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Response of Manzanelo Olive Seedlings to NPK Rats and Foliar Spray with Citric Acid Mixed with Some Nutrient Elements

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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. The investigation aimed to study the effect of applying NPK and\or 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 Super Max with 2% at four times (0, one, tow and three times \plant\year). 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 were determined and recorded. The obtained results revealed that using 180 gm NPK /plant / year gave the best results concerning plant height increment, Leaves dry weight % and root length. Whereas, 140 gm NPK /plant / year achieved the highest root length and lateral shoot number values. Regarding the effect of foliar fertilization doses on the vegetative growth data revealed that, with increasing times number of spraying Super Max some vegetative growth parameters of Manzanelo olive seedlings improved respectively, in these respect foliar fertilization with Super Max at two times at March and May achieved the highest values of the plant high and root number. Whereas, spraying Super Max at three times at March, may and July increased significantly the shoot, leaf, root number.

Key words: Manzanelo Olive; NPK; citric acids; microelements; Super Max; foliar fertilization

INTRODUCTION

Olive (*Olea europaea* L.) is a subtropical evergreen tree is native to the Mediterranean region, tropical and central Asia and various parts of Africa. Olive trees often undergo a rather contradictory fertilizing management. In some cases they are occasionally fertilized due to the wrong belief that this species has small nutritional requirements; in others, the fertilizing routines are carried out using excessive doses which do not reflect the real needs of the plant but are managed in this way because it is a tradition or because it is thought that this may lead to ever-increasing production Fernández and Marín, (1999). NPK are considering to be essential element for plant growth and development as reported by Ferreira (1984) who found that different NPK levels had significant influence on various growth parameters of olive tree.

Healthy plant production requires complimentary nutrients foliar applications additional to soil applications. Only soil applications are not enough, additional foliar application should be done. Plants should be supported with foliar applications to avoid any nutrient deficiency. In many instances, it is beneficial to apply a fertilizer directly to the foliage of a plant, i.e. to use a foliar fertilizer. Such instances include situation where a given soil has characteristics such that the transport properties of nutrients through the soil are poor. In such instances, the use of a foliar fertilizing composition overcomes the soil disadvantages. As such, a number of different foliar fertilizer compositions have been developed and/or used with a variety of different types of crops. Foliar Fertilizers are fertilizers that are applied to foliage to boost nutrient density in crops and to correct nutrient deficiencies. The main benefit of foliar spraying that is a perfect tool for correcting nutrient deficiencies and has more efficiency rate of uptake as opposed to soil application. In this respect Anonymous, (2001) stated that, foliar fertilizers are widely used in vegetable and fruit crops, that contain various macro and micronutrients, which are essential for the proper growth and yield. Foliar fertilizer technology came into use early in this century, but did not become more common practice. After 1980s, the application of foliar fertilizers is the quickest way to deliver nutrients to the tissues and organs of the crop, and is proved that application of these micronutrients is beneficial to correct certain nutrient deficiencies. Also, 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. Noticeable, improving growth characters in response to the foliar application of micronutrients may be due to their positive action on increasing cell division in the meristematic tissues and accelerating carbohydrates and proteins formation Ghanta and Metra (1993). Also, these elements play an important role in the multi-biological processes such as the role of Zn in the

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synthesis of IAA Nijjar (1985). With respect to citric acid 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. Recently 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 Elade (1992). This investigation aimed to study the effect of NPK rates and super max times of applications 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 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 super max used as foliar application on Manzanelo transplants at the nursery.

The following treatments were investigated:

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.

Super Max applied with 0.2 % \plant\year as foliar application at three times, at middle March, May and July .Thus, the experiment was conducted as follows:

1- Control.
2- Super Max 2 % \ plant \ at middle March.
3- Super Max 2 % \ plant \ at middle May.
4- Super Max 2 % \ plant \ at middle July.
5- 120g NPK \ plant\ year.
6- 120g NPK \ plant\year + Super Max 2 %\plant\ at middle March.
7- 120g NPK \ plant\ year + Super Max 2 % \ plant \ at middle May.
8- 120g NPK \ plant\ year + Super Max 2 % \ plant \ at middle July.
9- 180 g NPK \ plant\ year.
10- 180 g NPK \plant\ year + Super Max 2 %\plant\ at middle March.
11- 180 g NPK \plant\ year + Super Max 2 % \plant\ at middle May.
12- 180 g NPK \plant\ year + Super Max 2 % \ plant \ at middle July.
13- 240 g NPK \ plant\ year.
14- 240 g NPK \ plant\ year + Super Max 2 %\plant\ at middle March.
15- 240 g NPK \ plant\ year + Super Max 2 % \ plant \ at middle May.
16- 240 g NPK \ plant\ year + Super Max 2 % \ plant \ at middle July.

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, spraying times of super max one time at March 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 increasing NPK rate up to 240 gm /plant /year the percentage of plant height increment decreased significantly. With reference to the interaction between NPK rates and super max number of spring times, data recorded that using NPK 180 gm /plant /year and sparing super max either at one time (at March) or tow doses (at March and May) /plant /year achieved the highest percentage of plant height increment.

Leaf Number Per Plant:

Table (2) showed that, a Leaf number value was increased significantly by NPK at zero rate. On the contrary, Leaf number values was increased significantly by increasing spraying times until three times /plant /year (at March, May and July). With respect to interaction between NPK rates and super max spring times, data recorded that application of super max three times /plant /year (March, May and July) without NPK fertilization achieved the highest significant value of leaf number per plant.

Shoots Number Per Plant:

Table (3) showed that, shoots number per plant was increased significantly by NPK at zero rate, on contrary spraying super max at any number of times significantly increased shoot number per plant. With respect to interaction between NPK rates and super max spraying times, data recorded that application of super max three times /plant /year either without NPK fertilization or 120 gm/plant /year achieved the highest significant value of leaf number per plant.

Stem Diameter:

As shown in table (4), Stem diameter values was increased significantly by increasing spraying times until tow times /plant /year (at March and May) and decreased significantly with increasing spraying times up to the third times at July. on the other hand results of interaction between NPK and super max spraying times reviled that, using the highest rate of NPK (240 gm /plant /year) with super max spray at three times led to the highest significant values of stem diameter.

Leaf Dry Weight %:

Obviously Table (5) cleared that, leaf dry matter percentage increased significantly by increasing NPK rates up to the high rate (240 gm /plant /year). However, leaf dry matter percentage increased significantly with one dose of super max sprayed at one time. While as, the highest leaf dry matter percentage was recorded from Manzanelo olive seedlings fertilized with medium rate of NPK (180 gm /plant /year) without sprayed with super max.

Root Number:

Results in Table (6) showed that, root number values were decreased significantly with decreasing NPK fertilizer rate. On the other hand root number was increased significantly with the increasing spraying times of super max until tow times /plant /year. Seedlings sprayed three times with Super max led to a decline in root number significantly. Using the low rate of NPK (120 gm /plant /year) with spraying seedlings with super max two times led to the highest significant root number values.

Root Length:

Results in Table (7) showed that, root length in Manzanelo olive seedlings responded to both tested sources of fertilization when applied individually. However, root length increased significantly with increasing NPK rates up to the high rate (240 gm /plant /year). While root length increased significantly with increasing times of spray with super max. The highest root length was recorded from Manzanelo olive seedling fertilized with NPK medium rate (180 gm /plant /year) sprayed three times with super max. Similarly, using highest rate of NPK (240 gm /plant /year) with spraying super max two times achieved the same trend.

Table 1: Percentage of plant height increment as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	40k	71d	68e	72d	62.75C
120 g NPK	52h	80b	71d	60g	65.75B
180 g NPK	78c	89a	88a	80b	83.75A
240 g NPK	62f	50i	50i	44j	51.5D
Mean	58D	72.5A	69.3B	64C	

Table 2: Leaf number per plant as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	50m	55 l	129b	156a	97.5B
120 g NPK	68j	100f	110e	115d	98.2A
180 g NPK	72i	124c	93g	90h	94.7C
240 g NPK	48n	65k	57 l	50m	55D
Mean	60D	86B	79C	103A	

Table 3: Shoot number per plant as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	2e	6b	5c	8a	5A
120 g NPK	2e	6b	5c	8a	5A
180 g NPK	4d	6b	4d	4d	4AB
240 g NPK	2e	4d	4d	4d	3B
Mean	3B	6A	5A	6A	

Table 4: Stem diameter as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	3e	3.5	3.5bc	3.1de	3.3A
120 g NPK	3.2d	3.7ab	3.6b	3.3cd	3.4A
180 g NPK	3.3cd	3.6b	3.6b	3.3cd	3.4A
240 g NPK	3.3cd	3.6b	3.4c	2.8a	3.3A
Mean	3.2B	3.6A	3.5A	3.1B	

Table 5: Leaves dry weight %. as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	42.1g	53.2d	44.6f	49.5e	47.4D
120 g NPK	53.8d	55.8c	46.6	53.2	52.4C
180 g NPK	70.2a	60.7b	55.9c	58.6	61.4B
240 g NPK	66.3b	66.3b	66.5b	66.4b	66.4A
Mean	58.1B	59A	53.4D	56.9C	

Table 6: Root number as as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	4e	8c	11a	6d	7.3A
120 g NPK	7cd	5de	12a	6d	7.5A
180 g NPK	3e	4e	9b	7cd	5.8B
240 g NPK	5de	3e	4e	3e	3.8C
Mean	4.7B	5B	9A	5.5B	

Table 7: Root length as affected by rats of NPK fertilization and super max spraying times on Manzanelo Olive seedlings.

Treatment	without super max	super max One time Spraying at Mars	super max One time Spraying at Mars & may	super max One time Spraying at Mars , may& July	Mean
0 NPK	13e	17cd	19bc	19bc	17B
120 g NPK	16d	12e	19bc	20b	16.7B
180 g NPK	18c	20b	20b	23a	20.2A
240 g NPK	19bc	21ab	22a	21ab	20.7A
Mean	16.5C	17.5B	20A	20.7A	

Discussion:

From the abovementioned results, it is clear that using NPK at 180 gm /plant /year gave the best results concerning percentage of plant height increment, Leaf dry weight % and root length. Whereas, NPK at 120 gm /plant /year achieved the highest root length and shoot number values. 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 acual nitrogen/plant/year combined with urea

spray at 0.5% was the most effective on olive seedlings growth performance. In addition, the foliar application could reinforce fertilization programs and enhancement it's efficiency. Also the obtained results are in agreement with the findings of Nawaf and Yara (2006) and Obreza, and Biggs (1989) who 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. Regarding the effect of foliar fertilization times on the vegetative growth data revealed that, with increasing number of spraying super max times some vegetative growth parameters of Manzanelo olive seedlings were improved markedly, in these respect foliar fertilization with super max two times at Mars and May achieved the highest values of the plant high and root number. Whereas, spraying super max three times at March , may and July increased significantly the shoot, leaf and root number. These results are confirmed with those obtained by El-Monem *et al*. (2011) who indicated that spraying microelements especially when combined with humic acid improved vegetative growth of Coratina olive seedlings comparing with the untreated plants (control) and Yousef *et al*. who indicated that treated Chemlali olive seedlings with (Humic acid +amino acids+ macro elements + trace elements) treatments was the most effective one compared with the other treatment since this treatment gave the best results concerning plant height, brunch numbers, leaf numbers, also it increased plant diameter and leaves area and raised root length and root weight than the control plant. Our results are in harmony with the finding of 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. Similar result were obtained by Vieira Neto *et al*. (2011) Elade (1992) Maksoud *et al*. (2011) Mansour *et al*. (2008). The improvement in vegetative growth parameters of Manzanelo olive seedling namely plant hight increment percentage, leaf number, shoot number, stem diameter, dry weight, root number and root length. The positive effect of citric acid as antioxidant which has an auxinic action that improved vegetative growth parameters. These results are in some what in harmony with the findings of El Sayed *et al*., (2000) and Ragab (2002) who ststed that 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.

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