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Annals of Agricultural Science, Moshtohor (ASSJM)
https://assjm.journals.ekb.eg/

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Original Article Vol. 62(2) (2024), 63 – 72 DOI: 10.21608/assjm.2024.299588.1295

Growth and Productivity of Canino Apricot Trees as Influenced by Mineral Nk Soil Application Rate and Some Bio-Stimulants Spray.

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Abstract

The present investigation was carried out to study the influence of Nitrogen (N) and potassium (K) fertilizers (soil added at 1&2 kg/tree either solely or combined with one or more of bio-stimulants of Seaweeds extract (SWE), Active dry yeast extract (ADYE) and Humic acid (HA) foliar application beside the N and K fertilization program adopted in the region as control were investigated on growth, and productivity of Canino apricot trees , as well as fruit quality during two successive seasons (2022 & 2023).

Data obtained displayed obviously that all twelve investigated nutritional treatments with the N and K mineral fertilization and the three HA, SWE and ADYE bio-stimulants increased significantly all evaluated growth (shoot length, No. of leaves/each, leaf dry weight & area) measurements over control (adopted N and K fertilization in farm during both 2022 & 2023 seasons. Herein T_{13}: (N_2K_2 + HA + SWE + ADYE) followed both by T_{12}: (N_2K_2 + SWE + ADYE) and T_7: (N_1K_1 + HA + SWE + ADYE) were the most effective. Moreover fruit quality (both physical & chemical characteristics) of Canino apricot trees followed to great extent the same trend, whereas the most desirable fruit physical (weight, volume & dimensions) and chemical (TSS & TSS/TA ratio) were increased significantly as compared to there of either control or other investigated ones by such three effective treatment.

Key words: Apricot, Bio-stimulants, Fertilization, Growth, Productivity, Humic acid, and Seaweeds.

Introduction

Apricot is one of the few temperate fruit trees and most apricot cultivars are cultivated in Mediterranean countries. In Egypt, apricot has a great importance for local consumption due to its desirable tastes and high nutritive value. According to Ministry of Agriculture and Land Reclamation **(FAO stat., 2022)**, the harvested area of apricot reached 11514 feddans, with a total production about 71978.88 tons with average of 6.25 tons/fed.

Undoubtedly, there is a general agreement that several factors affecting the productivity and fruit quality of apricot trees. One of these important effective factors is fertilization, which plays an excellent role and contributes to tree production in this respect.

The present investigation several researchers reported that spraying some fruit trees species including apricot trees with some different stimulating compounds such as seaweeds extract (SWE), active dry yeast extract (ADYE) and humic acid (HA) enhanced vegetative growth, increased productivity and improved most fruit characteristics. in this regard, **Fathi *et al.* (2002), Morsey *et al.* (2015)** and **Ismail andAbd El-Hady (2018)** on apple trees; **Abou-Grah (2004), Wahba (2007)** and **Sharaf *et al.* (2012)** on persimmon, **Eissa-Fawzia (2003), Bakry and Wanas (2003); Shddad *et al.* (2005), Kabeel *et al.* (2005)** and **El-Naggar (2009), Haggag-Laila *et al.* (2016), Shaaban-Sanaa *et al.* (2016)** and **Taha-Nevien and El-Shahat (2017)** on "Canino" apricot.

Therefore, the present investigation was planned to throw some lights about the possibility of recognizing the following main goals:

1- Financial purpose by minimizing production cost through replacing partially the higher expensive mineral N and K fertilizers by other cheaper source like as some bio-stimulants by which it could be increasing or at least keeping both higher productivity and desirable fruit quality of "Canino" apricot fruits.
2- Human healthy purpose by decreasing soil, underground water and fruits pollution, which certainly reflected positively on human health.

Consequently, "Canino" apricot trees were subjected to two minerals N and K fertilizers each at two rates in combination with three bio-stimulants during both 2022 and 2023 experimental seasons.

Materials and Methods

The present investigation was carried out in a private orchard at shoubra shehab village belonging to El-Kanater El-Khaireia district, Kalyubia Governorate, Egypt. This study has been extended for the two consecutive seasons of 2022 and 2023 on 12 year-old Canino apricot trees budded on local apricot rootstocks cultivar (Amar).

Two rates of both N and K mineral fertilizers i.e., ammonium sulphate (20.6 % N) and potassium sulphate (48.0 % K_2O), each at two rates (1.0 and 2.0 kg/tree) soil applied yearly in two split equal doses through the third week of both Feb. and Apr. either alone or in combination with one or more of these stimulants compounds namely i.e., Seaweeds extract (SWE) (2.5ml/5L), Active dry yeast extract (ADYE) (5gm/5L) and Humic acid (HA) (5gm/5L) foliar sprayed three times, at the beginning of blooming (at 15th of Feb), full bloom (at 15th of Mar) and one month later (at 15th of Apr) in both seasons, whereas (0.1%) superfilmas a surfactant agent was used with all spray treatments even control. Moreover, 5 liters solution were found to be enough for covering the whole foliage of each tree canopy.

Thus, the different investigated (N and K) and bio-stimulants fertilization treatments were as follows:

T_1: Control (the mineral N, P and K fertilizers used in the farm as recommended + tap water spray).

T_2: N_1K_1 (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 1.0 kg/tree of soil added + tap water spray).

T_3: N_1K_1 + SWE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 1.0 kg/tree of soil added + Seaweed extract).

T_4: N_1K_1 + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 1.0 kg/tree of soil added + Active dry yeast extract).

T_5: N_1K_1 + HA + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 1.0 kg/tree of soil added + Humic acid + Active dry yeast extract).

T_6: N_1K_1 + SWE + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 1.0 kg/tree of soil added + Seaweed extract + Active dry yeast extract).

T_7: N_1K_1 + HA + SWE + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 1.0 kg/tree of soil added +Humic acid + Seaweed extract + Active dry yeast extract).

T_8: N_2K_2 (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 2.0 kg/tree of soil added + tap water spray).

T_9: N_2K_2 + SWE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 2.0 kg/tree of soil added + Seaweed extract).

T_{10}: N_2K_2 + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 2.0 kg/tree of soil added + Active dry yeast extract).

T_{11}: N_2K_2 + HA + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 2.0 kg/tree of soil added + Humic acid + Active dry yeast extract).

T_{12}: N_2K_2 + SWE + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 2.0 kg/tree of soil added + Seaweed extract + Active dry yeast extract).

T_{13}: N_2K_2 + HA + SWE + ADYE (the mineral N, P and K fertilizers used in the farm as recommended + the mineral N and K fertilizers each at 2.0 kg/tree of soil added +Humic acid + Seaweed extract + Active dry yeast extract).

Experimental layout:

The randomizing complete block design (RCBD) with three replicates was employed for arranging the aforesaid thirteen treatments, whereas each replicate was represented by a single tree. So, thirty-nine healthy canino trees nearly uniform as possible in their vigor diseases free, grown in clay loamy soil at 5 meters apart under flood irrigation system and received regularly the same cultural practices adopted in the region were carefully selected. Besides, 13 additional trees were included also, so a reserve would be available. All choice trees were divided according to their vigor into three equal categories (blocks), whereas each tree of every division (block) was randomly subjected to one of the thirteen investigated nutritional treatments.

At the beginning of each season four main brunches (limbs) well distributed around each tree periphery (one towards every geographical direction) were carefully selected and labeled. For determining the impact of differential investigated treatments, the response of the following growth, fruiting, and fruit quality parameters were evaluated:-

1- Vegetative growth measurements:

Through the last third of August during each season the average shoot length, number of leaves per shoot, leaf dry weight and leaf area were determined to evaluate the response of these four growth parameters to the investigated treatments.

2- Fruiting parameters:-

2-a. Fruit set%: As an earlier fruiting parameter for every tree was estimated during every season according to the following equation after (**Westwood, 1993**).

Fruit set (%) = No. of set fruitlets / Total No. of flowers at full bloom x 100

2-b. Tree productivity (yield):

Productivity (yield) was estimated either as number and weight (in kg) of harvested mature fruit per each individual tree or in tons per feddan. Besides, the differences in yield estimated on the base of yield in kg of harvested fruits per an individual tree between control and any of each other ones according to the following equation according to **Kabeel (1998)**.

Differences % of yield for a giving treatment = Yield/treatment - yield/control / Yield/control x 100

3- **Fruit quality (characteristics):**

Twenty mature fruits from each tree (replicate) were sampled for determining the following physical and chemical properties.

3-1. Fruit physical properties: The average fruit weight (g.), fruit volume (ml^3), fruit dimensions (fruit height& fruit diameter in mm.), and fruit shape index (fruit height: fruit diameter ratio).

3-2. Fruit chemical properties: Fruit juice Total soluble solids TSS (%) using hand refractometer and fruit juice titratable acidity as Malic Acid (%) (mg/100 g. fruit juice) were determined according to **A.O.A.C. (2000)** and **Vogel (1968),** then TSS/acid ratio was estimated.

All the obtained data during the two seasons of this study were subjected to analysis of variance method according to **Snedecor and Cochran (1990)**. Meanwhile, differences among means were compared using Duncan's multiple range tested at 5 % level (**Duncan, 1955**).

Results and Discussions

1- Vegetative growth parameters:

Regarding the response of four evaluated growth parameters of canino apricot trees i.e., average shoot length (cm), number of leaves per shoot, leaf dry weight (g) and leaf area (cm^2) to the differential investigated nutritional treatments of N AND K mineral fertilizers and bio-stimulants, obtained data tabulated in Table (1) displayed obviously that, all 12 N AND K bio-stimulants fertilization treatments increased significantly four investigated abovementioned four evaluated growth measurements as compared to the control treatment in both 2022 and 2023 seasons of study. Moreover, Table (1) displays also that effectiveness of such 12 investigated nutritional treatments over control (adopted N AND K fertilization program in region) varied from one treatment to another. Herein canino apricot trees subjected to the T_{13} nutritional treatment i.e., these trees received both N AND K mineral fertilizers soil added at higher rate (2.0 kg/tree) combined with foliar spray of tree (HA + SWE and ADYE) bio-stimulants together was statistically the superior. Since, it exceeded not only control but also all other investigated nutritional treatments whereas the tallest shoots with the greatest number of leaves per each and the largest leaf area with the heaving dry weight were detected during both 2022 & 2023 seasons.

Nevertheless, T_{12} nutritional treatments (N AND K soil added each at 2.0 kg/tree + foliar spray with SWE + ADYE) ranked statistically 2nd followed in a descending order by T_7 i.e., N AND K soil added each at lower rate (1.0 kg/tree) combined with foliar spray of three (HA+SWE+ADYE) bio-stimulants and T_{11} nutritional treatments (N AND K soil added each at 2.0 kg/tree + foliar spray with both HA & ADYE) which come third and fourth respectively from the statistical point of view.

On the contrary fertilized canino apricot trees by the fertilization program adopted in the region after the Agriculture Ministry Recommendation were significantly the inferior in this regard, followed in an ascending order by T_2 and T_8 nutritional treatments i.e., those trees subjected to N AND K soil added solely either each at the lower (1.0 kg/tree) or higher (2.0 kg/tree) rate respectively. In addition, other investigated nutritional treatments (T_3, T_4, T_5, T_6, T_9, and T_{10}) were in between the aforesaid two extremes. Such trend was true during both 2022 and 2023 experimental seasons with some relative tenderly of variance between six members of such intermediate category.

The enhancement of all studied vegetative growth parameters by the investigated fertilization treatments under may be attributed to the performed effect of tree growth regulating substances produced by the effective micro-organisms or in improving the availability and acquisition of nutrients from the soil which promoted the vegetative growth. However, **Jagnow *et al.*, (1991)** reported that, the bacteria associated with bio-fertilizers produce adequate amount of IAA and cytokinins which increase the surface area per unit root length and enhanced the root hair branching with an eventual increase in acquisition of nutrient from the soil. The present results are in agreement and generally supported by many researchers, **Abou-Grah-Fatma (2004), Wahba (2007), and Sharaf *et al.* (2012)** on persimmon trees; **Osman *et al.* (2010)** on olive trees; **and Morsey *et al.* (2015); Ismail and Abd El-Hady (2018)** on apple trees; **Eissa-Fawzia (2003), Kabeel *et al.* (2005), Shdded *et al.* (2005) and El-Naggar (2009)** on apricot trees and **Haggag-Laila *et al.* (2016), Shaaban-Sanaa *et al.* (2016)** and **Taha-Nevien and El-Shahat (2016)** on "Canino" apricot trees.

Table 1. Some vegetative growth measurements (shoot length, No. of leaves/shoot, leaf dry weight and leaf area) of "Canino" apricot trees in response to mineral N AND K soil added and bio-stimulants sprays treatments during both 2022 and 2023 seasons.

Treatment	Shoot length (cm)		No. of leaves/shoot		Leaf dry weight (mg)		Leaf area (cm^2)	
	2022	2023	2022	2023	2022	2023	2022	2023
T_1- Control	45.20 G	47.03 J	18.67 H	19.00 I	404.3 I	416.7 I	26.06 I	26.40 J
T_2- N_1K_1	46.17 F	49.50 I	22.67 F	22.33 H	417.7 H	433.0 H	29.24 H	28.42 I
T_3- N_1K_1 + SWE	49.37 E	52.60 G	24.00 E	24.00 G	428.7 G	446.0 GH	31.66 FG	31.83 GH
T_4- N_1K_1 + ADYE	51.27 D	53.33 F	23.00 EF	23.33 G	433.3 G	437.0 H	31.14 G	32.18 G
T_5- N_1K_1 + HA + ADYE	52.33 C	53.93 E	23.33 EF	25.00 F	439.0 F	456.7 FG	32.14 EF	32.91 F
T_6- N_1K_1+ SWE + ADYE	52.43 C	54.93 D	25.33 D	26.33 E	458.7 E	485.3 D	33.83 D	34.14 E
T_7- N_1K_1 + HA + SWE + ADYE	54.97 B	56.80 C	27.00 C	28.00 C	486.7 C	522.0 C	34.90 C	36.05 C
T_8- N_2K_2	49.00 E	51.60 H	20.00 G	24.00 G	442.7 F	455.0 FG	29.64 H	31.35 H
T_9- N_2K_2 + SWE	51.93 CD	53.17 F	23.00 EF	26.67 DE	456.3 E	473.3 DE	32.33 E	34.46 E
T_{10}- N_2K_2 + ADYE	52.63 C	53.07 FG	22.33 F	26.33 E	458.3 E	468.7 EF	31.82 EF	34.30 E
T_{11}- N_2K_2 + HA + ADYE	52.77 C	55.20 D	23.00 EF	27.33 CD	480.0 D	488.0 D	33.83 D	35.49 D
T_{12}- N_2K_2+ SWE + ADYE	55.40 B	59.17 B	29.33 B	31.00 B	569.3 B	556.7 B	36.42 B	36.68 B
T_{13}- N_2K_2 + HA + SWE + ADYE	57.40 A	62.33 A	31.00 A	33.33 A	581.0 A	593.3 A	39.55 A	39.02 A

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range Test at P= 0.05.
* (N AND K): Nitrogen and Potassium. * (SWE): Seaweed extract.
* (ADYE): Active dry yeast extract. * (HA): Humic acid.

2- Fruiting aspects parameters:

2-a. Percentage of fruit set and number of fruits/tree.

Obtained data represented in Table (2) revealed that, the percentage of fruit set of apricot trees "Canino cv.", responded significantly to all investigated fertilization treatments under study as compared to control treatment during both seasons. Moreover, results showed that, the highest percentage of fruit set was always in significant relationship to the T_{13}: (N_2K_2 + HA + SWE + ADYE) which was the superior and the most effective. Meanwhile, both T_{12}: (N_2K_2 + SWE + ADYE) and T_7: (N_1K_1 + HA + SWE + ADYE) showed nearly the same effectiveness and ranked second (two categories) especially in most cases. Differences between the abovementioned three fertilization treatments were significant as compared either each other or to the remained ten treatments during both 2022 and 2023 seasons of study. On the other hand, an opposite trend was observed with the control trees, which were statistically the inferior, which exhibited the least value of fruit set percentage during two seasons. Referring the yield expressed as number of fruits per Canino apricot tree as influenced by the different evaluated fertilization treatments under study, obtained results during both seasons displayed clearly that, the response nearly followed the same trend previously detected with percentage of fruit set. Additionally, the other investigated treatments were in between the aforesaid two extents with a tendency of variability in their effectiveness.

Table 2. Some fruiting aspects parameters (fruit set % and number of fruits/tree) of "Canino" apricot trees as influenced by mineral N AND K soil added and bio-stimulants spray treatments during both 2022 and 2023 seasons.

Treatment	Fruit set (%)		No. of fruits / tree	
	2022	2023	2022	2023
T_1- Control	6.73 K	7.87 I	1663. K	1754. K
T_2- N_1K_1	7.67 J	8.63 H	1715. J	1802. J
T_3- N_1K_1 + SWE	9.27 H	9.33 G	1754. I	1884. F
T_4- N_1K_1 + ADYE	9.57 G	9.27 G	1746. I	1823. I
T_5- N_1K_1 + HA + ADYE	10.33 EF	9.97 F	1772. H	1873. G
T_6- N_1K_1+ SWE + ADYE	11.73 D	11.10 D	1837. F	1929. E
T_7- N_1K_1 + HA + SWE + ADYE	12.97 B	12.93 B	1869. D	2004. B
T_8- N_2K_2	8.87 I	9.10 G	1808. G	1833. H
T_9- N_2K_2 + SWE	10.23 F	10.47 E	1852. E	1891. F
T_{10}- N_2K_2 + ADYE	10.50 E	10.73 E	1844. EF	1980. D
T_{11}- N_2K_2 + HA + ADYE	11.57 D	11.33 D	1885. C	1992. C
T_{12}- N_2K_2+ SWE + ADYE	12.73 C	12.03 C	1943. B	2010. B
T_{13}- N_2K_2 + HA + SWE + ADYE	13.67 A	13.97 A	1991. A	2051. A

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range Test at P= 0.05.
*(N AND K): Nitrogen and Potassium. *(SWE): Seaweed extract.
*(ADYE): Active dry yeast extract. *(HA): Humic acid.

2- b. Tree productivity (yield in kg/tree and ton/feddan as well as yield increment % in relation to the control).

Considering the tree productivity of fruits estimated as kg/tree and ton/feddan of "Canino" apricot trees, obtained results in Table (3) during both 2022 and 2023 seasons indicated clearly that, both studied characters following typically the same trend of response during the two seasons of study. Moreover, fruit productivity of apricot trees (Canino cv.) estimated as either kg/tree or ton/feddan responded significantly to all investigated fertilization treatments as compared to the control treatment in the two seasons of study. Furthermore, the T_{13}: (N_2K_2 + HA + SWE + ADYE) treated trees was the most effective and the superior which exhibited statistically the highest and greatest values of productivity (kg/tree and ton/feddan) during both experimental seasons. Moreover T_{12}: (N_2K_2 + SWE + ADYE) fertilization treatment i.e., ranked significantly second during two seasons besides T_7: (N_1K_1 + HA + SWE + ADYE) in the second season only also ranked significantly second.

Table 3. Some fruiting aspects parameters (tree productivity and yield increment %) of "Canino" apricot trees as influenced by mineral N AND K soil added and bio-stimulants sprays treatments during both 2022 and 2023 seasons.

Treatment	Yield (Kg/tree)		Yield (Ton/fed.)		Yield increment (%) over the control	
	2022	2023	2022	2023	2022	2023
T_1- Control	44.86 K	48.30 I	7.54 K	8.11 I	0.00 K	0.00 J
T_2- N_1K_1	49.58 J	51.02 H	8.33 J	8.57 H	10.52 J	5.61 I
T_3- N_1K_1 + SWE	56.84 H	59.42 F	9.55 H	9.98 F	26.70 H	23.00 G
T_4- N_1K_1 + ADYE	53.44 I	55.98 G	8.98 I	9.40 G	19.12 I	15.86 H
T_5- N_1K_1 + HA + ADYE	58.61 G	60.26 F	9.85 G	10.12 F	30.63 G	24.79 G
T_6- N_1K_1+ SWE + ADYE	61.73 F	64.11 E	10.37 F	10.77 E	37.61 F	32.75 F
T_7- N_1K_1 + HA + SWE + ADYE	67.55 C	73.36 B	11.35 C	12.33 B	50.58 C	51.10 C
T_8- N_2K_2	54.50 I	56.64 G	9.16 I	9.52 G	21.46 I	17.30 H
T_9- N_2K_2 + SWE	62.31 EF	64.18 E	10.47 EF	10.78 E	38.87 EF	32.86 F
T_{10}- N_2K_2 + ADYE	63.21 E	67.19 D	10.62 E	11.29 D	40.89 E	39.14 E
T_{11}- N_2K_2 + HA + ADYE	66.11 D	70.59 C	11.10 D	11.86 C	47.36 D	46.15 D
T_{12}- N_2K_2+ SWE + ADYE	71.71 B	74.43 B	12.04 B	12.50 B	59.82 B	54.11 B
N_2K_2 + HA + SWE + ADYE	76.07 A	76.78 A	12.78 A	12.90 A	69.54 A	58.99 A

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range Test at P= 0.05.
* (N AND K): Nitrogen and Potassium. * (SWE): Seaweed extract.
* (ADYE): Active dry yeast extract. * (HA):Humic acid.

On the other hand, the control treatment was statistically the inferior as recorded the least values of yield either as kg per tree or ton per feddan in the two seasons of study. In addition, the other remained investigated treatments were in between the abovementioned two extents. Regarding the yield increment (%) in relation to the control, data in Table (3) show clearly that, the response typically followed the same trend previously detected with abovementioned fruiting characteristics i.e., tree yield in kg and ton per feddan during both 2022 and 2023 seasons of study. The obtained results are in conformity with those previously reported by **Abou-Grah-Fatma (2004), Wahba (2007),** and **Sharaf *et al.* (2012)** on persimmon trees; **Kabeel *et al.*, (2005), Shddad *et al.* (2005)** and **El-Naggar (2009); Shaaban-Sanaa *et al.* (2016)** and **Taha-Nevien** and **El-Shahat (2017)** on "Canino" apricot; **Kabeel *et al.* (2008)** on pear trees, **Morsey *et al.* (2015)** and **Ismail** and **Abd El-Hady (2018)** on apple trees.

3-a. Fruit quality (characteristics):

3-a.1. Fruit weight (gm) and fruit volume (cm^3):

With regard to the fruit weight (gm) and fruit volume (cm^3) as affected by the different investigated nutritional treatments under study, data represented in Table (4) displayed clearly that, both investigated parameters were increased by all evaluated fertilization treatments as compared to the control during both 2022 and 2023 seasons. Moreover, it could be noticed clearly thatT_{13}: (N_2K_2 + HA + SWE + ADYE), T_{12}: (N_2K_2 + SWE + ADYE) and T_7: (N_1K_1 + HA + SWE + ADYE) fertilization treatments, the heaviest weight of fruits (38.20 and 37.43 gm), (36.90 & 37.03 gm) and (36.13 & 36.60 gm) during 1st& 2nd seasons, respectively. Differences between the abovementioned three fertilization treatments and other investigated treatments were significant from the standpoint of statistic as compared in two seasons. Concerning fruit volume results followed typically the same trend previously detected with fruit weight hence, the greatest value and biggest fruit volume was induced byT_{13}: (N_2K_2 + HA + SWE

+ ADYE) followed significantly by both T_{12}: (N_2K_2 + SWE + ADYE) and T_7: (N_1K_1 + HA + SWE + ADYE) treatments. Contrary to that, the control trees exhibited significantly the lightest weight and the smallest volume of "Canino" fruits during the first and second seasons of study. On the other hand, the other remained tested treatments were statistically in between the abovementioned two extents with a tendency of variance in their effectiveness as compared each other during 2022 and 2023 seasons of study. The present results are in harmony with those previously reported by many researchers, **Eissa-Fawzia (2003), Kabeel *et al*. (2005), Shddad *et al*. (2005), El-Naggar (2009), El-Goushy** and **Baiea (2015), Taha-Nevien** and **El-Shahat (2016)** and **Haggag-Laila *et al*. (2016)** on Canino" apricot fruits.

Table 4. Some fruit physical characteristics (fruit weight and fruit volume) of "Canino" apricot trees as influenced by mineral N AND K soil added and bio-stimulants sprays treatments during both 2022 and 2023 seasons.

Treatment	Fruit Weight (g)		Fruit Volume (cm^3)	
	2022	2023	2022	2023
T_1- Control	26.97 J	27.53 J	28.00 I	27.90 I
T_2- N_1K_1	28.90 I	28.30 I	30.13 H	29.03 H
T_3- N_1K_1 + SWE	32.40 G	31.53 G	33.27 F	32.63 F
T_4- N_1K_1 + ADYE	30.60 H	30.70 H	32.00 G	32.03 G
T_5- N_1K_1 + HA + ADYE	33.07 FG	32.17 F	34.00 EF	32.67 F
T_6- N_1K_1+ SWE + ADYE	33.60 EF	33.23 E	34.73 DE	34.47 E
T_7- N_1K_1 + HA + SWE + ADYE	36.13 C	36.60 B	36.90 B	37.73 B
T_8- N_2K_2	30.13 H	30.90 H	32.20 G	32.47 FG
T_9- N_2K_2 + SWE	33.63 EF	33.93 D	34.40 DE	35.03 D
T_{10}- N_2K_2 + ADYE	34.27 E	33.93 D	34.87 D	34.67 DE
T_{11}- N_2K_2 + HA + ADYE	35.07 D	35.43 C	35.77 C	36.20 C
T_{12}- N_2K_2+ SWE + ADYE	36.90 B	37.03 AB	37.30 B	38.10 B
T_{13}- N_2K_2 + HA + SWE + ADYE	38.20 A	37.43 A	38.63 A	38.87 A

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range Test at P= 0.05.
* (N AND K): Nitrogen and Potassium. * (SWE): Seaweed extract.
* (ADYE): Active dry yeast extract. * (HA): Humic acid.

3-a.2. Fruit dimensions (fruit height and fruit diameter):

Referring influence of various investigated mineral N AND K fertilizers and bio-stimulants substances fertilization treatments on fruit dimensions of "Canino" apricot trees (fruit height and fruit diameter), it is quite evident from results tabulated in Table (5) that, fruit height was increased significantly by all studied fertilization treatments as compared to the control treatment which exhibited statistically the least value in this concern during both seasons of study. However, the highest significant value of fruit height produced from apricot trees fertilized by both T_{13}: (N_2K_2 + HA + SWE + ADYE) and T_7: (N_1K_1 + HA + SWE + ADYE) fertilization treatments, respectively in the two seasons of study whereas the differences were significant between the two aforesaid treatments as compared to each other in both the first and second seasons in the present work. On the other hand, the other remained investigated fertilization treatments under study were in between the abovementioned two extremes from the standpoint of statistic during 2022 and 2023 seasons.

With regard to fruit diameter, data presented in the same Table revealed obviously that, all investigated fertilization treatments under study followed approximately a similar trend to that previously detected with fruit height during both seasons of study.

The obtained data are in conformity with those previously reported by several researchers, **Fathi *et al.* (2002),** and **Morsey *et al.* (2015)** on apple trees, **Abou-Grah-Fatma (2004), Wahba (2007)** and **Sharaf *et al.* (2012)** on persimmon trees and **Kabeel *et al.* (2005), El-Naggar (2009), El-Goushy and Baiea (2015), Haggag-Laila *et al.* (2016)** and **Taha-Nevien and El-Shahat (2017)** on "Canino" apricot trees.

3-a.3. Fruit shape index (fruit height/diameter ratio):

With regard to the fruit shape index (fruit height/diameter ratio) of "Canino" apricot trees as influenced by investigated fertilization treatments, obtained results tabulated in Table (5) indicated clearly that, however the differences in most cases were no too higher and clear to be pronounced as most treatments were compared each other and. Generally, it could be concluded that fruit shape index tended to be depressed (less than 1.0). Moreover, fruit shape index as control and few treatments especially T_{10} & T_{11} particularly in 2nd season showed statistically the least fruit shape index value. Meanwhile other investigated treatments

showed approximately the same shape value from the statistic point of view during both seasons.

Table 5. Some fruit physical characteristics (fruit height, diameter and shape index) of "Canino" apricot trees as influenced by mineral N AND K soil added and bio-stimulants sprays treatments during both 2022 and 2023 seasons.

Treatment	Fruit height (cm)		Fruit diameter (cm)		Fruit shape index	
	2022	2023	2022	2023	2022	2023
T_1- Control	3.033 J	3.167 J	3.333 H	3.400 J	0.911 D	0.933 D
T_2- N_1K_1	3.267 I	3.433 I	3.367 H	3.567 I	0.971 AB	0.962 BC
T_3- N_1K_1 + SWE	3.367 HI	3.567 H	3.500 G	3.667 H	0.962 BC	0.973 AB
T_4- N_1K_1 + ADYE	3.533 FG	3.767 FG	3.733 DE	3.867 F	0.946 C	0.974 AB
T_5- N_1K_1 + HA + ADYE	3.633 EF	3.867 E	3.800 DE	3.933 EF	0.956 BC	0.983 A
T_6- N_1K_1+ SWE + ADYE	3.767 CD	3.900 DE	3.833 D	4.000 DE	0.983 A	0.975 AB
T_7- N_1K_1 + HA + SWE + ADYE	4.133 A	4.467 B	4.267 A	4.633 B	0.969 AB	0.964 ABC
T_8- N_2K_2	3.433 GH	3.567 H	3.600 FG	3.767 G	0.954 BC	0.947 CD
T_9- N_2K_2 + SWE	3.600 EF	3.733 G	3.700 EF	3.867 F	0.973 AB	0.966 AB
T_{10}- N_2K_2 + ADYE	3.667 DE	3.833 EF	3.733 DE	4.067 D	0.982 A	0.943 D
T_{11}- N_2K_2 + HA + ADYE	3.800 C	3.967 D	3.967 C	4.233 C	0.958 BC	0.937 D
T_{12}- N_2K_2+ SWE + ADYE	3.967 B	4.167 C	4.100 B	4.300 C	0.967 AB	0.969 AB
T_{13}- N_2K_2 + HA + SWE + ADYE	4.233 A	4.633 A	4.367 A	4.767 A	0.970 AB	0.972 AB

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range Test at P= 0.05.
* (N AND K): Nitrogen and Potassium. * (SWE): Seaweed extract.
* (ADYE): Active dry yeast extract. * (HA):Humic acid.

3-b. Fruit chemical characteristics:

3-b.1. Fruit juice TSS (%):

With regard to the effect of the different investigated (mineral and bio-stimulants) fertilization treatments on fruit juice TSS% of "Canino" apricot, it is quite evident from data in Table (6) that, fruit juice TSS content responded significantly to all fertilization treatments as compared to the control during two seasons of study. However, apricot trees treated with T_{13}: (N_2K_2 + HA + SWE + ADYE) treatment exhibited the richest fruits in their fruit juice TSS and showed the highest significant value in this concern during both 2022 and2023 seasons. On the other hand, the reverse was noticed with control trees, which induced statistically the poorest fruits in their TSS content during two seasons. Furthermore, the remained investigated fertilization treatments were intermediate the abovementioned two extremes in 2022 and 2023 of seasons.

3-b.2. Fruit juice total Acidity (%):

Generally, it could be clearly notice that on opposite trend to that previously detected with the fruit juice TSS % was found with the fruit juice total acidity percentage. Herein both T_1control and T_2 (N_1K_1) and to great extent T_8 (N_2K_2) also exhibited statistically the highest fruit juice total acidity % during both seasons. However, the reverse was detected with the three T_{13}, T_{12} and T_7 nutritional treatments i.e., those trees subjected to (N_2K_2 + HA + SWE + ADYE), (N_2K_2 + SWE + ADYE) and (N_1K_1 + HA + SWE + ADYE) which showed the least fruit juice total acidity as compared to other treatments particularly in 2nd season in addition, other investigated treatments were in between the aforesaid two extremes.

3-b.3. Rate of fruit juice TSS (%)/total acidity (%):

Table (6) clearly displays that, both T_{13}: (N_2K_2 + HA + SWE + ADYE) and T_7: (N_1K_1 + HA + SWE + ADYE) fertilization treatments exhibited significantly the highest values of TSS/acid ratio in fruit juice during both 2022 and 2023 seasons. Besides, four T_{12}, T_{11}, T_{10} and T_6 i.e., (N_2K_2 + SWE + ADYE), (N_2K_2 + HA + ADYE), (N_2K_2 + ADYE)

and (N_1K_1 + SWE + ADYE) during 2nd season showed the same effectiveness of both (T_{13}&T_7). Generally it could be safely concluded that both TSS % and TSS/acid ratio followed similarly the same trend, while total acidity % took the other way around this remarkable conclusion may be attributed to rate of changes in both total TSS % and acidity % were not similar but it was more pronounced in TSS % then acidity %.

Obtained results concerning the response of studied fruit chemical properties to the investigated nutritional fertilization treatments under study are in accordance with those previously reported by several investigators, **Fathi *et al.* (2002), Abou-Grah-Fatma (2004), Kabeel *et al.* (2005), Wahba (2007), Kabeel *et al.*, (2008), El-Naggar (2009), Sharaf *et al.* (2012), Morsey *et al.* (2015),** and **El-Goushy and Baiea (2015),** on some deciduous fruit trees.

Table 6. Some fruit chemical characteristics (fruit juice TSS %, acidity % and TSS/acid ratio) of "Canino" apricot trees as influenced by mineral N AND K soil added and bio-stimulants sprays treatments during both 2022 and 2023 seasons.

Treatment	TSS (%)		Acidity (%)		TSS/acidratio	
	2022	2023	2022	2023	2022	2023
T_1- Control	8.06 I	9.06 I	0.733 A	0.660 C	11.01 I	13.75 C
T_2- N_1K_1	8.73 H	9.63 H	0.750 A	0.713 A	11.65 I	13.51 C
T_3- N_1K_1 + SWE	9.96 F	10.40 F	0.620 C	0.643 CD	16.10 F	16.24 BC
T_4- N_1K_1 + ADYE	10.23 E	10.03 G	0.600 D	0.563 F	17.06 E	17.82 B
T_5- N_1K_1 + HA + ADYE	10.43 E	11.23 E	0.627 C	0.633 DE	16.70 EF	17.76 B
T_6- N_1K_1+ SWE + ADYE	11.47 D	11.57 D	0.577 EF	0.533 G	19.90 C	21.73 A
T_7- N_1K_1 + HA + SWE + ADYE	12.50 B	12.20 B	0.557 G	0.530 G	22.46 A	23.04 A
T_8- N_2K_2	9.56 G	9.96 G	0.707 B	0.683 B	13.54 H	14.60 BC
T_9- N_2K_2 + SWE	10.37 E	10.33 F	0.553 G	0.623 E	18.73 D	16.62 BC
T_{10}- N_2K_2 + ADYE	10.30 E	11.53 D	0.693 B	0.537 G	14.85 G	21.49 A
T_{11}- N_2K_2 + HA + ADYE	12.00 C	11.93 C	0.593 DE	0.527 G	20.23 C	22.67 A
T_{12}- N_2K_2+ SWE + ADYE	12.57 B	11.97 C	0.583 DE	0.530 G	21.56 B	22.58 A
T_{13}- N_2K_2 + HA + SWE + ADYE	12.87 A	12.50 A	0.560 FG	0.530 G	22.99 A	23.63 A

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range Test at P= 0.05.
* (N AND K): Nitrogen and Potassium. * (SWE): Seaweed extract.
* (ADYE): Active dry yeast extract. * (HA):Humic acid.

Recommendation

Generally, data obtained in this study proved the great benefit could be achieved by the mineral NK soil added fertilizers and bio-stimulants spray nutritional treatments which reflected positively significantly on most parameters those related to vegetative growth, nutritional status, productivity and fruit quality of canino apricot trees. So, it could be safely conclude more pronounced desirable effect was exhibited by T_{13}, T_{12} and T_7 nutritional treatments. However, from the financial point view and for safety purpose T_7 i.e., soil added fertilizer each at lower rate (1.0 kg/tree) combined with three (HA+SWE+ADYE) bio-stimulants in the most adviceable in this concern

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استجابة نمو وانتاجية اشجار المشمش "كانينو" لمعدل الاضافة الارضية للتسميد النيتروجيني والبوتاسي المعدني والرش ببعض المخصبات الحيوية

اجريت هذه الدراسة على اشجار مشمش صنف كانينو نامية في تربة طينية طميية علي مسافة 5 متر وتروي بنظام الري بالغمربمزرعة خاصة بقرية شبرا شهاب التابعة لمركز القناطر الخيرية بمحافظة القليوبية بجمهورية مصر العربية خلال عامي 2022 & 2023 م لمعرفة تأثير معدل التسميد الارضي بالسمادين المعدنيين سلفات الامونيوم وسلفات البوتاسيوم (1، 2 كجم/شجرة) سواء اضيفا منفردين او في تراكيب مع الرش بواحد او اكثر من المخصبات الحيوية الثلاثة (حمض الهيوميك بمعدل 2.5مل/5لتر – الطحالب البحرية بمعدل 5جم/5لتر – المستخلص الجاف للخميرة بمعدل 5جم/5لتر) اضافة الى برنامج التسميد الارضي المتبع بالمنطقة كمقارنة. هذا وقد قيمت الاستجابة من خلال التغيرات الناتجة في بعض القياسات الخضرية (طول الفرع وعدد الاوراق بكل منها ومتوسط الوزن الجاف ومساحة الورقة الواحدة) والانتاجية (نسبة العقدالمحصولي سواء للشجرة او الفدان) وبعض صفات الجودة سواء الطبيعية (وزن – حجم – ابعاد الثمار) او الكيميائية (نسبة المواد الصلبة الذائبة الكلية والحموضة الكلية والنسبة بينهما) وعن اهم النتائج والتي يمكن ايجازها في الاتي:

جميع المعاملات المختبرة اظهرت زيادة معنوية في كل القياسات المختبرة مقارنة بالكنترول خلال موسمي الدراسة ما عدا نسبة الحموضة الكلية اظهرت إنخفاضا معنويا. وان تفاوتت المعاملات المختبرة فيما بينها الا ان المعاملات الثلاثة T_{13}: (اي إضافة النيتروجين والبوتاسيوم كتسميد ارضي بمعدل 2 كجم/شجرة + الرش بالمخصبات الثلاثة معا) تليها كل T_{12}: (أي إضافة النيتروجين والبوتاسيوم كتسميد ارضي بمعدل 2 كجم/شجرة + الرش بـ (ADYE + SWE) وT_7: (اي إضافة النيتروجين والبوتاسيوم كتسميد ارضي بمعدل 1 كجم/شجرة + الرش بالمخصبات الثلاثة معا)هي الاكثر تفوقا في تحسين النمو والانتاجية لأشجار المشمش صنف الكانينوالمنزرعة في الأراضي الطينية والتي تروي بالغمر بالإضافة إلى تحسين خصاص الجودة للثمار