

Effect of NPK and Humic Substance Applications on Vegetative Growth of Egazy Olive Seedlings

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Abstract: This study was carried out on cultivated Egazy olive transplants grown at the greenhouse of National Research Center, Dokki, Giza, Egypt. The investigation aimed to study the effect of applying NPK, humic substance on vegetative growth of Egazy olive seedlings planted in plastic bags at nursery stage. After planting Egazy olive seedlings, the following treatments were applied: T1: NPK (Crystalon 20% N: 20% P: 20% K) at four rates (0, 25, 37.5 and 50 g \ plant \ year), T2: humic substance (Potash actosol) at four rates (0, 2, 4 and 6 cm³ \ plant \ year), also the interaction between NPK, humic substance treatment were studied. At the end of the season, percentage of plant height increment, leaves number per plant, shoot numbers per plant, stem diameter, leaves dry weight %, root numbers, root length were determined and recorded. The obtained results revealed that treatment (4 cm³ humic substance only) 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, also it increased leaves dry weight % comparing with the control. On the other hand, the highest root number was recorded from Egazy olive seedlings not fertilized with NPK and/or humic substance. While, the highest root length value was obtained by using 2cm³ humic substances without NPK.

Key words: Egazy olive % Humic substance % NPK

INTRODUCTION

Olive (*Olea europaea* L.) was spread from its place of origin on what is today Turkey and Syria to other parts of the Mediterranean basin in a very early period [1]. 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. As to the nonconventional sources of organic matter suitable for soil amendments, different humic acid- derived materials have improved soil characteristics and plant growth [2]. Humic acid is complex substances derived from organic matter decomposition. Agricultural humic acid are reputed to enhance nutrient uptake, drought tolerance, seed germination and overall plants performance [3, 4]. Fernández-Escobar *et al.* [5] mentioned that, under field conditions, foliar application of leonardite extracts (humic substances extracted) stimulated shoot growth and promoted the accumulation of K, B, Mg, Ca and Fe in leaves. However, when leaf N and leaf K values were

below the threshold limit for the sufficiency range, foliar application of humic substances was ineffective to promote accumulation of these nutrients in leaves. Abdel Fatah *et al.* [6] mentioned that, soil drench application of humic acid to Tifway Bermudagrass hybrid improved growth parameters. Hassan *et al.* [7] indicated that, Klamata olive young leaves dry weight per plant showed higher value in the first season when treated with mineral nitrogen source at 100 % + humic acid at monthly doses from March to November each of 20 ml/plant. Abou Rawash *et al.* [8] pointed that, leaves dry weight per plant of Picual live young trees showed higher value in the first season when treated with mineral nitrogen source at 100 % + humic acid at monthly doses from March to November each of 20 ml/plant. Yousef *et al.* [9] 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 comparing with control. On the other hand, this treatment raised root length and root weight than the control plant.

This investigation aimed to study the effect of NPK and humic substance on some growth parameters of Egazy olive seedling grown in greenhouse nursery.

MATERIALS AND METHODS

This study was carried out on Egazy olive cv. healthy and almost uniform seedlings cultivated in black polyethylene bags with 30 cm diameter foiled with 10 kg washed sand mixed very good with 2.5 kg cattle manure in the experimental research green house of National Research Center, Dokki, Giza, Egypt. The investigation aimed to study the effect of applying NPK (crystalon 20% N: 20% P: 20% K) and humic substance source (Actosol product), the natural organic fertilizer which contain 1:5:6 NPK and 20% humic acid, (commercially known as potash actosol). The NPK and humic substance used in this study as a direct soil application on Egazy transplants at the nursery. The following treatments were investigated:

- C NPK (Crystalon 20% N: 20% P: 20% K) applied as soil application 16 doses from March to October about one dose every 15 day at four rates 0, 50g actual NPK (15.6 g Crystalon/plant\15 days), 37.5 g actual NPK (11.7 g\ Crystalon/plant\15 days) and 25 g actual NPK (7.8 g Crystalon/plant\15 days).
- C Humic substance (potash actosol) applied as soil application 8 doses from March to October about one dose every 15 day at four rates 0, 2, 4 and 6 cm³/plant.

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 gently with their root system to estimate and record the following data:

- C Percentage of plant height increment.
- C Shoot numbers per plant.
- C Stem diameter (mm).
- C Leaves number per plant.
- C Leaves dry weight %.
- C Root numbers.
- C Root length (cm).

Statistical Analysis: Data were subjected to analysis of variance and the method of Duncan's was used to differentiate means [10].

RESULTS

Percentage of Plant Height Increment: Data presented in Table 1 showed that, increasing organic fertilizer rates at 4 cm³ / plant / month without adding humic substance recorded the highest percentage of plant height increment compared with all other treatments including the control. However, increasing humic substance rates leads to significant increase in percentage of plant height

Table 1: Percentage of plant height increment as affected by mineral and organic fertilization on Egazy olive seedlings

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	134 e	160 c	204 a	187 b	169A
25gm NPK	120 g	132 f	144 d	144 d	134 B
37.5gm NPK	144 d	114 ih	144 d	120 g	108 C
50gm NPK	112 i	116 h	108 j	104 k	110 C
Mean	127.5 C	108 D	150 A	136.5 B	--

Table 2: Leaves number per plant as affected by mineral and organic fertilization on Egazy olive seedlings

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	101fg	88 j	152 a	122 b	115.75 A
25gm NPK	90 i	94 h	105 d	108 c	99 B
37.5gm NPK	102 ef	103 e	90 i	88 j	95.75 C
50gm NPK	95h	100 g	81 k	75 l	87.75 D
Mean	97 C	96 D	107 A	98 B	--

Table 3: Lateral shoot numbers per plant as affected by mineral and organic fertilization on Egazy olive seedlings

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	5 c	5 c	8 a	4 d	5.5 B
25g NPK	4 d	5 c	8 a	6 b	5.75 A
37.5g NPK	3 e	3 e	3e	3 e	3 C
50g NPK	2 f	2 f	2 f	2f	2 D
Mean	3.5 C	3.75 B	5.25 A	3.75 B	--

Table 4: Stem diameter as affected by mineral and organic fertilization on Egazy olive seedlings

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	2.1e	2.4b	2.4b	2.5a	2.35 A
25g NPK	1.9g	2f	2.3c	2.2d	2.1 B
37.5g NPK	2f	2.2d	2.3c	2f	2.12 B
50g NPK	1.7h	1.6i	1.4j	1.3k	1.52 C
Mean	1.92 D	2.05 B	2.12 A	2 C	--

Table 5: Leaves dry weight % as affected by mineral and organic fertilization on Egazy olive seedlings

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	43.2 o	44.6n	45.3m	46.9 l	45 D
25g NPK	48.3 k	50.9 i	56.8 a	55.3 c	52.82 B
37.5g NPK	50.2 j	52.8 e	54.7 d	55.8 b	53.37 A
50 gm NPK	51.1h	51.3 j	52.6 f	52.9 e	51.95 C
Mean	48.2 D	49.9 C	52.35 B	52.7 A	--

Table 6: Root numbers as affected by mineral and organic fertilization on Egazy olive seedlings

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	9 a	4 f	7 b	6 c	6.5 A
25g NPK	5 d	6 c	4 f	4 f	4.75 B
37.5 g NPK	5 de	4 ef	3 g	3 g	3.83 C
50g NPK	3g	3g	2h	2h	2.5 D
Mean	5.42 A	4.3 B	4.08 C	3.75 D	--

Table 7: Root length as affected by mineral and organic fertilization on Egazy olive seedlings during studied season

Treatments	0 humic substance	2 cm ³ humic substance	4 cm ³ humic substance	6 cm ³ humic substance	Mean
0 NPK	8e	30a	20b	15c	18.25 A
25g NPK	4i	6g	7f	9d	6.50C
37.5 g NPK	7f	8e	9d	9d	8.25 B
50g NPK	5h	6g	6g	7f	6.00 D
Mean	6 C	12.5 A	10.5 B	10 D	--

increment and reached to the maximum extent at the rate of 4 cm³ / plant / month while with increasing humic substance rate up to 6 cm³ / plant / month the percentage of plant height increment decreased significantly.

Leaves Number per Plant: Data in Table 2 showed that, leaves number per plant was increased with increasing humic substance rates and reached the maximum extent at the rate of 4 cm³/ plant / month without using NPK. However increasing humic substance rate up to 6 cm³ / month / plant decreased leaves numbers per plant significantly. The present data also indicated that olive seedlings that received zero NPK recorded higher leaves number more than those received higher rates of NPK.

Shoots Number per Plant: The results in Table 3 showed that, application of humic substance at 4 cm³/plant /month either without addition of NPK or with the lowest rate of

mineral fertilizer gave the higher shoots number per plant compared to other treatments. Shoots number per plant were increased significantly with increasing humic substance rates till 4 cm³/ plant / month, while increasing humic substance rate up to 6 cm³/ month / plant reduced this increment significantly. However, shoots number values was increased significantly due to using NPK at the lowest rate compared to those obtained by medium or high rates.

Stem Diameter: As shown in Table 4, stem diameter varied according to the source of applied fertilizer. In this respect, stem diameter responded significantly to the increase in humic substance rate. On the contrary, increasing NPK rate decreased the stem diameter. The highest value of stem diameter was recorded from olive seedlings fertilized with the high rate of humic substance without adding NPK (0g NPK +6 cm³ humic substance / plant / month).

Leaves Dry Weight %: Data in Table 5 illustrated that, leaves dry matter percentage in Egazy olive seedlings responded to both tested sources of fertilization when applied individually. However, leaves dry matter percentage was increased significantly with increasing humic substance up to the high rate (6 cm³ humic substance / plant / month). Similar trend with lower extend was obtained by increasing NPK up to the medium rate (25g actual NPK as 4.6 g / plant / 15 day). Meanwhile, the highest leaves dry matter percentage was recorded from Egazy olive seedling fertilized with low rate NPK with the medium rate of humic substance (25g actual NPK as 4.6 g / plant / 15 day + 4 cm³ humic substance / plant / month).

Root Numbers: Results in Table 6 showed that, root numbers was decreased significantly with increasing fertilizer rate either applied as NPK or humic substance individually. The highest root numbers was recorded from Egazy olive seedlings did not receive NPK and/or humic substance (control).

Root Length: Results in Table 7 showed that, root length was affected by fertilization treatments either applied as NPK or humic substance individually. In this respect, Egazy olive seedling fertilized with medium or high rate as NPK or organic form decreased root length significantly compared to those fertilized with the lower ones. The highest root length value was obtained by fertilizing Egazy olive seedling with 0g NPK + 2 cm³ humic substance/plants/month.

DISCUSSION

From the abovementioned results, it is clear that treatment (4 cm³ humic substance/plants /month only) was the most effective treatment compared with the other treatments. Since this treatment gave the best results concerning percentage of plant height increment, shoot number, leaves number per plant, stem diameter, also it increased leaf dry weight % comparing with the control. On the other hand, the highest root numbers was recorded from Egazy olive seedling not fertilized with NPK and/or humic substance. While, the highest root length value was obtained by using 2 cm³ actosol without NPK fertilization. These results are harmony with those obtained by Fernández-Escobar *et al.* [5] who reported that, foliar application of leonardite extracts (humic substances extracted) under field conditions, stimulated plant growth of young olive plants. This may be due to the effect of humic acid in increasing root growth in a

manner similar to auxin [11]. Moreover we can added that, growth parameters which not affected by most mineral treatments may be attributed to low nutritional demand of young olive trees as mentioned by Xiloyannis *et al.* [12], they indicated that, demand of irrigated olive trees, cultivar Coratina for P and K is minimal during the first four years after planting and can be fulfilled by naturally supplied soils. Low doses of N should be applied through localized fertilization during the year. Also, Yousef *et al.* [9] indicated that treatment of (Humic acid + amino acids + macro elements+ trace elements) was the most effective one compared with the other treatment since Chemlali olive seedlings treated with this treatment gave the best results concerning plant height, brunch numbers, leaf numbers, also it increased plant diameter and leaves area comparing with the control. On the other hand, this treatment raised root length and root weight than the control plant.

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