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Impact of NPK, humic acid and algae extract on growth of "Aggizi" olive seedlings cultured in sandy soil under greenhouse condition

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This study was carried out on Aggizi cv. olive seedlings grown at greenhouseof National Research Center, Dokki, Giza governorate, Egypt. The investigation aimed to study the effect of bio stimulant based on algae extract, humic acid and mineral fertilizer NPK on vegetative growth and Leaf mineral content of Aggizi olive seedlings planted in plasticbags at nursery stage. After planting Aggizi olive seedlings, the following three treatments wereapplied as follows, T1: algae extractwith 1%which added at a rate of 0.5 liter per bag every 15,T2:humic acid as Actosal (Humic acid 20% + NPK 1:5:6) which added at a rate of 4 cm3 per bag every 15 T3:combination ofNPK (20% N: 20% P: 20% K) at 45 g\plant\year divided into 16 equal doses about one dose every 15 day as applied as soil applicationand algae extractwith 1% which added at a rate of 0.5 liter per bag every 15from March to October. At the end of the season,percentage of plant height increment, leaf number per plant, shoot number per plant, stem diameter,leaf dry weight %, root number, root length, NPK Leaf mineral content were determined and recorded. The obtained resultsrevealed that using mineral fertilizer with 45 gm NPK /plant / year combined with bio stimulant based on algae extract (1%)gave the best results concerning lateral shoot numbers, Stem diameter,Leaves number,root numbers nitrogen, phosphor and potassium percentage. Whereas, algae extractalone achieved the highest plant height increment % lateral shoot numbers, Stem diameter, Leaves number, root lengthvalues. Regarding the effect of Humic acid data revealed that, with using humic acid alone, a Leaves dry weight %of Aggizi olive seedlings improved respectively.

Key words: olive, humic acid , algae extract, vegetative growth

Introduction

Olive (Oleaeur opaea L) belong family Oleaceae is a widely distributed tree grown in many arid areas of the world.Olive is one of the most important economic cropfor many countries such as Spain, Italy,Greece, Turkey,Tunisia and Egypt.The olive tree yield has two main products: oil and table olives,

produced from several cultivars such as Coratin, Klamata, Picual and Aggizi. The Egyptian olive production reached about 507053 tons produced from 110764 Feddan (4200 m2) according to the statistics of M.A.L.R (2007).

An appropriate fertilization is important for olive seedlings during the first years of growth and development of its root system and canopy. Thereby several studies had been conducted in order to raise efficiency of fertilization programs (Hassan *et al*., 2010;Aml *et al*., 2011; McEwen, 2012). Besides, the current global approaches firmly emphasize the need to adopt eco-friendly agricultural practices for sustainable agriculture (Fawzy *et al*., 2012). One of these practices focusing on utilizing of natural extracts and residues of crops and recycling these residues in agricultural system to protect environment, save agricultural expenditures and facilitate safe mechanism to disposal of these residues.

A lot of natural extractsand substances affected on plant growth performance and its physiological activities, humic acid considered one of them which promote plant growth and induce soil microorganisms like bacteria and fungi and provide carbon as a source for the organisms. Humi cacid as well acting as chelating good martial, and recoup the lack of mineral nutrient and losing them by leaching and also make many nutrient available in soil such as phosphate, calcium and trace elements and finally humic acid possesses high capability in controlling soil pH against changes which might occurs from the use of chemical fertilizer (Leonard, 2008).

Algae extract as a new bio-fertilizer containing macronutrients as well as micronutrients, some growth regulators, polyamines, natural enzymes carbohydrates , proteins and vitamins applied to improve vegetative growth and yield (Shaaban, 2001 and Abd El-moniem and Abd-allah, 2008). Al-Gosaibi (1994) stated that applying algae extractions to the soil improving soil characteristics that have a positive impact on nutritional status of plants. In addition, Whapham *et al.* (1993) reported that the application of algae extract fertilizer of Ascophyllum nodosum raised the chlorophyll contents of cucumber cotyledons and tomato plants. Moreover, growth performance of olive transplants was markedly enhanced as their root zoon was surrounded by pre-digested Scenedesmus bulk at the concentration equal to the recommended nitrogen dose. Nutrient concentrations and balance were also improved by the partial replacing of nitrogen by algal bulk (Abdel-Maguid *et al*., 2004).

Moreover, the trend of recycling crops residues became a universal goal for its benefits in protecting of environment and reducing pollution sources, improving soil conditions, minimizing water and mineral leaching, in addition narrowing agricultural expenditures. For instance, rice residues, irregular disposal and frequent burning of this waste constitute environmental hazards,

Ogbodo, 2010. Burning these wastes leads to atmospheric pollution, nutrient loss andit may be a cost-effective method for rice straw disposal (Dobermann and Fairhurst 2002). Rice residues can be used to improve properties of soil. Ogbodo (2010) also stated that apart from its major role in supplying nutrients, crop residues(rice chaff) used as mulch have the potentials to regulate temperature, conserve soil moisture, minimize erosion and result in positive effects on soil productivity.

The aim of the current work is spotlight on importance of natural extracts (humic acids and algae extract) and recycling rice residues to reducing the use of mineral nutrientsin olive nurseries and its promising impact on growth performance of seedlings.

Material and methods

This study was carried out in in the experimental research greenhouse of National Research Center, Dokki, Giza, Egypt during 2012. healthy and almost uniform Aggizi olive seedlings (one year old) similar vigor, age and size cultivatedin black polyethylene bags with 30 cm diameter fooled 10 kg a mixture of 1:1(7.5 kg washed sand +2.5 kg cattlemanure): (Crunched rice straw). Olive seedlings were irrigated twice weekly. The investigation aimed to study the effect of bio stimulant based on algae extract in liquid form, humic acid as Actosal (Humic acid 20% + NPK 1:5:6) and applications of mineral fertilizer as Crystalon (20% N: 20% P: 20% K) a quarter of the recommended doses (45g\plant\year) divided into 16 equal doses from March to October about one dose every 15 day as applied as soil application.

1. A bio stimulant based on algae extract, in liquid form with concentration of 1% (10 milliliter algae extract / 1 liter water) which added at a rate of 0.5 liter per bag every 15 days from the beginning of March until October.
2. Actosal (Humic acid 20% + NPK 1:5:6) added at a rate of 4cm3 per bag every 15 days from the beginning of March until October.
3. UsingQuarter (%25) of the recommended doses (45 g\plant\year) of mineral fertilizer (Crystalon) divided into 16 equal doses from March to October about one dose every 15 day as combined with algae extract with 1% concentration,which added at a rate of 0.5 liter per bag every 15 days from the beginning of March until October.

Treatments were arranged in randomized complete block design with four replicates for each treatment and each replicate was represented by three seedlings. At the end of October, plants of each treatment were removed gently with their root system to estimate and record the following data:

Vegetative growth parameters:
1. plant height increment %
2. Lateral shoot numbers
3. Stem diameter
4. Leaves number
5. Leaves dry weight %

Rootgrowth parameters:
1. Root length
2. Root numbers

LeavesMineral content:
1. Nitrogen percentage
2. Potassium percentage
3. Phosphor percentage

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

Data Analysis

The data were subjected to analysis of variance and the method of Duncan's was used to differentiate means (Duncan, 1959).

Results

Vegetative growth parameters

Concerning to vegetative parameters, Data in Table (1) revealed that algae extract and humic acid separately produced higher values of plant height, Lateral shoot numbers, Stem diameter and Leaves number without significantly differences. While as, humic acid treatment recorded the highest value of leaf dry weight percentage. Also table (1) indicated that (Algae extract + 25% NPK) produced the highest number of leaves. Meanwhile, differences were insignificant for lateral shoot number and stem diameter among all tested treatments.

Table (1) Effect of humic acid, algae extract and mineral fertilization NPK on vegetative parameters of olive seedlings

Treatments	plant height increment %	Lateral shoot numbers	Stem diameter	Leaves number	Leaves dry weight %
Algae extract	73.00 a	5.67 a	6.33 a	176.70 ab	50.55 b
Humic acid	68.00 a	6.67 a	6.33 a	150.00 b	54.68 a
NPK(25%)+ Algae	48.67 b	5.33 a	8.33 a	204.7 a	45.45 c

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

Generally, Algae alone or with NPK (25%) surpassed Humic acid treatment in most measured vegetative growth parameters.

Root parameters

In regard to root parameters, Table (2) showed that algae extract alone or combined with NPK (25%) surpassed humic acid treatment in root length and root number respectively.

Table (2) Effect of humic acid, algae extract and mineral fertilizationNPK on root parameters of olive seedlings

Treatments	Root length	Root numbers
Algae extract	22.33 a	3.33 b
Humic acid	10.67 c	5.33 a
NPK (25%)+ Algae	14.67 b	5.67 a

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

Leaf mineral determination:

In regards to leaf mineral content, data in Table (3) indicated that Algae combined with NPK (25%) treatmentgave the best levels of mineral content in leaves in comparison with Algae extract and Humic acid separately.

The obtained results revealed that using quarter (%25) of the recommended doses (45 g\plant\year) of mineral fertilizer (Crystalon) combined with bio stimulant based on algae extract(1%) gave the best results concerning nitrogen, potassiumandphosphor percentage compared with using algae extract individually. Whereas, application of Humic acid treatment achieved high phosphorpercentage and the lowest nitrogen, potassiumpercentage.

Table (3) Effect of humic acid, algae extract and mineral fertilization NPK on leaves mineral content of olive seedlings

Treatments	N%	K%	P%
Algae extract	1.40 b	0.64 b	0.04 b
Humic acid	1.23 c	0.44 c	0.06 a
NPK (25%)+ Algae	1.84 a	0.73 a	0.06 a

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

Discussion

From the abovementioned results, it is clear that all treatments had positive effect on olive seedlings;and this was on harmony with what found by Jensen (2004)who found that humic acid play an important role to enhance plant growth by improving soil texture and increase water holding in soil, plants roots ability to growth and penetrate soil. Humic acid is very important as trans missive media for nutrition's from soil to plant and stimulate soil microorganisms activity. While Algae extracts contain cytokinins as well in which induce the physiological activities (for instance activating some enzymes that involved in photosynthesis) and increase the total chlorophyll in the plant, this will positively Reflect on the activity of photosynthesis and the synthesized materials which will positively reflect on shoots characteristics (Thomas, 1996).This increase in shoots characteristics might also due to the macronutrients content in seaweed extracts. Macronutrients have a great role in plant nutrition like nitrogen, potassium and phosphorous which are very essential for the growth and development of the plant (Attememe, 2009)
However treatments algae acid alone or mixture of (algae+ NPK 25%) were the most effective in compare with algae alone. The reasons behind these results might also be due to that the due to that the effect of adding humic acid is limited to its high content of nutrient elements as well as providing nutrient base that increase the activity of the microorganisms (Tisdale *et al*., 1997). Further than, improving the physical and chemical characteristics of the soil, all these have a positive impact on the plant growth and yield. While algae extracts effects could be attributed to result of the present auxins which will increase vitamins and hormones producing in the treated plants. As well as it contains GA3, GA7 and vitamin, in addition to containing trace elements which are the most important algae components which is present in achelate state combined with iron in calkalius soils. The chelate compounds are as carbohydrates combined with iron so it will be available to improve photosynthesis efficiency. (O' Dell, 2003). These results are in agreement with what has been found by

Kowalski *et al.* (1999), who stated the positive effect of algae extracts (kalpak extract) on the growth of the plant and increasing the total yield of potato plants, the treatment significantly affected on the shoot growth characteristics and leaves content of nutrient elements and increased the qualitative and quantitative characteristics of the yield significantly.

Surpassing both of algae or algae + NPK (25%) treatments in their results, might also be due to the auxins content in the algae extracts which have an effective role in cell division and enlargement; this leads to increase the plant height,and stem diameter, leaves numberwhich were harmony with findings by (Gollan and Wright, 2006).

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