Australian Journal of Basic and Applied Sciences, 6(7): 558-563, 2012
ISSN 1991-8178

Effect of NPK Soil Fertilization and Super Max Foliar Application on Vegetative Growth of Manzanelo Olive Seedlings

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Abstract: This study was carried out on cultivated Manzanelo olive seedlings grown at the greenhouse of National Research Center, Dokki, Giza governorate Egypt. The investigation aimed to study the effect of applying NPK, super max on vegetative growth of Manzanelo olive seedlings planted in plastic bags at nursery stage. After planting Manzanelo olive seedlings, the following 16 treatments were applied: NPK (20% N: 20% P: 20% K) at four rates (0, 120, 180 and 240 g\plant\year) and\or supermax at four rates (0, 0.1 , 0.2 and 0.4% \plant\year) alone or in subint. At the end of the season, percentage of plant height increment, leaf number per plant, shoot number per plant, stem diameter, leaves dry weight; root number and root length were determined and recorded. The obtained results revealed that using NPK at 180 gm /plant / year and spraying super max at March with 0.2 % /plant /year was the most effective one compared with the other treatments. Since this treatment gave the best results concerning percentage of plant height increment, lateral shoot number per plant, leaves number per plant, stem diameter, Leaves dry weight %, also it increased root number comparing with the control. On the other hand, highest root length value of Manzanelo olive seedlings was obtained from 0.1% foliar spray alone.

Key words: Manzanelo Olive; NPK ; citric acids; supermax; microelements

INTRODUCTION

Fertilizers are materials that are used to supply elements needed for plant nutrition. Fertilizer material may be in the form of solids, semi-solid, slurry suspension, pure liquids, aqueous solutions and gases. Fertilizing materials may be introduced into a plant's environment in a number of different ways, including through addition to the soil, through application directly to a plant's foliage, and the like. The use of fertilizers is critical to commercial agricultural as fertilizers are essential to correct deficiencies and/or replace components in soil.

Olive's nutrient requirements are lower than that for many other fruit trees, but shortage in these requirements costs the tree major physiological disorder Dimassi *et al*. 1999 and Popovic *et al.* (1999).Nitrogen is one of the essential nutrients needed by plants mainly for chlorophyll buildup and associated with high photosynthetic activity Bouranis *et al*. (1999) and Jasrotia *et al*. (1999).However, nitrogen uptake and metabolism is a key factor for olive roots to change the pH of their surrounding solution, whichfacilitates nutrients uptake increasing their availability to the plant Cesco *et al*. (1999).phosphorus also is an important structural component essential for energy storage and transfer (ADP and ATP) for subsequent use in growth and reproductive processes Mengel (1982).Potassium has important role in increasing water uptake and consequently in cell expansion Jasrotia *et al*. (1999).Potassium was reported to affect transportation rate by regulating stomata opening and closure Havlin et al (1999) and Hopkins (1995). In general, growth of young olives trees improved with NPK fertilization Bouranis *et al*. (2001) but most of the researches and studies concern olive growth rate of young olive trees. Generally, there is lack of information about the potential of various olive cultivars and their response to fertilization. Although trees should theoretically be able to take up all their required nutrients from the soil, several factors can limit nutrient availability to the crop. In many cases, adding the nutrient to the soil will only result in further lockup. Supplementing with a carefully planned foliar program at key stages can have a marked positive effect on fruit yield and quality. Foliar application of various macro and micro nutrients has been proved beneficial, foliar feeding is a relatively new and controversial technique of feeding plants by applying liquid fertilizer directly to their leaves. A properly formulated foliar spray particularly amended with appetizers/bioactive materials/bio-stimulants and surfactants increases uptake of nutrients from the soil (Yaseen *et al*., 2004) because foliar fertilization causes the plant to pump out more sugars and other exudates from its roots into the rhizosphere (Marschner, 2003). with respect to antioxidants such as ascorbic acid and citric acid have auxinic action and also synergistic effect on flowering and fruiting of fruit trees. Recently antioxidants used instead of auxins and other chemicals for enhancing growth and fruiting of various fruit trees El Sayed et al., (2000) and Ragab (2002).

Therefore, the objective of this study was to investigate the effect of Feed olive seedlings a balanced fertilizer with a 20-20-20 nitrogen-phosphorus-potassium (NPK) ratio and study the effect of foliar fertilizer of

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some nutrients and citric acid (super max) on some growth parameters of Manzanelo olive seedling grown in greenhouse nursery.

MATERIAL AND METHODS

This study was carried out on Manzanelo olive cv. healthy and almost uniform seedlings cultivated in black polyethylene bags with 30 cm diameter fooled with 10 kg washed sand mixed very good with 2.5 kg cattle manure in the experimental research green house of National Research Center at dokki, Giza governorate Egypt. The investigation aimed to study the effect of applying NPK (crystalon 20% N: 20% P: 20% K) and and supermax source (citric acid 7%, chelate calcium 1.8%, magncium 3%, Sulfur Makrony 0.02%, chelate zinc 3.4%, iron 3.4%, manganese 1.4%, cupper 0.05%, boron 0.02%, molybdenum 0.02%, cobalt 0.01%, nickel 0.01%). The NPK used in this study as a direct soil application while supermax used as foliar application on Manzanelo transplants at the nursery.

The following treatments were investigated:

1- NPK Crystalon (20% N: 20% P: 20% K) applied as soil application at four rates 0, 120, 180 and 240 g\plant\year divided into 16 doses from March to October about one dose every 15 day at four rates 0, 7.5 (low rate), 11.25 (medium rate) and 15 (high rate) g NPK \ plant\15 day.

2- Super max applied as foliar application once at middle March with four concentrations 0, 0.1% , 0.2% and 0.4% \plant\year . Thus, the experiment was conducted as follows:

1- Control.
2- Super max 0.1%\ plant.
3- Super max 0.2%\ plant.
4- Super max 0.4%\ plant.
5- 120 g NPK \ plant\year.
6- 120 g NPK \ plant\ year + super max 0.1% \ plants.
7- 120 g NPK \ plant\ year + super max 0.2% \ plants.
8- 120g NPK \ plant\ year + super max 0.4% \ plants.
9- 180 g NPK \ plant\ year
1. 180g NPK \plant\ year + super max 0.1%\ plant.
2. 180 g NPK \plant\ year + super max 0.2%\ plant.
3. 180 g NPK \plant\ year + super max 0.4%\ plant.
4. 240 g NPK \ plant\ year.
5. 240 g NPK \ plant\ year + super max 0.1% \ plants.
6. 240 g NPK \ plant\ year + super max 0.2% \ plants.
7. 240 g NPK \ plant\ year + super max 0.4% \ plants.

The treatments were arranged in randomized complete block design with six replicates for each treatment and each replicate was represented by three plants. At the end of October plants of each treatment were removed genteelly with their root system to estimate and record the following data:

1- Percentage of plant height increment.
2- Shoot number per plant.
3- Stem diameter (mm).
4- Leaf number per plant.
5- Leaf dry weight %.
6- Root number.
7- Root length (cm).

Statistical Analysis:

The data were subjected to analysis of variance and the method of Duncan's was used to differentiate means, (Duncan 1955).

3. Results:

Percentage of Plant Height Increment:

Table (1) showed that, increasing super max rates up to 0.2 % with adding NPK recorded the highest percentage of plant height increment compared with all other treatments including the control. However, increasing NPK rates leads to significant increase in percentage of plant height increment and reached to the maximum extent at the rate of 180 gm /plant /year while with increasing NPK rate up to 240 gm /plant /year either applied alone or combined with super max, the percentage of plant height increment decreased significantly. Corresponding to interaction between NPK and super max rates, data recorded that using NPK at

180 gm /plant /year accompanied with spraying super max at 0.2 % once /plant /year achieved the highest percentage of plant height increment.

Leaf Number Per Plant:

Table (2) showed that, application of super max at 0.2 % once /plant /year either without addition of NPK or with 180 gm NPK /plant /year gave the higher Leaf number per plant compared to other treatments. However, Leaf number values was increased significantly due to using NPK at 180 gm /plant /year either without addition of supermax or with spraying supermax at 0.2 % once /plant /year gave the higher Leaf number per plant compared to other treatments.

Shoots Number Per Plant:

Table. (3) Showed that, shoots number per plant were increased significantly with spraying super max at 0.2 % once /plant /year. However, shoots number values was increased significantly due to using NPK at 180 gm /plant /year compared to those obtained by medium or high rates. With respect to interaction between NPK and supermax rates, data recorded that application of super max at 0.2 % once /plant /year with addition of NPK either at 0, 120 or 180 gm/plant /year achieved the highest Shoots number per plant. Also using NPK at 180 gm /plant /year either at 0.1 % or 0.2 % once /plant /year gave the highest values of Shoots number per plant.

Stem Diameter:

As shown in table (4), Stem diameter values was increased significantly due to spraying super max either at 0.1, 0.2 or 0.4 % once /plant /year . Also, the highest Stem diameter values was recorded from Manzanelo olive seedling fertilized with NPK either at 120, 180 or 240 gm /plant /year .on the other hand results of interaction between NPK and super max rates reviled that, using the lowest rate of NPK (120 gm /plant /15 year) with spraying plants by the highest percentage of super max (0.4% once /plant /year) led's to the highest significant values. Also, the highest stem diameter value was obtained by fertilizing Manzanelo olive seedling with medium rat of NPK (180 gm /plant /ear) with spraying plants by the lowest percentage of super max (0.4% once /plant /year).

Leaf Dry Weight %:

Obviously Table (5) cleared that, leaf dry matter percentage in Manzanelo olive seedlings responded to both tested sources of fertilization when applied individually. However, leaf dry matter percentage increased significantly by increasing NPK rates up to the high rate (120 gm /plant /year). While as leaf dry matter percentage increased significantly with medium and lowest percentage of super max sprayed. Meanwhile, the highest leaf dry matter percentage was recorded from Manzanelo olive seedling fertilized with medium rate NPK (180 gm /plant /year) without sprayed with super max.

Root Number:

Results in Table (6) show that, root number values were decreased significantly with decreasing NPK fertilizer rate. While root number increased significantly with the lowest percentage (0.1%) of super max sprayed. The highest root number was recorded from Manzanelo olive seedlings did not receive NPK and sprayed with 0.1 % super max.

Root Length:

Results in Table (7) show that, root length was affected by fertilization treatments either applied as NPK or super max individually. In this respect, Manzanelo olive seedling sprayed with medium or high percentage of super max increased root length significantly compared to those sprayed with the lower ones. However, root length increased significantly by increasing NPK rates up to the high rate (240 gm /plant /year). Highest root length value was obtained by fertilizing Manzanelo olive seedling fertilized with either medium or maximum rate of NPK sprayed with either medium or maximum percentage of super max.

Table 1: Percentage of plant height increment as affected soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	40 m	73f	71g	70hg	63.5 C
120 g NPK	52j	75e	80c	72g	69.75 B
180 g NPK	78d	82b	89a	80c	82.25 A
240 g NPK	62i	46 l	50k	47 l	51.25 D
Mean	58 D	69 B	72.5 A	67.25 C	

Table 2: Leaf number per plant as affected by soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	50jk	51j	55i	70e	56.5D
120 g NPK	68f	95d	100c	102b	91.25 B
180 g NPK	72e	104b	124a	101bc	100.25 A
240 g NPK	48k	60h	65g	67fg	60 C
Mean	59.5 B	77.5 B	86 A	85 A	

Table 3: Lateral shoot number per plant as affected by soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	2e	2e	6a	4c	3B
120 g NPK	2e	4c	6a	5b	4AB
180 g NPK	4c	6a	6a	5b	5A
240 g NPK	2e	2e	4c	3d	3B
Mean	3B	4B	6A	4B	

Table 4: Stem diameter as affected by soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	3g	3.5d	3.5d	3.6c	3.4 B
120 g NPK	3.2f	3.6c	3.7b	3.8a	3.57 A
180 g NPK	3.3e	3.8a	3.6c	3.8a	3.62 A
240 g NPK	3.3e	3.7b	3.6c	3.6c	3.55 A
Mean	3.2 B	3.6 A	3.6 A	3.7 A	

Table 5: Leaves dry weight %. as affected by soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	42.1j	46.3g	53.2h	49.8i	47.8 D
120 g NPK	53.8h	59.6e	55.8g	53.2h	55.6 C
180 g NPK	70.2a	65.6c	60.7d	58.3f	63.7 B
240 g NPK	66.3b	67.2b	66.3b	66.1bc	66.5 A
Mean	58.1 B	59.7 A	59 A	56.8 B	

Table 6: Root number as affected by soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	4	9a	8b	6d	7A
120 g NPK	7c	8b	5e	6d	6 B
180 g NPK	3g	5e	4f	4f	4 C
240 g NPK	5e	4f	3g	3g	4 C
Mean	5B	6 A	5 B	5B	

Table 7: Root length as affected by soil fertilization with NPK and super max spraying concenterations on Manzanelo Olive seedlings.

Treatment	supermax zero%	supermax 0.1%	supermax % 0.2	supermax 0.4 %	Mean
0 NPK	13i	17f	16g	20c	16.5 B
120 g NPK	16g	12j	15h	19d	15.5 B
180 g NPK	18e	20c	22a	20c	20 A
240 g NPK	19d	21b	21b	22a	20.7 A
Mean	16.5 C	17.5 BC	18.5 B	20.3 A	

Discussion:

From the abovementioned results, it is clear that using NPK at 180 gm /plant /year and spraying super max at middle of Mars with 0.2 % concentration /plant /year was the most effective one compared with the other treatments. Since this treatment gave the best results concerning percentage of plant height increment, lateral shoot number per plant, leaves number per plant, stem diameter, Leaves dry weight %, also it increased root number comparing with the control. On the other hand, highest root length value was recorded from Manzanelo olive seedlings not fertilized with NPK and sprayed with 0.1% concentration of supermax . The obtained results are in harmony with those obtained by Mustafa *et al*. (2011) Who indicated that applying crystalon (20:20:20 NPK) as soil application twice monthly (from March till October)at 37.5 g/year combined with urea spray at 0.5% was the most effective on growth performance. In addition, the foliar application could reinforce fertilization programs and enhancement it's efficiency. Also Nawaf and Yara (2006) reported that, 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. With respect to influence of citric acid with some nutrients (supermax), Eman *et al*. (2011) stated that, microelements especially when combined with humic acid improved vegetative growth and of olive seedlings comparing with the untreated plants (control). In this respect, treatment micro elements 0.5% + Humic acid 1% seems to be the promising one since it enhanced vegetative growth parameters and gave higher values concerning the plant height, leaf area and total leaf area. On the same line, El-Monem *et al*. (2011) indicated that spraying microelements especially when combined with humic acid improved vegetative growth of Coratina olive seedlings comparing with the untreated plants (control).Also Aml *et al.* (2011) reported that, Kronaki olive seedlings were sprayed with mixture of some chelated microelements (Zn+Mn+Fe) at 0.5% combination with Pepton (the commercial form of amino acids mixture) at 0.5 % treatments gave the best results concerning height and diameter of the plant, branches number, leaves number and leaves area comparing with the control. On the same trained Vieira Neto *et al.* (2011) studied the effects of 6 formulations of fertilizers (N, P, K, Zn, Cu, Fe, Mn, B, Mo, S, Mg, Al, Si, Ca and Ti) on the performance of olive seedlings. They found that the formulations markedly differ in terms of the number of roots, root length, and leaf, stem and root dry matter weights. By Studying the impact of citric acid, Elade (1992) stated that, using citric acid as antioxidant is suggested mainly for improving yield and fruit quality instead of using synthestic auxins which greatly damaged and polluted out environment. It has many functions in plant metabolism. It catches all free radical produced during plant metabolism, since leaving these free radicals leads to oxidation of lipids, loss of plasma membrane permeability and later the death of the cells and also it has an auxinic action. In this respect Maksoud *et al.* (2011) Indicated that sole application of either ascorbic acid or citric acid 2000 ppm improved yield and fruit quality of olive trees. Also Mansour *et al.* (2008) reported that, a promising influence was detected on yield and fruit quality when all nutrients and citric acid were applied together.

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