 in both seasons, respectively. These increments in both polar and equatorial diameter led to insignificant influence on polar / equatorial diameter ratio.

Referring to foliar spraying of humic acid influences on fruit physical and chemical properties, data of table (4) showed that both treatments increased significantly fruit firmness, during investigated seasons. Vice versa, they did not affect any of fruit chemical attributes in a comparison with control.

As respect of soil applications of humic acid, data of table (4) showed that 'Canino' apricot fruit firmness, juice soluble solids content (SSC) and SSC / acidity ratio were increased significantly as soil doses were added in both seasons of the study. On the other hand, acidity percentage records were decreased in a significant manner by both soil treatments. The most improved significant values of all fruit quality attributes were recorded for 75 cm^3 soil addition treatment in the two seasons.

Concerning the interaction between foliar spraying of humic acid and soil additions, data showed that trees of the most concentrate foliar spray and the biggest soil dose of humic acid treatment (15

cm^3 + 75 cm^3) gained the most firm fruits (11.4 & 11.0 lb / $inch^2$) in both seasons of the study. Fruit juice of the same trees recorded the highest SSC / acidity ratio (20.15 & 18.37) when had the highest content of soluble solids (12.0 & 11.6) and the lowest acidity ratio (0.60 & 0.64). Also, it was shown that physical and chemical quality properties of 'Canino' fruits were gradually improved as humic acid doses were increased.

Table (4): Effect of foliar (A) and soil (B) applications of humic acid on physical and chemical characters of 'Canino' apricot fruits.

Treatments		Fruit firmness (lb / $inch^2$)		SSC %		Acidity %		SSC / acidity ratio	
Foliar (A)	Soil (B)	2008	2009	2008	2009	2008	2009	2008	2009
0.0	0.0	7.29	7.14	8.5	8.7	1.00	0.96	9.19	9.10
	37.5	9.50	9.80	10.3	10.8	0.76	0.72	13.64	15.11
	75.0	9.95	10.00	11.5	11.0	0.70	0.68	16.56	16.46
Average of (A)		8.91	8.98	10.1	10.2	0.82	0.79	13.13	13.56
9.0	0.0	8.05	7.80	8.6	8.7	0.90	0.92	9.65	9.49
	37.5	10.20	10.45	11.0	11.2	0.81	0.72	13.77	15.71
	75.0	10.60	10.80	11.7	11.4	0.74	0.70	15.90	16.43
Average of (A)		9.62	9.68	10.4	10.4	0.81	0.78	13.11	13.88
15.0	0.0	8.50	8.70	8.6	8.6	0.93	0.90	9.29	9.59
	37.5	10.90	10.95	11.6	11.4	0.68	0.70	17.17	16.60
	75.0	11.40	11.00	12.0	11.6	0.60	0.64	20.15	18.37
Average of (A)		10.27	10.22	10.7	10.5	0.73	0.75	15.54	14.85
Average of (B)	0.0	7.95	7.88	8.6	8.7	0.94	0.93	9.37	9.39
	9.0	10.20	10.40	11.0	11.1	0.75	0.71	14.86	15.81
	15.0	10.65	10.60	11.7	11.3	0.68	0.67	17.54	17.09
LSD at 5 % of (A)		0.48	0.61	0.41	0.62	0.16	0.09	1.72	0.87
LSD at 5 % of (B)		0.36	0.34	0.46	0.49	0.13	0.11	1.54	2.08
LSD at 5 % of (A x B)		0.63	0.59	0.81	0.86	0.23	0.19	2.66	3.62

Response of yield economical values of 'Canino' apricot fruits to humic acid foliar spraying is shown in table (5). Data showed that regardless of soil additions, the lowest dose (9 cm^3 / tree) of humic acid foliar spraying of treatment did not affect significantly any of recorded determinations. At the same time, highest dose (15 cm^3 / tree) of foliar spraying treatment significantly decreased number of fruits per kilogram at season of 2009 only, while significantly increased yield monetary value per tree and benefit percentage at both season.

Table (5): Effect of foliar (A) and soil (B) applications of humic acid on yield economical values of 'Canino' apricot fruits.

Treatments		Number of fruits / kg		Yield monetary value / tree (£E)		Net profit (£E)		Benefit %	
Foliar (A)	Soil (B)	2008	2009	2008	2009	2008	2009	2008	2009
0.0	0.0	21.8	24.7	42.3	35.6	42.3	35.6	0.00	0.00
	37.5	22.1	21.8	50.0	49.3	49.0	48.3	15.74	26.33
	75.0	21.6	21.5	53.2	52.3	51.2	50.3	17.41	29.33
Average of (A)		21.8	22.7	49.5	46.8	47.5	44.7	10.97	20.38
9.0	0.0	22.3	22.1	43.1	40.3	42.9	38.1	1.52	6.67
	37.5	22.2	21.7	50.8	48.9	49.5	47.6	13.27	25.31
	75.0	21.7	21.4	52.0	52.1	49.7	49.8	14.91	28.55
Average of (A)		22.1	21.7	48.6	47.8	47.4	46.5	10.66	23.39
15.0	0.0	20.1	20.3	46.0	47.6	45.6	37.2	7.24	4.31
	37.5	20.0	19.7	59.2	55.0	57.5	53.3	26.51	33.22

	75.0	20.0	19.4	61.3	55.0	58.8	52.5	28.37	32.23
Average of (A)		20.0	19.8	57.2	52.5	55.6	51.0	23.94	30.25
Average of (B)	0.0	21.4	22.4	45.5	41.8	45.3	41.6	6.65	14.41
	9.0	21.4	21.1	53.3	51.1	52.0	49.7	18.68	28.41
	15.0	21.1	20.8	55.5	53.2	53.2	50.9	20.52	30.04
LSD at 5 % of (A)		2.62	2.04	3.38	4.17	3.65	4.66	4.05	3.92
LSD at 5 % of (B)		2.33	2.91	4.13	5.16	4.50	5.84	3.70	3.21
LSD at 5 % of (A x B)		4.03	3.32	2.60	3.19	3.69	3.75	4.68	5.56

As respect of soil additions of humic acid, data observed that the highest soil addition (75 cm^3 / tree) of humic acid treatment decreased number of fruits per kilogram when compared with control, but significance was found only at second season. Beside, statistical significance was clear in a comparison of both soil application treatments with a control in yield monetary value per tree, net profit and benefit percentage of 'Canino' apricots, in both seasons.

Referring to interaction between humic acid foliar spraying treatments and soil addition ones, data in table (5) concerning the economical values of 'Canino' apricot fruit yield showed that both soil addition treatments when applied with highest dose (15 cm^3 / tree) of foliar spraying treatment decreased significantly number of fruits per kilogram, at the second season. Moreover, they increased yield monetary value per tree, net profit and benefit percentage in most cases, significantly..

4. Discussion and conclusion

Humic acid treatments (foliar and soil applications) markedly increased the growth parameters (shoot length, number of leaves / shoot and leaf area) of 'Canino' apricot. These results are in line with those of Fathi *et al*. (2002), Eissa Fawzia *et al*. (2003) and Shaddad *et al*. (2005) which recorded that humic compounds increased shoot length, leaf area and leaf chlorophyll content of 'Canino' apricot. Like wise, Bohme and Lua (1997); Hartwigsen and Evans (2000) and Liu and Cooper (2002) recorded that humic acid has a good influence on plant growth and development. Furthermore, Eissa Fawzia *et al*. (2007a, b and c) illustrated that humic acid promoted peach, pear, apple and apricot to grow better and accumulate higher amounts of NPK and dry matter, even under salinity conditions. These results could be explained in light of obtained results of Tatini *et al*. (1991) and Jianguo *et al*. (1998) which showed that humic acid substances increased dry matter of foliage and roots, promoted N uptake and accumulation of nutrients and enhanced photosynthesis of apple trees.

Besides, the fruit set and yield determinations as retained fruits and fruit weight and number per tree were positively responded to humic acid treatments. Meanwhile, physical and chemical properties of 'Canino' apricot fruits (fruit firmness, juice SSC and SSC / acidity ratio) were progressively increased as foliar and soil doses of humic acid increased, then juice acidity decreased indicating better fruit quality.

At the same time, obtained increase of fruit size while polar / equatorial ratio of 'Canino' apricot fruit was decreased indicating better fruit shape and quality. It could be explained in light of humic acid induced bioassay effects similar to those of cytokinins and gibberellins as well as increased water uptake of trees (Honay and Tich, 1976), possibly as a result of increasing root surface area or increasing cell permeability (Webb and Biggs, 1988). Also, Chen *et al*. (1994) reported that humates markedly increased cell membrane permeability and exhibit hormone like activity.

Most of yield economical values (yield monetary value, net profit and percentage of benefit) of 'Canino' apricot were positively responded as a result of humic acid applications, while decreased number of fruits / kilogram may be was a direct effect of fruit size increment.

Henceforth, the treatment of humic acid foliar spraying with15 cm^3 per tree and 75 cm^3 / 3 L as a weekly soil addition, during the growth season is estimable and recommended to improve the vegetative growth, yield and fruit quality of 'Canino' apricot which reflects on grower income increment.

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