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Effect of Rates and Methods of Calcium Nitrate Application on Vegetative Growth of Dolcy Olive Seedlings

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Abstract: This study was carried out ton Dolcy olive seedlings grown at the greenhouse of National Research Center, Dokki, Giza governorate, Egypt. The investigation aimed to study the effect of rats and method of calcium nitrate applications as nitrogen fertilization source on vegetative growth of Dolcy olive seedlings planted in black polyethylene bags at nursery stage. After planting Dolcy olive seedlings, the following treatments were applied: T1: calcium nitrate applied on olive seedlings as soil application at three rates 25, 37.5 and 50 g actual nitrogen / plant / year, T2: calcium nitrate applied on olive seedlings as foliar application at three rates 25, 37.5 and 50 g actual nitrogen / plant /year, T3: calcium nitrate applied on olive seedlings as by soil + foliar applications at three rates (12.5+37.5),(25+25) and (37.5+12.5)g actual nitrogen / plant / year. At the end of the experiment, percentage of plant height increment, lateral shoot number per plant, stem diameter, leaf number per plant, leaf dry weight %, root number and root length were determined and recorded. The obtained results indicated that spraying seedlings with the high rate of calcium nitrate (50 g actual nitrogen applied weekly from March to October) was the most effective one compared with the other treatment since this treatment gave the best results concerning percentage of plant height increment, lateral shoot number per plant, stem diameter, also it increased root length compared with control. On the other hand, the highest root number achieved with the lowest rate of calcium nitrate as foliar application.

Key words: Calcium nitrate · Vegetative growth · Dolcy olive seedlings

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 [1]. An appropriate fertilization is important during the first years of growth when the tree has to take in nutrients and produce assimilates for the development of its root system and canopy perennial structures and to prepare itself for future fructification. In this period an adequate nutrition stimulates a fast vegetative growth which presumably reduces the juvenile and non-productive phase [2]. The knowledge concerning the nutritional requirements can assure a balanced development of the plant and, at the same time, avoid surplus administration of fertilizers which, in most cases, also heavily damage the environment. Miller and Smith [3] stated that nitrogen is the most important mineral element in fertilization programs because plants usually need N in greater amounts than other mineral nutrients. Dou and Alva [4] reported that, understanding the rate of different forms of nitrogen fertilizers applied to soils is an important step in enhancing N use efficiency and minimizing N losses. Ebert *et al.* [5] studied the effect of varying Ca $(NO_3)_2$ rates on growth of NaCl-stressed guava seedlings (*Psidium guajava* L.) found that, addition of Ca $(NO_3)_2$ stimulated shoot growth more than root growth. Nawaf and Yara [6] found that, young olive trees benefit from low levels of NPK and N alone and additional fertilizers was not significant. However, NPK are considering being essential element for plant growth and development. Garcia *et al*. [2] studied the effect of different N forms on the growth of olive seedlings in the greenhouse. They found that, N-NH_4 treatments resulted in a significantly higher growth compared to KNO_3 treatment. Also, using the peat-sand substrate and the N concentrations described above, seedling growth was higher than in sterile sand, but no differences among treatments were observed.

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This investigation aimed to study the effect of rates and methods of calcium nitrate as nitrogen fertilization application on some growth parameters of Dolcy olive seedling in greenhouse nursery.

MATERIALS AND METHODS

This study was carried out on Dolcy olive cv. healthy and almost uniform Seedling, 30 cm height 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, Dokki, Giza, Egypt. The investigation aimed to study the effect of applying calcium nitrate (15.5%) as a nitrogen fertilizer with soil and foliar applications on Dolcy Olive seedling at the nursery. The following treatments were applied:

- 50 g actual nitrogen (9.2 g/ Ca $(NO_3)_2$/ plant/week started from March to October) applied as soil application recommendation of MALR [7].
- 37.5 g actual nitrogen (6.9 g /Ca $(NO_3)_2$/plant / week started from March to October) applied as soil application.
- 25 g actual nitrogen (4.6 g /Ca $(NO_3)_2$/plant / week started from March to October) applied as soil application.
- 50 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 3.6 % every week started from March to October).
- 37.5 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 2.7 % every week started from March to October).
- 25 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 1.8 % every week started from March to October).
- 37.5 g actual nitrogen applied as soil application (6.9 g / Ca $(NO_3)_2$/ plant / week started from March to October) + 12.5 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 0.9%% every week started from March to October).
- 25 g actual nitrogen applied as soil application (4.6 g / Ca $(NO_3)_2$/ plant / week started from March to October) + 25 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 1.8%% every week started from March to October).
- 12.5 g actual nitrogen applied as soil application (2.3 g / Ca $(NO_3)_2$/ plant / week started from March to October) + 37.5 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 2.7% every week started from March to October).

Calcium nitrate was fertilizer divided into 35 equal weekly doses through growing season (one dose per week started from March to October) as soil or foliar application. The treatments were arranged in a completely randomized block design with six replicates for each treatment and each replicate was represented by three seedlings. At the end of October, plants for each treatment were removed genteelly with their root system to estimate the following data:

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

Statistical Analysis: Data were subjected to analysis of variance and the method of Duncan's was used to differentiate means [8].

RESULTS

Percentage of Plant Height Increment: Fig. 1 showed that, there were clear relation between Percentage of plant height increment and increasing in rate of fertilization applied as soil, foliar or soil + foliar application.

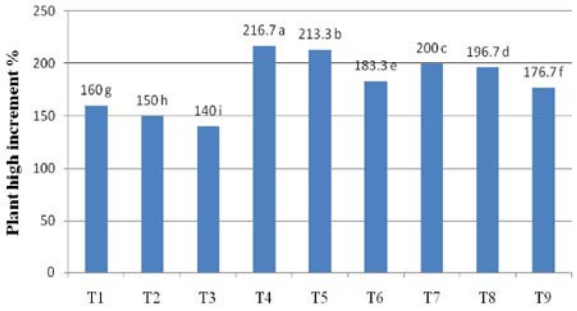

Fig. 1: Effect of rates and methods of calcium nitrate application on percentage of plant height increment of Dolcy olive cv. seedling.

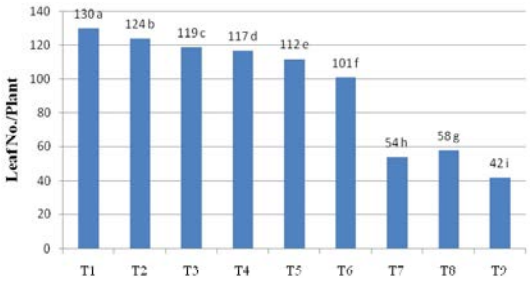

Fig. 2: Effect of rates and methods of calcium nitrate application on Leaf number per plant of Dolcy olive cv. seedling.

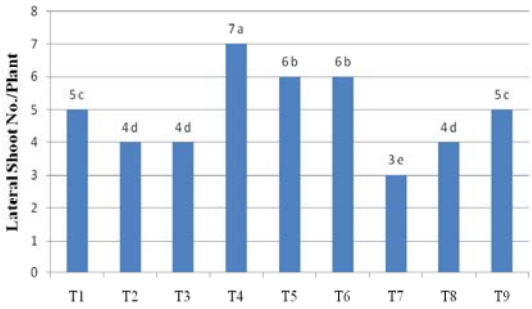

Fig. 3: Effect of rates and methods of calcium nitrate application on lateral shoot number per plant of Dolcy olive cv. seedling.

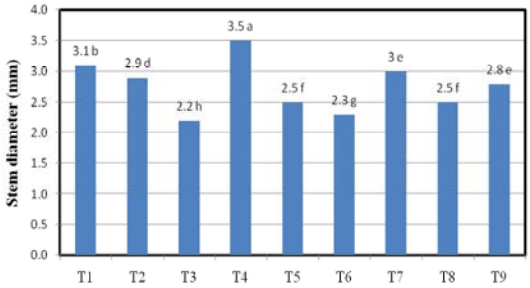

Fig. 4: Effect of rates and methods of calcium nitrate application Stem diameter of Dolcy olive cv. seedling.

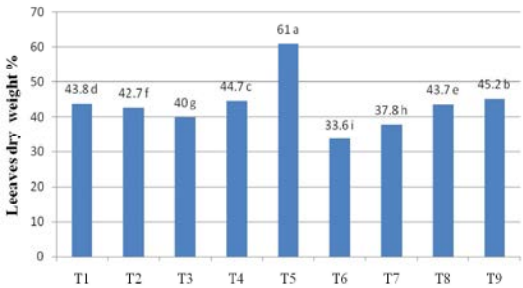

Fig. 5: Effect of rates and methods of calcium nitrate application on leaves dry weight percentage of Dolcy olive cv. seedling.

Significant differences were recorded among treatments, but the highest percentage of plant height increment was recorded by 50 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 3.6 % every week started from March to October). While, the lowest Percentage of plant height increment accrued with 25 g actual nitrogen as soil application.

Shoot Numbers per Plant: Fig. 2 showed that a significant differences among treatment. It can be noticed that, high rates of calcium nitrate as soil or foliar application recorded the highest shoot number value. On the contrary, high rates of calcium nitrate applied as soil + foliar application gave the lowest value. Finally using the highest rate with spraying method showed the highest significant value compared with all other treatments.

Stem Diameter: Fig. 3 showed that stem diameter was significantly affected by different rates of N application; however it increased significantly with increasing the rate of N application either applied as soil or foliar application. While, using calcium nitrate as soil + foliar application method did not give a clear direction. Generally the highest significant value of stem diameter was recorded by 50 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 3.6 % every week started from March to October).

Leaves Number per Plant: Fig. 4 illustrated that, the increase in leaves number per plant was accompanied by the higher rates of N fertilization under all methods of application. The highest number of leaves per plant was recorded from 50g actual nitrogen (9.2 g \ plant \ week started from March to October) applied as soil application compared to all other N treatments. On the other hand, results indicated that (soil + foliar) application gave the lowest leaves number per plant compared to soil or foliar applications individually.

Leaves Dry Weight %: Fig. 5 indicated that leaves dry weight % was significantly affected by the method of N application rather than the N rate. However, foliar application of 37.5 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 2.7 % every week started from March to October) recorded the highest significant increase in leaves dry weight % compared with all other treatments.

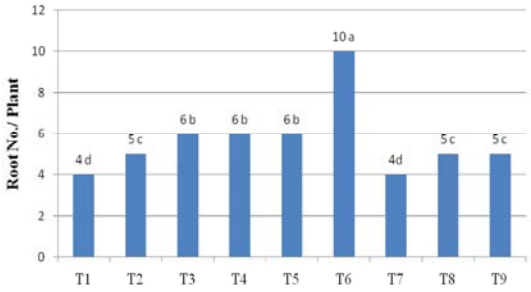

Fig. 6: Effect of rates and methods of calcium nitrate application on root number of Dolcy olive cv. seedling.

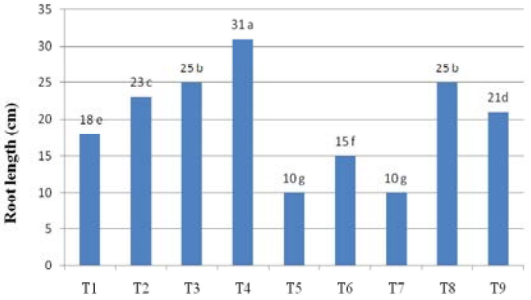

Fig. 7: Effect of rates and methods of calcium nitrate application on root length of Dolcy olive cv. seedling.

Root Numbers: Fig. 6 showed that a general trend in root number values was noticed. In this respect, decreasing rat of fertilization under all methods of application resulted in increasing in root number per plant. 25 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 1.8 % every week started from March to October) showed the highest significant root numbers value compared with all other treatments.

Root Length: Fig. 7 showed that, 50 g actual nitrogen applied as foliar application (sprayed seedling calcium nitrate with concentration 3.6 % every week started from March to October) showed the highest significant root length value compared with all other treatment. In addition, it was cleared that the methods of N application had a significant impact on the results; the highest root length per plant was detected by using the lowest N rate as foliar application method. Where decreasing soil N application rate increasing root length values.

DISCUSSION

With respect to the method of application it could be noticed that there is a general trend, that the N fertilization as foliar application gave the best results compared to other methods of applications (soil and soil + foliar). As for N rate application, it became clear that the high rate of N (50 g) recorded the highest values for percentage of plant height increment, shoot number per plant, stem diameter and root length when calcium nitrate applied as foliar application. While, high rate of N (50 g) when applied as soil application led to the highest leaves number per plant. With respect to the effect of rates and methods of calcium nitrate application on seedling roots, results obviously showed that, the highest root number achieved with the lowest rate of calcium nitrate as foliar application. On the contrary, the highest root length was obtained with the highest rate of calcium nitrate as foliar application. However, the obtained results are in harmony with those obtained by Fernandez-Escobar *et al*. [9] who reported that Containerized olive nursery plants clearly responded to the application of N fertilizers to the substrate. Fertilized plants increased significantly in shoot growth compared to control plants. However, plant growth was dependent on the amount of N applied. When 2 g N were added to each pot, shoot growth was reduced compared to the addition of only 0.75 g N. Some damage was observed in plants that received the highest amount of N. Similar observations have been reported previously by Garcia *et al.* [2] on olives and Maust *et al*. [10], for other tree species suggested that, high N concentration in the root atmosphere may reduce growth of containerized plants.

REFERENCES

1. Fernández-Escobar, R. and L. Marín, 1999. Nitrogen fertilization in olive orchards. Acta Hort., 474: 333-335.
2. Garcia, J.K., J. Linan, R. Sarmiento and A. Troncoso, 1999. Effects of different N forms and concentrations on olive seedlings growth. Acta Hort., 474: 323-327.
3. Miller, R.J. and R.B. Smith, 1976. Nitrogen balance in the southern San Joaquin Valley. J. Environ. Qual., 5: 274-278.

4. Dou, H. and A.K. Alva, 1998. Nitrogen availability to citrus seedlings from urea and from mineralization of citrus leaf or compost. J. Plant Nutrition, 21(1): 13-24.
5. Ebert, G., J. Eberle, H. Ali-Dinar and P. Lüdders, 2002. Ameliorating effects of Ca $(NO_3)_2$ on growth, mineral uptake and photosynthesis of NaCl-stressed guava seedlings (*Psidium guajava* L.). Scientia Horticulturae, 93(2): 125-135.
6. Nawaf, M. Ferihat and Yara K. Masa`deh, 2006. Response of two-year-old tree of four olive cultivars to fertilization. Amrican-Erasian J. Agric. and Environ. Sci., 1 (3): 185-190.
7. MALR, 2007. Ministry of Agriculture and Land Reclamation. Modern technique for olive cultivation and production. Horticulture Research Institute, Agriculture Research Center, Bulletin No. 15(in Arabic).
8. Duncan, D.B., 1955. Multiple Range and Multiple "F" Tests. Biometrics, 11: 1-42.
9. Fernandez-Escobar, R., M. Benlloch, D. Barranco, A. Duenas and J.A. Gutérrez Ganan, 1999. Response of olive trees to foliar application of humic substances extracted from leonardite. Scientia Horticulturae, 66(3-4): 191-200.
10. Maust, B.E. and J.G. Williamson, 1994. Nitrogen nutrition of containerized citrus nursery plants. J. Am. Soc. Hort. Sci., 119 (2): 195-201.