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Optimizing fruit quality and quantity of "Aggizi" olive trees cultured in North Sinai by using some organic extracts.

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ABSTRACT

This study was carried out during the two seasons 2011, 2012 on olive trees Aggizi cv. the trees were 10 years old growing in sandy soil at a private orchard in north Sinai governorate, Egypt. This investigation was performed to study the effect of humic acid as Actosol® (contains 20 % humic acid + NPK 1:5:6) and Greenpower (Vinasse 80%+Soybean amino acid 20%) as soil application under the drippers of each tree at (150, 75 and 50 cm3) from April till June. At the end of the season, yield (kg/tree) and Fruit quality: average fruit size, weight, shape index (length/diameter) and pulp/pit ratio also fruit chemical characterizes: fruit oil and acidity percentage were recorded. The obtained results showed that, "Aggizi" olive trees received humic acid soil application at 150 cm3 per tree once at full bloom gained the highest yield (kg/tree) as while as fruit oil rather than dividing humic acid soil application dose into two or three doses.

Key words: olive Aggizi cv, yield, Fruit quality, fruit oil percentage, fruit acidity, organic fertilizer, Humic acid, Greenpower, Vinasse, Soybean amino acid.

Introduction

The olive (Olea europaeaL.) is indigenous to the Mediterranean basin. It is a small to medium sized tree that is a major crop in the Mediterranean Basin countries and has been grown in other similar climates in the southern hemisphere, south west Asia, africa and elsewhere. This tree crop has played a major role in the culture and diet of peoples in the Mediterranean regions of the world.

The olive tree productivity is generally low due to the poor soil fertility and low water holding capacity. Accordingly, it seems that trees need to organic fertilizers avoided pollution and reduced the costs of fertilization. Also, it has drowned the attention of olive growers to use the organic and bio-fertilizers that would be healthy for human and safe for environment (Fayed (2010)

Adani *et al.*, (1998) mentioned that, humic acid (HA) is a heterogeneous mixture of many compounds with generally similar chemical properties which performs various functions in the soil and on plant growth. One of the functions of humic acid is the positive effect on the promotion of root development. Tattini *et al.* (1990 and 1991) reported that humic acid increased the root/shoot ratio as well as the production of thin lateral roots of olive plants. In addition, HA, prepared from leonardite coal, stimulated both shoot and root growth.

Forthermore, humic acid is known to improve nutrient absorption and plant growth. In many soils, phosphate readily forms in almost insoluble mineral compounds, such as apatite. Experimental data conducted by Lobartini *et al*. (1994) reported that increasing the amount of HA increased the rate of dissolution of apatite. Phanuphong and Partid (2003) showed that the application of humic acid has a positive influence in promoting overall tree vigor. Treated avocado trees were larger and the root system was better developed than the untreated trees.

Aml *et al.*, (2011) indicated that treatment Chemlali olive with (Humic acid +amino acids+ macro elements+ trace elements) was the most effective one compared with the other treatments since this treatments gave the best results concerning plant height, brunch numbers, leaf numbers, also it increased plant diameter and leaves area comparing with control. On the other hand, this treatment raised root length and root weight than the control plant.

Humic materials may increase root growth in a manner similar to auxins (Donnell, 1973, Tatini*et al.*, 1991). Fernández-Escobar *et. al.(*1999) who mentioned that, foliar application of leonardite extracts (humic substances extracted) to young olive plants stimulated shoot growth when they were growing without the addition of mineral elements to the irrigation water, but did not promote growth when applied to plants watered with a nutrient solution, although growth of fertilized plants was greater than that of unfertilized ones. Under field conditions, foliar application of leonardite extracts stimulated shoot growth and promoted the accumulation of K, B, Mg, Ca and Fe in leaves.

Cavalcante*et al.*, (2011) demonstrated that humic substances sprayed positively affect aerial part and root system of papaya seedlings and seedling quality of papaya were improved by humic acids foliar spray.

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One of the main factors affecting plant growth in sandy soils is the types and amounts of fertilizers. However, the cost of mineral fertilizers has been significantly going up. As a result, it has become necessary to seek alternatives that would supply the poor soil with more economic sources of fertilizers (Rodriguez, 2000).

Organic materials have the benefit or disadvantage of being slow release fertilizers and are less likely to leach into ground or surface waters. Conventional fertilization has traditionally been used because they are cheap, less bulky and easy to apply. The line between has been becoming blurred with slow release conventional fertilizers and high analysis organic fertilizers that are easily applied and less bulky.

Vinasse is a byproduct of distilleries during alcohol production. In terms of volume, approximately 13 L of vinasse are produced by each L of alcohol obtained from cane must (Copersucar. 1986). Vinasse has high levels of potassium, calcium and organic matter in its chemical composition as well as moderate amounts of nitrogen and phosphorus (Gloria, N. 1985) and could represent an alternative to supply such nutrients in crop production (García, A. 1994, Gloria, N. 1985). Various research works carried out in other countries, particularly in Brazil, report that vinasse increases sugarcane productivity (Copersucar. 1980, Copersucar. 1986, Gloria, N. 1985) as well as they have demonstrated that under controlled conditions, it can partially or completely replace mineral fertilization.

On the other hand, Bioregulator substances were shown to enhance the biosynthesis of certain chemical constituents in plants. In this respect the amino acids which have a high integrity with different metabolic pools in plants were used to promote plant growth (Coruzzi and Last, 2000). Maxwell and Kieber (2004) indicated the link of methionine to the biosynthesis of growth regulating substances, e.g. cytokinins, auxins and brassinosteroids in plants. Whereas the link of tryptophan to the biosynthesis of auxins, the phytoalexincamalexin, phenyl propanoids and other related natural products in plants was recently reported (Tao *et al.* 2008). Studies have proved that amino acids can directly or indirectly influences the physiological activities of plant growth and development.

The aim of this study was evaluating fruit physical and chemical properties and yield of "Aggizi" trees treated with of organic matter (humic acid , amio acids and Vinasse) as soil applications in Sinai condition.

Material and Methods

This study was conducted during two successive seasons, 2011 and 2012, on 10 years old olive trees Aggizi cv. Grown in a private orchard in north Sinai (Balozza) – Egypt. The trees spaced 5 x 5 meter apart (168 trees/acre) in a sandy soil (Table1). The trees received the same cultural practices that were recommended. The farm is depending on wells in irrigation (Table 2). Greenpower (Vinasse 80% + Soyabean amino acid 20%) and humic acid as Actosol® (contains 20 % humic acid + NPK 1:5:6) was added in this study to the trees as soil applications under the drippers of each tree.

Complete randomized design was applied. Seven treatments were applied in three replicates; all of the 21 trees conducted in this study were vigorous and similar in growth and canopy.

The investigation aimed at studying the effect of different doses and applications time of Actosal and Greenpower as the following:

1- Without Actosol®or Greenpower application (control)
2- 150 cm^3 Actosol® add to the soil once time at the first week of April (during full bloom).
3- 75 cm^3 Actosol® add to the soil two times during growth season the first application at the first week of April while the second application at the first week of May (75 cm^3 at full bloom and 75 cm^3 after one month from full bloom).
4- 50 cm^3 Actosol®drenched to the soil three times during growth season the first application at the first week of April, the second application at the first week of May, while the third application at the first week of June (50 cm^3 at full bloom, 50 cm^3 after one month from full bloom and 50 cm^3 after two month from full bloom).
5- 150 cm^3Greenpower add to the soil once time at the first week of April (during full bloom).
6- 75 cm^3Greenpower add to the soil two times during growth season the first application at the first week of April while the second application at the first week of May (75 cm3 at full bloom and 75 cm3 after one month from full bloom).
7- 50 cm^3Greenpower drenched to the soil three times during growth season the first application at the first week of April, the second application at the first week of May, while the third application at the first week of June (50 cm^3 at full bloom, 50 cm^3 after one month from full bloom and 50 cm^3 after two month from full bloom).

Yield and Fruit Quality:

In both seasons, samples of 10 random mature fruits per tree were used for the determination of average fruit size (volume), weight, shape index (length/ diameter) and pulp/pit ratio was measured.

Fruit chemical characteristics:

- Fruit oil percentage: Fruit oil content was determined by means of the Soxhlett fat extraction apparatus using Hexan of 60-80°C boiling point as described by (A.O.A.C. 1975).
- Fruit acidity (%): Fruit juice total acidity % as Malic acid (mgs/100 gms fruit juice) according to Vogel (1968) and A.O.A.C (1975).

Data Analysis:

- All the obtained data, during the two seasons of the study, was statistically analyzed of variance method, differences between means were compared using Duncan's multiple range test at 0.05 level according (Duncan, 1955).

Results and Discussion

Fruit Properties:

Concerning the effect of number of applications of humic acid and Greenpower on some physical and chemical properties of Aggizi olive fruits during season (2011) as shown in Tables (3,4). It was clear that humic acid or Greenpower application doses treatments increased fruit physical and chemical parameters compared with the control in both seasons.

It is found that, fruit physical parameters, fruit oil and acidity percentage where affected by dividing humic acid or Greenpower into two or three doses. The highest values of fruit weight, size and shape index where obtained from fruits harvested from Picual trees received humic acid at one dose (150 cm3) during full bloom, followed, in a descending order, by application at two and three doses for humic acid then by application Greenpower treatments at one, two and three doses respectively.

In humic acid treated trees, fruit weight, size, Pulp/Pit ratio and shape index values ranged between (7.30 - 8.53 gm), (7.50 – 8.50 cm3), (4.37 – 4.80) and (1.25 – 1.36), corresponding values for greenpower treatments, the values for fruit weight, size, Pulp/Pit ratio and shape index ranged between (4.63 – 5.50 gm), (4.17 – 5.17 cm3), (4.17 – 4.60) and (1.14 – 1.25), respectively. Whereas, the lowest fruit weight, size , Pulp/Pit ratio and shape index where recorded in the control treatment, the values were 4.10 gm, 4.0 cm3, 4.01 and 1.09, respectively. With respect to adding soil application of humic acid or Greenpower to olive picual trees, it is noticeable that not affecting significantly fruit oil percentage and fruit acidity %.

As shown in Tables (5,6) it is clear that fruit physical properties i.e. fruit weight, size, pulp/pit ratio, shape index, oil % and acidity % as a chemical properties were significantly affected by the source of material (humic acid or Greenpower) as will as number of applications. Generally, humic acid applications were superior in their impact on studied fruit quality parameters than Greenpower, Moreover, humic acid or Greenpower applications at one dose resulted in higher significant values compared with two or three times of application, while pulp/pit ratio, oil% and fruit acidity % did not follow the trend obtained for fruit weight, size and shape index as affected by humic acid or Greenpower number of application treatments. Humic acid impact on weight, size, pulp/pit ratio and shape index ranged between (5.63 - 6.74 gm), (5.50 – 6.50 cm3), (4.35 – 4.75) and (1.25 – 1.34), respectively. The corresponding values for Greenpower number of application treatments where (3.11 – 3.79 gm), (3.0 – 3.51 cm3), (4.18 – 4.60) and (1.15 – 1,26), respectively. Adding soil application of humic acid or Greenpower to olive picual trees affecting significantly fruit oil percentage. So soil application of humic acid once during full bloom gave the highest oil percentage of Agaze olives grown in Sinai in the second season. Also noticed that, fruit oil percentage was increased in the second season than the first one, which might be due to accumulation effects of organic treatments.However, the control treatments recorded the lowest fruit oil and acidity %.

These observations are in accordance with those obtained by Fathy *et al*. (2010) who stated that, physical and chemical properties of 'Canino' apricot fruits were progressively increased as foliar and soil doses of humic acid increased. Also, Hegazi (2007) observed that, poultry manure source in inhancing fruit physical properties of olive trees. However, soil application of compost tea on Le cont pear trees with humic acid and or biofertilizers gave the highest level of improving all fruit physical properties Mohammed (2010). Also Fayed (2010) observed that highest values of fruit physical properties of Roghiani olive trees were obtained by spraying yeast + humic acid. Where, Mostafa (2009) reported that, compost tea gave high significant values of Washington navel orange fruit quality.

Yield:

Data in Table (7) showed the effect of humic acid or Greenpower rates (one, two and three doses) on yield of "Aggizi" olive trees during (2011 and 2012) and average of the two seasons. Results revealed that both of humic acid or Greenpower increased significantly yield (kg/tree) in both seasons as while as the average of the two seasons.

The yield obtained from humic acid treatments ranged between (100 - 150 kg/tree) and (85 - 120 kg/tree) in the first and second season, respectively. While the effect of Greenpower treatments on "Aggizi" yield ranged between (65 - 85 kg/tree) and (50 - 60 kg/tree) in the first and second season, respectively. Meanwhile, the corresponding values of the control yield recorded 30 and 20 kg/tree in the first and second season respectively.

It was clear that humic acid application treatments resulted in a significant increase in "Aggizi" olive yield than those received Greenpower, while both of humic acid and Greenpower treatments significantly increased yield than the control in both seasons. The highest yield was obtained from adding humic acid at a rate of 150 cm3 at full bloom as one dose. However, increasing application dose number to two or three doses tended to significantly reduce the obtained increment in yield as compared with one dose application.

These results were in the same trend with those found by reported These observations are in accordance with those obtained by Fayed (2010) indicated that, soil application of compost tea gave the highest set and yield (Kg\ tree) of Roghiani olives grown in Libya in two seasons, followed by manure tea comparing to control trees. Also noticed that, fruit set percentage and yield were increased in the second season than the first one, which might be due to accumulation effects of organic treatments . These observations are in accordance with those obtained by Ferrara and Brunetti (2010) that, the application of humic acid caused a significant increase in berry size. In particular, humic acid applied at full bloom significantly increased width and weight of berries collected at harvest with respect to the control treatment. The increase in berry size as a consequence of humic acid application at full bloom is probably ascribed to the uptake of mineral nutrients by the grapevines, but the possible hormone- like activity of the humic acid (i.e.,auxin-, gibberellin- and cytokinin-like activity) should also be taken into consideration. Also, the results are in line with Hegazi (2007) on olive trees, Mohammed (2010) on pear trees, who found that using compost tea with spraing humic acid recorded the highest values offruit set and yield. Mostafa (2009), on orange reported that the combination between compost tea and chicken manure extracts at concentratuion (1: 10 x 1: 10 w\v) gave significant increase in yield per tree.

Vinasse improves most factors involved in soil fertility, provides favoring conditions for nitrogen assimilation into the soil, protects nutrients against washing out in winter and maintains them as reserve nutrients as a slow release during the vegetative period. These are the most important affect, leading to increase yield and quality of crops.

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins (Davies, 1982). Amino acids are particularly important for stimulation cell growth, they act as buffers which help to maintain favorable PH value within the plant cell, since they contain both acid and basic groups; they remove the ammonia from the cell.

This function is associated with amid formation, so they protect the plants from ammonia toxicity. They can serve as a source of carbon and energy, as well as protect the plants against pathogens. Tyrosine is hydroxyl phenyl amino acid that is used to build neurotransmitters and hormones. Hass (1973) reported that the biosyntheses of cinamic acids (which are the starting materials for the synthesis of phenols) are derived from phenylalanine and tyrosine.

The role of Tryptophan is well known: it has an indirect role on the growth via its Influence on auxin synthesis. Phillips (1971) reported that alter native routes of IAA synthesis exist in plants, all starting from Tryptophan. Thus, when Tryptophan was supplied to some plant tissues, IAA was formed. Thiamine (vitamin B1) could serve as coenzyme in decaboxylation of a-keto acids, such as Pyruvic acid and keto-glutamic acid which has its importance in the metabolism of carbohydrates and fats (Bidwell, 1974). Thiamine is an important cofactor for the transketolation reactions of the pentose phosphate cycle, which provides pentose phosphate for nucleotide synthesis and for the reduced NADP required or various synthetic pathways (Kawasaki, 1992).

Conclusion:

Soil application of humic acid once at full bloom stage at 150 cm3\tree to "Aggizi" olive trees is recommended for high yield and oil% under Sinai condition. The increase in yield and oil% as a consequence of humic acid application at full bloom is probably ascribed to the uptake of mineral nutrients by the olive trees, but the possible hormone- like activity of the humic acid (i.e.,auxin-, gibberellin- and cytokinin-like activity) should also be taken into consideration. These results were in the same trend with those reported by Maggioni *et al*. 1987; De Kreij&Basar 1995; Mackowiak *et al*. 2001) that, humic acid is especially beneficial in freeing up nutrients in the soil so that they become available to the plant as needed. In several studies, humic and folic

acids preparations were reported to increase the uptake of mineral elements, and to increase the yield of crop plants (Kauser *et al.* 1985; Chen *et al.* 2004 a, b).

Due to the positive effect of humic substances on the visible growth of plants, these chemicals have been widely used by the growers instead of other substances such as pesticides etc. This, however, has led to growers using excessive amounts of these substances.

Table 1: Chemical characteristics of sandy soil used for the present study.

parameters	Depth of simple (cm)		
	Surface sample	30 cm depth	60 cm depth
pH	7.76	7.73	7.82
EC(dSm-1)	3.60	2.80	2.80
	Soluble cations (meq\l)		
Ca++	4.00	10.00	11.00
Mg++	2.00	6.40	6.10
Na+	29.20	10.50	10.20
K+	0.49	0.30	0.20
	Soluble anions (meq\l)		
CO3=	-	-	-
HCO3-	0.60	1.00	2.00
Cl-	28.00	13.00	13.50
SO4=	8.09	13.20	12.00

Table 2: Chemical characteristics of well water used for the present study.

parameters	Values
pH	7.57
EC(dSm-1)	4.00
Soluble cations (meq\l)	
Ca++	1.72
Mg++	0.80
Na+	1.60
K+	0.11
Soluble anions (meq\l)	
CO3=	-
HCO3-	0.90
Cl-	1.20
SO4=	2.11

Table 3: Effect of number of application of humic acid and Greenpower on some physical fruit properties Aggizi olive during first season.

Treatment		weight	Mean	volume	Mean	Pulp/Pit	Mean	L/D	Mean
Humic acid	Once	8.53 a	7.99 A	8.50 a	8.0 A	4.80 ab	4.44 A	1.36 a	1.31 A
	Twice	8.15 b		8.0 ab		4.16 d		1.33 ab	
	Three times	7.30 c		7.50 b		4.37 c		1.25 b	
Green bower	Once	5.50 d	4.99 B	5.17 c	4.67 B	4.60 b	4.58 A	1.25 b	1.20 B
	Twice	4.86 e		4.67 d		4.96 a		1.22 bc	
	Three times	4.63 f		4.17 d		4.17 d		1.14 c	
Control		4.1 g	4.10 C	4 d	4.0 C	4.01 d	4.01 B	1.09 c	1.09 C
Mean	Once	6.04 A’		5.89 A’		4.47 A’		1.23 A’	
	Twice	5.70 B’		5.56 AB’		4.38 A’		1.21 AB’	
	Three times	5.34 C’		5.22 B’		4.18 B’		1.16 B’	

Table 4: Effect of number of application of humic acid and Greenpower on some physical fruit properties Aggizi olive during first season.

Treatment		Oil % dry weight	Mean	Acidity% of fruit	Mean
A	B				
Humic acid	Once	10.70 ab	10.60 A	0.23 a	0.22 AB
	Twice	10.30 b		0.23 a	
	Three times	10.80 a		0.21 a	
Green bower	Once	10.73 ab	10.61 A	0.24 a	0.24 A
	Twice	10.43 b		0.23 a	
	Three times	10.67 ab		0.23 a	
Control		10.12 b	10.12 B	0.20 a	0.20 B
Mean	Once	10.52 A’		0.22 A’	
	Twice	10.28 B’		0.22 A’	
	Three times	10.53 A’		0.21 A’	

Table 5: Effect of number of application of humic acid and Greenpower on some chemical fruit properties Aggizi olive during second season.

Treatment		weight	Mean	volume	Mean	Pulp/Pit	Mean	L/D	Mean
Humic acid	Once	6.74 a	6.13 A	6.50 a	6.0 A	4.75 ab	4.42 AB	1.34 a	1.31 A
	Twice	6.01 b		6.0 ab		4.15 c		1.32 ab	
	Three times	5.63 ab		5.50 b		4.35 bc		1.27 b	
Green bower	Once	3.79 c	3.51 B	3.65 c	3.38 B	4.60 b	4.56 A	1.26 bc	4.56 B
	Twice	3.63 cd		3.50 c		4.89 a		1.24 bc	
	Three times	3.11 d		3.0 c		4.18 c		1.15 c	
Control		3.01 d	3.01 C	2.89 c	2.89 C	4.07 c	4.07 B	1.01 d	1.01 C
Mean	Once	4.51 A’		4.35 A’		4.47 A’		1.23 A’	
	Twice	4.22 B’		4.13 AB’		4.37 AB’		1.22 B’	
	Three times	3.92 C’		3.79 B’		4.20 B’		1.17 C’	

Table 6: Effect of number of application of humic acid and Greenpower on some chemical fruit properties Aggizi olive during second season.

Treatment		Oil % dry weight	Mean	Acidity% of fruit	Mean
A	B				
Humic acid	Once	11.12 a	11.02 A	0.25 ab	0.25 AB
	Twice	10.75 b		0.26 ab	
	Three times	11.19 a		0.23 ab	
Green bower	Once	11.25 a	11.09 A	0.28 a	0.27 A
	Twice	10.98 ab		0.27 ab	
	Three times	11.04 ab		0.27 ab	
Control		10.45 b	10.45 B	0.22 b	0.22 B
Mean	Once	10.94 A’		0.25 A’	
	Twice	10.73 A’		0.25 A’	
	Three times	10.89 A’		0.24 A’	

Table 7: Effect of number of application of humic acid and Greenpower on yield Aggizi olive during (2011 – 2012).

Treatment		Yield 2011	Mean	Yield 2012	Mean	Average yield	Mean
Humic acid	Once	150 a	123.3 A	120 a	101.7 A	135.0 a	112.5 A
	Twice	120 b		100 b		110.0 b	
	Three times	100 c		85 c		92.5 c	
Green bower	Once	85 d	75.0 B	60 d	55.0 B	72.5 d	65.0 B
	Twice	75 e		55 e		65.0 e	
	Three times	65 f		50 f		57.5 f	
Control		30 g	30 C	20 g	20.0 C	25.0 g	25.0 C
Mean	Once	88.3 A’		66.7 A’		77.5 A’	
	Twice	75.0 B’		58.3 B’		66.7 B’	
	Three times	65 C’		51.7 C’		58.3 C’	

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