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# Influence of Mineral NPK and Compost Tea as Soil Applications on Growth of "Aggizi" Olive Seedlings under Greenhouse Condition

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**ABSTRACT**

This study was carried out in greenhouse of National Research Center, Dokki, Giza government, Egypt on olive seedlings Aggizi cv to study the influence of mineral NPK (0 and 25 %) and compost tea ( 0, 15 and 30 $cm^3$/ seedling ) as soil applications every 15 days from March to October on growth and chemical constituents of "Aggizi" olive seedlings under greenhouse condition. In general, application of compost tea at 15 $cm^3$/ seedling as soil drench with or without mineral NPK gave the best results for increasing all vegetative growth such as plant height increment % , number of leaves/ seedling, dry weight of leaves %, root length and number per seedling as well as nitrogen and potassium contents in leaf seedlings such as compared to control treatments without using mineral NPK or compost tea in growing season.

**Kew words:** olive,seedling,Aggizi, NPK, compost tea, plant growth parameters and leave mineral contents.

## Introduction

Olive trees areas increased rapidly in Egypt and reached about 68602 ha with total production about 611600 tons, where 20% of the total fruit production produces about 10000 tons of olive oil (FAO STAT,2011).

Using chemical fertilizers in agricultural production contaminates the soil and underground water. The movement of Agrochemicals through soil to groundwater or their discharge to surface waters represents an ecological risk (Allinson *et al*., 2000). It is also accumulated in food chain causing hazard effects (Hegazi *et al*., 2010). Many solutions were suggested to reduce the previously mentioned problems, out of them using organic fertilizers such as compost tea which are low in cost and friendly environmental amendments. Compost applied to the soil, improve its quality by altering its chemical and physical properties, increasing organic matter content, water holding capacity, the overall diversity of microbes, providing macro and micro nutrients essential for plant growth and suppressing diseases, which indirectly contribute to plant growth enhancement (Heather *et al* ., 2006).

Nawaf and Yara (2006) found that, young olive trees benefit from low levels of NPK and N alone and additional fertilizers would not be significant. However, NPK are considering being essential element for plant growth and development. The 16 g NPK and 32 g N significantly gave the highest shoot and root dry weight, this probably due to nitrogen concentration which increased dry matter accumulation in roots and decreased shoot: root ratio. Osman *et al*. (2010) revealed that bio and NPK fertilizer treatments significantly increase number of shoots/ branch/ meter, number of leaves per shoot, shoot length, shoot diameter, leaf area, leaf fresh and dry weights, N,P and K contents in olive leaves.

Compost tea there is a global impact for organic farming through recycling of organic waste for persistent agriculture as well as for a pollution-free environment. For the development of sustainable farming, waste enrichment is of interest. Involvement of earthworms (*Eisenia foetida*) for the degradation of organic wastes and production of vermicompost is near commercialization (Kumar *et al.,* 2001).

Compost tea, in modern terminology is a compost extract, plant extracts, liquid manures and compost teas can be further understood in the context of their influences on the rhizosphere and phyllosphere. Also, manure and compost tea production is a brewing process that extracts microorganisms from compost or manure followed by microbial growth and multiplication including beneficial bacteria, fungi and protozoa (Ingham, 2005). Soil application of compost with compost tea gave better effect on all vegetative characteristics and leaves chemical constituents of macro and micro elements, total carbohydrates and C/N ratio compared to control of pear trees (Mohammed *et al.,* 2010).

Abd El-Hamied (2007) using both compost tea, chicken manure extract and their combinations on leaf area ($m^2$/vine) of Thompson seedless grapevines at Belkas, Dakahlia Governorate, Egypt, in 2003 and 2004 seasons. The grapevines were 15-year-old and grown in clay soil. Compost tea and chicken manure extract were tested at three concentrations (1:10, 1:20 and 1:30). They found that the highest values of leaf area were obtained from (the combination between compost tea and chicken manure extract at the concentration of 1:10 X1:10). Mostafa

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*et al*. (2009) treated Washington navel orange trees with Compost tea at 4.Liters in mid June plus 4 Liters in mid August (1/2 as soil and 1/2 as foliar application) gave the highest significant increase of shoot length, leaf number/shoot and relatively leaf surface area as well as significant increase in leaf content of nitrogen, phosphorus and potassium compared with control (treated with water only). Abdou (2010) on "Le- Conte" pear trees found that vegetative characteristics (growth rate of trunk diameter, length of the current shoots, shoot diameter, number of leaves / shoot and leaf area) were significantly affected by different treatments in both seasons. Interaction between organic rates (compost) and stimulators showed that the highest significant value was recorded for compost (30kg / tree) plus bio-fertilizer plus humic acid plus compost tea treatment followed by compost (15kg / tree) plus bio-fertilization plus humic acid plus compost tea treatment compared to other organic treatments. Meanwhile, trees received the organic (compost) only had the least vegetative characteristics value.

Mohammed *et al.* (2010) showed that application of compost tea gave the higher leaf N, P and K contents on pear trees. Allam *et al*. (2012) found that supplying Superior and Flame seedless grapevines with the suitable N (80 g/ vine/ year) via 50 % inorganic + compost (as solide or as compost tea via foliage or via soil) with or without bio-fertilization with the three bacterial strains namely *Azospirillumsp, Bacillus megaterium* and *Bacillus cerculanse* significantly was resulted in improving percentages of N, P and K in the leaves in relative to using N completely via inorganic form.

The aim of this study to the effect of different nitrogen sources, i.e., inorganic (mineral NPK) and organic (compost tea) for improving growth and nutrients statues of Aggizi olive seedling under greenhouse conditions.

## Materials and Methods

This study was carried out in the experimental research green house of National Research Center, Dokki, Giza, Egypt during 2012. For this purpose, healthy one years old olive and almost uniform seedlings Aggizi cv was used. The seedlings were planted in black polyethylene bags with 30 cm diameter fooled 10 kg washed sand mixed very good with 2.5 kg cattle manure (organic matter), olive seedlings were irrigated twice weekly. These seedlings which grown under greenhouse conditions were distributed in completely randomized design, included 6 treatments were resulted from combination between:

a. Two rates of mineral fertilizer NPK ( 0 and 25 %) equal 0 and 45g/ seedling in the form of Crystalon (20% N: 20% P: 20% K) applied as soil application divided into 16 doses from March to October about one dose every 15 days.

b. Three rates of organic fertilizer15 and 30 $cm^3$in the form of compost tea applied as soil drench application every 15 days from March to October.

*Compost tea rough materials:*

Different Agricultural wastes were used for preparing the experimented compost tea. The organic amendments included equal parts of the vegetative part ofblack nightshade, the vegetative part of wormwood, stems of common reed and the vegetative part of white cattail Saber *et al*, 2011 (a and b).

*Composting:*

To ensure uniformity, more surface area to microbial attack and rapid decomposition, the different plant materials were shredded to small pieces before being composted. The shredded plants were enriched with a chemical accelerator composed of 20-kg ammonium sulphate, 10-kg superphosphate, 50-kg calcium carbonate and 100-kg soil as microbial composting starter per ton dried plant material and wetted by both sheep's ruminal fluid at the rate of 10% of solid mass as complementary microbial composting starterand irrigating water at the rate of 50% of solid mass water holding capacity before being incubated at room temperature until maturity Saber *et al*, 2011(a and b).

*Aerated compost tea (ACT):*

A plastic bucket was one third filled with one hundred and fifty gram portions quality finished compost of one of the seven organic amendments and wetted with water to its top. The slurry was thereafter steeped for 7 days before being stirred, aerated for 72 hours and strained through cheesecloth into another bucket, diluted 10 folds with water so it's the color of tea Saber *et al,* 2011(a).

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*Microbiological biofertilizer used:*

Biofertilizer consisted of the bacteria*Azospirillum brasilense, Azotobacter chrococcum* and *Bacillus megaterium var phosphaticum* as soil plantgrowth-promoting bacteria (PGPB) was added to aerated compost tea for forming the experimental biofertilized compost tea, Abdelraouf *et al*, 2013.

*Growth parameters:*

In September and October the following parameters were measured:

1. Plant height increment percentage.
2. Lateral shoot numbers.
3. Stem diameter (cm).
4. Leaves number/ seedling.
5. Leaves dry weight percentage.
6. Root numbers.
7. Root length (cm).

*2. Chemical constituents:*

Nitrogen (N) and phosphorus (P) in leaves were calorimetrically determined according to the methods described by Bremner and Mulvaney (1982) and Olsen and Sommers (1982), respectively. Potassium (K) was determined flame photometrically according to the method advocated by Jackson (1970).

*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**

*1. Vegetative growth:*

Data in Table (1) show the effect of different mineral NPK rates and compost tea and their combination between them on plant height increment, lateral shoot numbers and stem diameter during the growing season.

There were significant differences between compost treats (alone) and the combination between mineral NPK and compost tea due to plant height increment percentage. The highest seedling height increment percentage was obtained by 25 % mineral NPK equal 45 g / seedling combined with compost tea at 30 $cm^3$as soil drench (49.59 cm) without significant differences with 0 mineral NPK + soil drench with compost tea 15 or 30 $cm^3$/seedling . While, the lowest plant height increment percentage was recorded with control treatment (without mineral N or compost tea) (23.07 cm).

**Table 1:** Effect of mineral NPK and compost tea on plant height increment %, number of lateral shoot and stem diameter of olive seedling cv Aggizi grown under greenhouse condition.

| Compost tea<br>NPK | 0 | 15 $cm^3$ | 30 $cm^3$ | Mean |
|---|---|---|---|---|
| | Plant height increment % | | | |
| 0.0 % | 23.07 d | 43.13 ab | 42.99 ab | 36.39 A |
| 25% | 26.44 cd | 35.15 bc | 49.59 a | 37.06 A |
| Mean | 24.75 C | 39.14 B | 46.29 A | |
| | Lateral shoot numbers | | | |
| 0.0 % | 3.67 b | 4.00 b | 4.67 b | 4.11 B |
| 25% | 4.00 b | 5.00 b | 7.00 a | 5.33 A |
| Mean | 3.83 B | 4.50 B | 5.83 A | |
| | Stem diameter (cm) | | | |
| 0.0 % | 0.53 a | 0.60 a | 0.50 a | 0.54 A |
| 25% | 0.63 a | 0.53 a | 0.60 a | 0.59 A |
| Mean | 0.58 A | 0.57 A | 0.55 A | |

*Means having the same letters within a column are not significantly different at 5% level.*

Regarding lateral shoot numbers, such data in the same table, indicated that, mineral NPK, compost tea and their combination between them had significant effect on lateral shoot numbers. The maximum lateral shoot number (7 shoots/seedling) was obtained when seedling with fertilized with 25 % mineral NPK and compost tea at 30 $cm^3$/seedling as soil drench. While the minimum values was obtained with control treatment (3.67

shoots/seedling).As for stem diameter, data in Table (1) show that, all treatments had no significant effect on stem diameter of seedling.
The beneficial effect of application of compost tea on the vegetative growth characteristics can be attributed to presence of macro and micronutrients in compost tea substrate which including N, P, Fe, Zn, Mn and Cu beside high biological benefits of compost tea such as diseases control of fungi infection. Darwish *et al*., 1995 .These results agree with Abd El-Hamied (2007) on grapevines and Mostafa *et al*. (2009)on orange and Abdou (2010) on pear.

*1.2. Leaves number and leave dry weight:*

Data in Table (2) show the effect of different mineral NPK rates and compost tea and their combination between them on Leaves number and Leaves dry weight % during the growing season.

Leaves number /seedling were increased significantly with mineral NPK, compost tea and their combination between them in growing season (Table 2). The highest number of leaves/seedling was recorded when fertilized seedling with compost tea at 15 $cm^3$/seedling without mineral N (217 leaves/ seedling) followed by 25 % mineral N only (156 leaves/ seedling) .On the contrary the lowest values was obtained with control treatment untreated seedling (109 leaves/ seedling).

Concerning dry weight percentage of leaves, such data showed that the combination between mineral NPK and compost tea reflected significant increases in dry weight percentage of leaves in growing season. The highest values was recorded by the combination between 25 % mineral NPK with compost tea at 15 $cm^3$/seedling (59.64 %), followed by 25 %mineral NPK only (57.27 %). On the other side, treated the seedling with 15 $cm^3$ compost tea only recorded the lowest values of leaves dry weight percentage (50%).

Compost tea has been received attention from both growers and researchers during last decades. Field trials and laboratory testes suggested these organic substances have the potential to provide the plant with some necessary nutrients, improve soil physical and chemical properties as well as suppress plant diseases, particularly fungal infections and, then increases growth of seedling (Biocycle, 2004).Results are in harmony with those reported with Osman *et al*. (2010) revealed that mineral NPK fertilizer treatments significantly increase number of leaves per shoot, leaf fresh and dry weights of olive. And Mohammed *et al.,* 2010 on pear found that. They found that application of compost with compost tea as soil application gave better effect on all vegetative characteristics compared to control

**Table 2:** Mineral NPK and compost tea on number of leaves/ seedling and dry weight of leaves of olive seedling cv Aggizi grown under greenhouse condition.

| Compost tea<br>NPK | 0 | 15 $cm^3$ | 30 $cm^3$ | Mean |
|---|---|---|---|---|
| | Leaves number/ seedling | | | |
| 0.0 % | 109.0 c | 217.0 a | 154.0 b | 160.0 A |
| 25% | 156.0 b | 137.7 b | 135.0 b | 142.9 B |
| Mean | 132.5 B | 177.3 A | 144.5 B | |
| | Leaves dry weight % | | | |
| 0.0 % | 51.13 d | 50.00 e | 56.30 c | 52.48 B |
| 25% | 57.27 b | 59.64 a | 56.34 c | 57.75 A |
| Mean | 54.20 B | 54.82 B | 56.32 A | |

*Means having the same letters within a column are not significantly different at 5% level.*

*1.3. Root number and length:*

The effect of mineral NPK and compost tea had significant effect on number of roots/ seedling and root length are shown in Table (3). In general, compost tea combined with 25 % mineral NPK or used alone gave the maximum number of roots/ seedling (5.67),while without significant differences with appling 25 % mineral only or in control treatment ( untreated seedling). While as treaded seedling with compost tea only at 30 $cm^3$/seedling as soil drench gave the minimum roots number/seedling in growing season (2.33).

**Table 3:** mineral NPK and compost tea on number of roots and length of olive seedling cv Aggizi grown under greenhouse condition.

| Compost tea<br>NPK | 0 | 15 $cm^3$ | 30 $cm^3$ | Mean |
|---|---|---|---|---|
| | Root numbers /seedling | | | |
| 0.0 % | 4.67 ab | 5.67 a | 2.33 c | 4.22 A |
| 25% | 4.33 abc | 5.67 a | 3.00 bc | 4.33 A |
| Mean | 4.50 A | 5.67 A | 2.67 B | |
| | Root length/seedling | | | |
| 0.0 % | 7.23 b | 20.33 a | 15.33 ab | 14.30 A |
| 25% | 20.33 a | 17.67 a | 15.00 ab | 17.67 A |
| Mean | 13.78 A | 19.00 A | 15.17 A | |

*Means having the same letters within a column are not significantly different at 5% level.*

Respecting root length, the same data in Table (3) showed that , all the combination treatments had significant effect on root length /seedling as compared control treatment ( untreated seedling) in growing season. Moreover, the longest root (20.33 cm) was obtained with applying25 % mineral NPK alone 45 g /seedling or using 15 $cm^3$/ compost tea individually. On the other hand control treatment recorded the shortest root length (7.23 cm/seedling).

*2. Mineral contents in seedling:*

Data in Table (4) indicated that, mineral NPK and compost tea and their combination between them had significant effect on N and K contents in leaves of seedling, while these treatments had no significant effect on P content in leaves seedling in growing season .Treated olive seedling with compost tea at 15 $cm^3$/seedling only as soil drench recorded the maximum N and K contents in leaves (1.30 and 0.82 % ), respectively, while the lowest contents were obtained with control treatment (0.59%N and 0.39%K).

**Table 4:** mineral NPK and compost tea on N, P and K contents on olive seedling cv Aggizi grown under greenhouse condition.

| Compost tea NPK | 0 | 15 $cm^3$ | 30 $cm^3$ | Mean |
|---|---|---|---|---|
| | Nitrogen (%) | | | |
| 0.0 % | 0.59 d | 1.30 a | 1.02 b | 0.97 A |
| 25% | 0.80 c | 0.66 d | 1.09 b | 0.85 B |
| Mean | 0.69 C | 0.98 B | 1.05 A | |
| | Phosphorus (%) | | | |
| 25% | 0.07 a | 0.06 a | 0.07 a | 0.85 B |
| 0.0 % | 0.24 a | 0.09 a | 0.07 a | 0.97 A |
| Mean | 0.16 A | 0.08 A | 0.07 A | |
| | Potassium (%) | | | |
| 0.0 % | 0.39 d | 0.82 a | 0.69 b | 0.63 A |
| 25% | 0.40 d | 0.40 d | 0.58 c | 0.46 B |
| Mean | 0.39 B | 0.61 A | 0.64 A | |

*Means having the same letters within a column are not significantly different at 5% level.*

These findings may be attributed to the ability of compost tea to improve the absorption and translocation of NPK by leaves tissues, beside their contents from there macro nutrients. These results are harmony with those reported with Mostafa *et al*. (2009) on orange. Mohammed *et al.* (2010) on pear and Allam *et al*. (2012) on grapevines. They found that applied compost tea to fruit trees significant increase in leaf content of nitrogen, phosphorus and potassium compared with control (treated with water only).

In general, it could be concluded that application of compost tea at 15 $cm^3$/ seedling as soil drench combined with 45 g NPK or without mineral NPK (gave the best results for increasing all growth and mineral contents in olive seedling under greenhouse conditions.

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