Impact of foliar application with dry yeast suspension and amino acid on vegetative growth, yield and quality characteristics of Olive (Olea *europaea* L.) Trees.

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Abstract

Bashika Olive trees (*Olea europaea* L.) were sprayed twice at full bloom stage and one month after that one with dry yeast suspension (5, 10g.L^{-1}) and amino acid (1, 2ml.L^{-1}), alone and in combination besides control (spraying with water only) during 2017 and 2018 growing seasons. Results showed that foliar spraying of dry yeast suspension at 10g.L^{-1} with amino acid 2ml.L^{-1} gave the highest significant value of vegetative growth(leaf area, total chlorophyll leaf content) and foliar spraying of dry yeast suspension at 10g.L^{-1} with amino acid 1,2ml.l^{-1} gave the highest significant value of carbohydrate leaf content and carbohydrate shoot percentage in first season and dry yeast suspension at 10g.L^{-1} with amino acid 2ml.L^{-1} in second season. Also, results showed that dry yeast suspension at 5g.$L^{-1}$with amino acid at 1ml.L^{-1} exhibited increase of fruit weight and fruit flesh weight in both seasons respectively. While, dry yeast suspension at 10g.$L^{-1}$with amino acid at 1ml.L^{-1} treatment gave the highest significant average yield per $tree^{-1}$in first and dry yeast suspension at 10g.$L^{-1}$with amino acid at 0 ml.L^{-1} in second season.

Treatment of dry yeast suspension at 10g.$L^{-1}$with amino acid at 0,1and 2 ml.L^{-1} gave the highest significant value of fruit protein content in the first season and dry yeast suspension at 10g.$L^{-1}$with amino acid at 1,2 ml.L^{-1} in seconed season, Dry yeast suspension at 10g.$L^{-1}$with amino acid at 1,2 m.L^{-1} treatment gave the highest significant value of fruit oil content in both seasons respectively and highest value of percentage of unsaturated fatty acids in the first season .

Keywords: Olive, Biostimulants, Bashika variety.

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Introduction

The Olive tree *Olea europaea* L. is an evergreen fruit that has been known since ancient times and is a sacred tree in all the heavenly religions. The current Olive belongs to the Oleaceae family, which originated from Mediterranean

Olea europaea L. belongs to the Oleaceae family of 30 species, including the genus Olea and 600 species. The species belongs to the Europaea type (16). The Olive has economic importance in the countries that are famous in its cultivation, where it comes first in Spain, Italy, Greece, Tunisia and Algeria (16).

The foliar spraying technique is an important tool to meet the requirements of the tree of nutrients Where this method is considered environmentally friendly. Fruit trees are always exposed to several types of stresses during their life cycle that may limit thier productivity To address this problem several types of modern mechanisms were used to increase tree resistance using of bio-fertilizers and amino acids that produced from natural sources considered as environmentally friendly is type of clean organic agriculture that is not polluted to environment(15). Bioenergy is important and plays an important role in improving the production of fruit trees by improving nutrient readiness, stimulating plant growth and minimizing the use of chemical fertilizers (15). It plays a vital role in increasing vegetative growth, quantitative and qualitative yield of trees on many evergreen trees Such as avocado trees (1) and olive (10). It has been shown through studies adding of chemical fertilizers in large quantities causes an increase in environmental pollution and health problems to humans and animals (21). It is therefore necessary to search for other machanisms which are used in the production of fertilizers such as yeast, bacteria, fungi plant suspensions and amino acids to be more safe "on the environment, humans and animals.. Respectively, El-Sayed (9) found that adding of yeast to the soil by 10 g. $tree^{-1}$ with 60 g of humic acid gave the best effect on Olive tree yield and fruit quality. The current research was carried out to study the effect of active yeast suspension, amino acid on some vegetative growth, yield and qualitative characteristics of the Olive fruit of Bashika cultivar.

Materials and Methods

The study was carried out during two seasons (2017 and 2018) on Bashika Olive trees (12 old ago) which planted at 6 meters apart in sandy soil under drip irrigation system in Nouriya Forest Station - Directorate of Agriculture of Al-Diwaniyah Governorate - affiliated to the Ministry of Agriculture. The physical and chemical properties of the experimental soil are presented in Table (1). Dry yeast suspension was sprayed in three concentration (0,5, $10g.L^{-1}$). The chemical composition of Dry yeast are shown in Table (2) . it is obtained from Al-DANA General Trading CO.L.L.C. Amino acid was sprayed in three concentration (0,1,2 $ml.L^{-1}$). it obtained from Agritecno. Spain the following composition: K_2O 20% W/W, Amino acid 5% W/W.

Table (1): Some physical and chemical properties of the experimental soil.

Texture soil	pH	Ec dsm^{-1}	Available nutrients (Cation)		
Silt Clay Loam	7.9	1.9	N 0.39ppm	P 4.87ppm	K 0.15mmol.L^{-1}

The selected trees were uniform in vigor as possible. Fertilization program and other agricultural practices were the same for all trees. The Complete Randomized Block Design (RCBD) was used for arranged treatments, where each of the following treatment was replicated three times using one tree. $plot^{-1.}$ Thus, treatments were applied as follows: -

T1. Control (spraying with tap water only).

T2. Amino acid spraying at 1ml.L^{-1}

T3. Amino acid spraying at 2ml. L^{-1}

T4. Dry yeast spraying at 5 g.L^{-1}

T5. Dry yeast spraying at 5 g.L^{-1} + amino acid spraying at 1ml.L^{-1}

T6. Dry yeast spraying at 5 g.L^{-1} + amino acid spraying at 2ml.L^{-1}

T7. Dry yeast spraying at 10 g.L^{-1}

T8. Dry yeast spraying at10 g.L^{-1} + amino acid spraying at 1ml.L^{-1}.

T9. Dry yeast spraying at10 g.L^{-1} + amino acid spraying at 2 ml.L^{-1}.

Table (2): Chemical composition of Dry yeast (Abou El-yazed and Mady,2011(2)

Amino acid (%)		Vitamins dry weight and amino acids	mg.100g	Growth regulator Ppm	
Alanine	1.69	**Vit B1**	23.33	Adenine	31
Arginine	1.49	**Vit B2**	21.04	Betaines	56
Aspartic Acid	2.32	**Vit B6**	20.67	**Minerals**	
Cystine	0.63	**Vit B12**	19.17	Nitrogen	6.88%
Glutamic acid	3.76	Thimain	23.21	Phosphorus	0.66%
Glycine	1.45	Riboflavin	27.29	Potassium	0.95%
Histidine	0.71	Insitol	20.43	Magnesium	0.19%
Isoleucine	0.85	Biotin	20.04	Calcium	0.17%
Leucine	1.91	Nicotinic acid	73.92	Sulfur	0.48%
Lysine	1.13	Panthothenic acid	38.43	Iron	107ppm
Phenylalanine	1.18	P Amino benzoic acid	29.49	Zinc	77ppm
Proline	1.29	Folic acid	26.22	Copper	5ppm
Serine	1.98	Pyridoxine	22.09	Manganese	13ppm
Threonine	1.54	Crude Protein	43%	**Enzymes**	
Tryptophan	0.25	Crude Fat	2.20%	cytochrome oxide	0.350
Tyrosine	0.99	Carbohydrates	33.21%	Cytochrome Pyroxidase	0.290
Valine	1.4	Crude Fiber	7.20%	Catalase	0.063
Methionine	0.4	Ash	3.80%		

All trees were sprayed twice, the first spraying was at full bloom and the second spraying was one month ago after the first one. The following parameters were measured in both seasons:

A. vegetative growth measurements: In this regard average leaf area(cm^2) (8) , Cchlorophyll leaf content (spad unit),Total carbohydrate leaf content(Dubois *et al* 1956(5), Total carbohydrate shoot percentage (%) (14) were investigated.

B. yield characteristics: At maturity stage (early October), fruits of each replicate tree were separately harvested, then 25 fruits from each replicate tree i.e. 75 fruits from each of the sprayed treatments were picked randomly to determine:

average fruit weight (g), fruit flesh weight, seed weight (g) and average yield per tree(Kg).

C. chemical properties: percentage of protein, percentage of oil, according to Hagagg *et al*. (11) , fruit carbohydrate

content (Dubois *et.al*. 1965) and percentage of unsaturated fatty acids according to Hagagg *et al*.(12).

Statistical analysis: The data were subjected to analysis of variance and Duncan's multiple range test was used to compare between means as described by (13).

Results

Table 3 showed that different sprayed treatments i.e., dry yeast suspension and amino acid well as combinations were significantly increased some of vegetative growth of Bashika Olive cv. in both seasons of this study. The highest increase of leaf area(6.48 and 6.37 cm^2), total carbohydrate leaf content(7.29 and 7.22 mg. g^{-1} dry weight) and the percentage of carbohydrate in shoot (9.52 and 9.40 %) was occurred with treatment of dry yeast suspension at 10g.L^{-1} and amino acid at 2m.l^{-1} treatment in both seasons respectively. Meanwhile, the lowest leaf area(4.50 and 4.08 cm^2) and total carbohydrate leaf content(6.13 and 6.13 mg. g^{-1} dry weight), was occurred with control treatment in both seasons respectively, and the highest significant chlorophyll leaf content (59.66 Spad unit) was happened at treatment of dry yeast suspension at 10g.L^{-1} with amino acid at 2 ml.L^{-1} treatment in first season and dry yeast suspension at 5g.L^{-1} with Amino acid at 2 ml.L^{-1} treatment(60.26 Spad unit) in second season (Table:3), Meantime, the lowest chlorophyll leaf content (50.90 Spad unit) was existed by dry yeast suspension at 10 g.L^{-1} with amino acid at 1 ml.L^{-1} treatment in first season and amino acid at 1 ml.L^{-1} treatment(50.33 Spad unit) in second season.

Results showed that dry yeast suspension at 5 g.L^{-1} with amino acid at 1 ml.L^{-1} treatment exhibited increase of fruit weight(2.74 and 2.90g) and fruit flesh weight (2.01and 2.22g) in both seasons respectively, Meanwhile, the lowest fruit weight(2.29 and 2.42 g) was existed by amino acid at 1ml.L^{-1} in both seasons respectively, Meanwhile, the lowest fruit flesh weight(1.82 g)was existed by amino acid at 1 ml.L^{-1} in s the second season. dry yeast suspension at 5 g.L^{-1} with amino acid at 1 ml.L^{-1} treatment gave the highest significant seed weight (0.743 g) in the first season. While, treatment of dry yeast suspension at 10 g.L^{-1} treatment gave the highest significant seed weight (0.718 g) in the second season. Meanwhile, the lowest seed weight (0.572 and 0.574 g) was existed by. amino acid treatment spraying at 1ml. L^{-1} in both seasons respectively. Dry yeast suspension at 10 g. L^{-1} with treatment of amino acid at 1 ml. L^{-1} treatment gave the highest significant treatment of average yield per tree (23.65 kg. $tree^{-1}$) in the first season and dry yeast suspension at 10 g. L^{-1} (5.02 kg. $tree^{-1}$) in the second season. treatment of dry yeast suspension at 10 g.L^{-1} with amino acid at 2 ml.L^{-1} treatment gave the lowest significant treatment of average yield per tree (12.56 kg.$tree^{-1}$) in the first season and treatment of dry yeast suspension at 5 g.L^{-1} with amino acid at 1ml.L^{-1} treatment (2.63) kg.$tree^{-1}$ in the second season. (Table4).

Table (3): Effect of spray with dry yeast suspension and amino acid on vegetative growth of Bashika Olive trees during 2017 and 2018 seasons.

Treatments	Leaf area (cm^2)		Total chlorophlly (spad unit)		Total carbohydrate leaf content(mg. g^{-1} dry weight)		Total carbohydrate shoot (%)	
	2017	2018	2017	2018	2017	2018	2017	2018
T1	4.50 d	4.08 f	52.55 cde	50.95 e	6.13 d	6.13 f	6.39 c	6.04 f
T2	4.73 cd	4.44 e	56.38 b	50.33 e	6.21 d	6.13 f	6.63 e	6.39 e
T3	4.74 cd	4.65 de	53.96 c	54.34 b	6.22 d	6.17 f	6.68 e	6.38 e
T4	4.68 cd	4.78 d	53.33 cd	52.18 d	6.56 c	6.40 e	7.82 d	8.15 c
T5	4.98 c	5.11 c	51.82 de	53.48 bc	6.56 c	6.51 d	8.08 c	7.71 d
T6	5.51 b	5.33 c	56.78 b	60.26 a	6.57 c	6.48 d	7.96 cd	7.94 cd
T7	5.90 b	5.69 b	52.97 cd	52.25 d	7.03 b	6.94 c	8.90 b	9.00 b
T8	5.73 b	5.73 b	50.90 e	52.70 cd	7.19 a	7.11 b	9.35 a	8.94 b
T9	6.48 a	6.37 a	59.66 a	53.82 b	7.29 a	7.22 a	9.52 a	9.40 a

Mean values followed the same letter within the treatments are not significantly differ ($p< 0.05$) according to the Duncan multiple range test.

Table 5 showed the effect of foliar spray of dry yeast suspension and amino acid and their combination on fruit chemical properties (percentage of protein, percentage of oil, total carbohydrate fruit content and percentage of unsaturated fatty) of ' Bashika ' Olive trees during both studied seasons. Results cleared that treatment of dry yeast suspension at $10g.L^{-1}$ with amino acid at $2ml.L^{-1}$ gave the highest significant value of percentage of fruit protein (4.70 and 4.64 %), percentage of fruit oil (20.55 and 19.47 %)and total carbohydrate fruit content(17.60 and 18.59 mg. g^{-1} dry weight), However, the control treatment gave the lowest value of percentage of fruit protein (3.14 and 2.80 %) and percentage of fruit oil (15.83 and 15.81 %) in both seasons respectively. Also, it was obvious from the results that the control treatment gave the lowest value of total carbohydrate fruit content(12.55 mg. g^{-1} dry weight) in the first season and amino acid treatment(14.76 mg . g^{-1} dry weight) in the second season. Whereas treatment of dry yeast suspension $10g.L^{-1}$ with amino acid at $2ml.L^{-1}$ treatment gave the highest significant value of percentage of unsaturated fatty acids (6.93%) in the first season and the lowest percentage of unsaturated fatty acids(6.87%) was existed with control treatment. Also, it was obvious from the results that there was no significant difference between treatments in percentage of unsaturated fatty acids in the second season.

Table (4): Effect of spray with dry yeast suspension and amino acid on yield characteristics of Bashika Olive trees during 2017 and 2018 seasons.

Treatments	Fruit weight (g)		Fruit flesh weight (g)		Seed weight (g)		Yield per tree (kg.tree^{-1})	
	2017	2018	2017	2018	2017	2018	2017	2018
T1	2.31 cd	2.41 c	1.73 b	1.82 c	0.579 c	0.590 e	14.02 b	3.39 bc
T2	2.29 d	2.42 c	1.72 b	1.94 bc	0.572 e	0.574 e	13.19 b	3.18 c
T3	2.35 bcd	2.50 c	1.72 b	1.84 c	0.630 d	0.653 d	17.45 b	2.95 c
T4	2.40 bcd	2.49 c	1.68 b	1.83 c	0.685 c	0.677 cd	16.56 b	3.37 bc
T5	2.74 a	2.90 a	2.01 a	2.22 a	0.723 b	0.681 bc	16.16 b	2.63 c
T6	2.40 bcd	2.68 b	1.68 b	1.97 bc	0.743 a	0.717 a	15.71 b	3.61 bc
T7	2.49 bc	2.69 b	1.76 b	2.03 b	0.730 ab	0.718 a	22.81 a	5.02 a
T8	2.52 b	2.78 b	1.80 b	2.08 a	0.722 b	0.704 ab	23.65 a	4.33 ab
T9	2.45 bcd	2.69 b	1.78 b	2.03 b	0.670 c	0.657 cd	12.56 b	3.23 c

Mean values followed the same letter within the treatments are not significantly differ ($p< 0.05$) according to the Duncan"s multiple range test.

Table (5): Effect of spray with dry yeast suspension and amino acid on fruit physical and chemical properties of Bashika Olive trees during 2017 and 2018 seasons.

Treatments	Protein (%)		Oil content (%)		total carbohydrate fruit content (mg. g^{-1} dry weight)		Unsaturated fatty acid (%)	
	2017	2018	2017	2018	2017	2018	2017	2018
T1	3.14 e	2.80 f	15.83 g	15.81 f	14.85 de	12.55 f	6.87b	4.57a
T2	3.19 e	3.01 e	16.04 g	15.93 ef	14.76 e	12.83 e	6.89abc	4.61a
T3	3.46 d	3.24 d	15.88 g	16.10 e	15.01 d	12.81 e	6.88bc	4.57a
T4	4.01 c	3.95 c	16.88 f	17.57 d	15.77 c	15.26 d	6.92ab	4.62a
T5	4.16 b	4.09 c	17.11 e	18.02 c	15.68 c	16.22 c	6.91ab	4.60a
T6	4.02 bc	3.95 c	17.53 d	18.06 c	15.78 c	16.25 c	6.92a	4.57a
T7	4.56 a	4.44 b	19.77 c	19.14 b	17.78 b	17.18 b	6.91ab	4.61a
T8	4.57 a	4.51 ab	20.13 b	19.26 b	17.91 b	17.60 a	6.92a	4.59a
T9	4.70 a	4.64 a	20.55 a	19.47 a	18.59a	17.60 a	6.93a	4.60a

Mean values followed the same letter within the treatments are not significantly differ ($p< 0.05$) according to the Duncan"s multiple range test.

Discussion

The results of experimentation natural source of biostimulants i.e. dry yeast suspension on Bashika Olive and the comparison of its effect with amino acid indicated that spraying of dry yeast suspension at 10g.L^{-1} with amino acid 2ml.l^{-1} led to increase the vegetative growth(leaf area,total relative chlorophyll, total carbohydrate leaf content and carbohydrate shoot percentage) (Table: 3). This result goes in line with the findings of (9, 11 and 12) on Olive trees, who showed the increase in vegetative growth when spraying of dry yeast suspension and amino acid which may be due to the content of yeast on large amounts of mineral elements, proteins and vitamins and growth organizations, including cytokine in(Table :2),These components can contribute to increase vegetative growth character of trees, as the containment of the yeast suspension on the multiple amino acids, DNA and RNA, which play a role in the formation of cytokines that stimulate cell division and expansion and thus increase vegetative growth character (Table:3) in addition the role of amino acid fertilizer to increase vegetative growth may due to the effect of the amino acids, its contains 5% of components which are involved in the installation of many enzymes of the process of photosynthesis as well as the processing of plant nitrogen directly, particularly if foliar spraying on the leaves (23) .Also its contain about 20% of K_2O , which contributes to increased cell division, growth, cellulose formation and acet aminophen, and help in transferring of starch and sugars between plant parts of the plant where they are needed (22). As well as its role in the growth and development of modern tissue cells (4 and 20), Also, dry yeast suspension at 5g.L^{-1} with amino acid 1ml.l^{-1} treatment exhibited increase of fruit weight and fruit flesh weight in both seasons respectively, Meanwhile, dry yeast suspension at 5g.L^{-1} with amino acid 2ml.L^{-1} treatment exhibited increase of seed weight in the first season. While, dry yeast suspension at 10g.L^{-1} treatment exhibited increase of seed weight in the second season. Also, the lowest fruit weight was occurred at. amino acid treatment at 1ml.L^{-1} in both seasons respectively. Treatment of dry yeast suspension at 10g.L^{-1} gave the highest significant of average yield per tree in both seasons respectively, while treatment of dry yeast suspension at 10 g.L^{-1} with amino acid 2ml.l^{-1} treatment gave the lowest average yield per tree in the first season and dry yeast suspension at 5 g.L^{-1} with amino acid 1ml.L^{-1} treatment in the second season. Meanwhile, dry yeast suspension at 10g.L^{-1} with amino acid 2ml.L^{-1} leads to increase fruit chemical properties (percentage of protein, percentage of oil, total carbohydrate fruit content in both seasons respectively and percentage of unsaturated fatty in first season) Also, it is obvious from the results that there are no significant different between treatments in percentage of unsaturated fatty acids in the second season and the lowest percentage of unsaturated fatty acids was occurred with control treatment in first season. This result goes in line with the findings of Sutham (20), Carl (4) who showed that the increase in yield characteristics when spraying Dry yeast suspension and Amino acid, and with Hagagg *et al* (11), Hagagg *et al*(12), Maksoud *et al* (17) and Shahin *et al* (19) on Olive trees, who confirmed that foliar spraying with Amino acids and potassium on Olive fruits gave the positive response on most of Fruit quantity and quality .

The decrease in average yield per tree may be due to the alternate bearing in the Olive trees and to the environmental conditions (thunderstorms and strong winds) which accompanied the arrival of trees in the full bloom stage and fall of a large proportion of fresh fruit, which caused the decline in the rate of the production of one tree in the second season and qualitative characteristics (percentage of unsaturated fatty acids), especially in the second year of the experiment, due to the exposure of Olive orchards in the forests of Nuria / Directorate of Al- Diwaniyah Agriculture to the low processing of irrigation water, especially during the hot summer. The Euphrates River to the sub-channels, which led to the exposure of Olive orchardes to water stress, especially in August and September, which led to a decrease in Olive oil content of unsaturated fatty acids. This is consistent with Dag *et al* (7) and Martinellia *et al* (18) , who pointed decline in the proportion of saturated fatty acids and unsaturated Olive trees as a result of exposure to tightening aqueous conditions..

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