International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.9756/INTJECSE/V14I5.884 ISSN: 1308-5581 Vol 14, Issue 05 2022

Improvement Of Grape Sapling Growth by Soil Application of O-DAP + Microelements Fertilizer

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Abstract

An experiment was conducted at the Al-Daghara Nursery belong to the Iraqi Ministry of Agriculture - Diwaniyah Agriculture Directorate for the period from 1 January 2021 to 1/10/2021 to study the impact of soil fertilization with local DAP fertilizer named" O-DAP + microelements" produced by the Agricultural fertilizer Factory, which is belong to the Faculty of Agriculture, Kufa University, at three levels: 0, 5, 10 g pot^{-1} was added 3 times in two months between additions, on the grape saplings (*Vitis vinifera* L.) cv. Flame seedless growth to improve it. The difference in local DAP fertilizer (O-DAP + microelements) levels had a moral impact on all shoots and roots growth indicators especially with level of 10 g. pot^{-1} in the main stem length (cane), cane diameter, the total leaves area, and shoots and roots dry weight.

Keywords: grape sapling, Dap fertilizer, soil fertilizer. Vegetative growths

Introduction

Grapes (*Vitis vinifera* L.) are growing in many parts of the world under a wide range of different environmental conditions in the warm, moderate, warm subtropical and mild cold regions [1]. The area planted in the world is estimated at 11.135 million hectares with a total production 78,034,332 tons[2], while the area planted with grapes in Iraq is estimated at 146,000 dunums with a production of 421868 tons per year, and the number of varieties in Iraq is estimated at about 70 varieties, most of which are concentrated in the northern region of Iraq, which contain more than 7 million grape vines, distributed in about 58 local, regional and international varieties, In other parts of Iraq, Salah al-Din province ranked first in terms of production, followed by Diyala province and Najaf province[3]. The Nutritional and consumption grapes fruits and their raisins and juice products has made them directly linked to human life, particularly since they are at the forefront of fruit trees in production and cultivated area, and the economic importance of grapes is due to its significant economic returns and its continued fruiting for decades and the high nutritional value of grapes as well as its importance in medical uses in the treatment of many diseases[4]. Due to the importance of the grape crop, it has received more care in its cultivation and production. There are many varieties that have not been commercially cultivated despite the appropriate environmental conditions for their cultivation, and the multiplicity of areas of their use, they are suitable for fresh consumption as table grapes desirable by the consumer, including flame seedless flame class and through interest in the production of good saplings can expand its cultivation to

meet Iraq's need for the fruits of this species. Fertilization is one of the most important agricultural processes that take place on grape saplings to improve the nutritional status of saplings, which reflects positively on their vegetative growth, and there are many fertilizers that contain more than one element added to the soil or sprayed on the vegetative total of plants and experiments have shown the possibility of supplying the plant with various nutrients through the use of fertilization that increases growth and obtained in grapes[5]. The use of phosphate fertilizers (di ammonium phosphates) has not received much attention compared to other fertilizers in improving the growth of fruit saplings at the beginning of their life, including grapes, despite the widespread use of these fertilizers at a field level in recent years in agricultural crops because they contain both of nitrogen and phosphorus. Muhammad Ali *et al.*,[6] found that the addition of DAP fertilizer at the level of 15 uncles/saplings for olive saplings a year-old "Shami" cultivar has morally influenced all vegetative and roots qualities by achieving them the best results.Al-Akam et al.,[7] found that the addition of DAP chemical fertilizer at level 9 mg of saplings improved the characteristics of the vegetative and roots growth of grape saplings a "French" cultivar compared to the control (without fertilization. Hussein [8] carried out a study on the effect of earth fertilization of apricot saplings *Prunus armeniaca* aged one year with four levels of DAP fertilizer: 0, 2, 4, 6 g for saplings and 6 levels for two-year-old saplings (0, 7, 9, 11, 13, 15 g/sapling) and three additions and found that the best level is 4 g for saplings aged one year and 13 g DAP at the age of two years as these two factors exceeded the positive effect in the height of the plant and the number of leaves The leaves area and dry weight of the sapling. Organic Diammonium Phosphate, supported by micro-elements named (O-DAP + micro-elements), is one of the fertilizers produced in the agricultural fertilizer plant at the Faculty of Agriculture, Kufa University, which has been equipped in addition to nitrogen and phosphorus with certain proportions of micro-elements and organic acids. Due to the lack of studies, if not non-existent, on the impact of locally produced organic DAP on grape saplings fertilization in Iraq, the research was conducted to test the impact of soil addition of new locally manufactured organic DAP fertilizer in the growth rate of grape saplings, improving their nutritional status, producing grape saplings with good vegetative growth and a good roots in a short time in the nursery and in order to achieve the farmer's desire to limit the time, effort and cost of planting good saplings so that they can grow well and quickly and be of good size, suitable height for cultivation in vineyard orchard.

Material And Methods

The experiment was carried out in Saran lath house in the nursery of Al-Daghara district - Diwaniyah governorate, belonging to the Directorate of Agriculture of Diwaniyah - Iraqi Ministry of Agriculture for the period from 1 January 2021 to 1/10/2021 to show the impact of land fertilization O-DAP+ micronutrient fertilizer on grape sapling growth indicators. one-year-old Flame Seedless saplings is planted in 10 kg plastic pots filled with river soil and one sapling for the pot.

The winter pruning of grape saplings was carried out at the beginning of February by removing all shoots, except one branch of a palace of 2-3 eyes [9]. Samples of soils used in the experiment was taken and analyzed to know its physical and chemical qualities (Table 1) according to the methods contained in Page *et al.*,[10].

Table1: Soil Chemical and Physical characteristics

soil characteristics	value
N	0.08%
P %	0.003%
K %	0.07%
Ca%	0.013%
Organic substance (%)	nil
pH	7.4
EC	1.59dsm^{-2}
Texture	Sandy loam

Experimental treatments arranged in Randomized Complete Block Design(RCBD) with three replicates and 4 saplings each treatments. Three levels, 0, 5 g, 10 g per pots of O-DAP organic fertilizer (Organic-Diammonium Phosphate) supported by micro-elements produced by the organic fertilizer plant at the Faculty of Agriculture, Kufa University as shown in a table (2) were used[11].

Table 2: Components of ' O-DAP + micronutrients' fertilizer

Component	%	Component	%	Component	%
N %	16.5	Fe	0.005	Humic acid	2.38
P %	48.2	Cu	0.008	Folvic acid	5.64
K %	2.14	Mn	0.024	Organic acids	14.30
Ca%	8.64	Zn	0.008		
Mg	0.264	B	0.0003		

Fertilizer soil additions were carried out 3 times during the experiment period, the first addition began on 1-3-2021 and between one addition and another two months.The results were analysed using genstat12th[12], where analysis of Variance (ANOVA) was performed.

Vegetative and roots growth parameters

Length of canes

The measurement of cane length of the was performed using the metric strip in October 2021, from the base of the cane to its growth top.

Diameter of canes

At the beginning of October 2021, the diameters of the kasbahs were calculated using vernier's electronic foot, 5 cm from the base of the kasbah (at the third salami) and the rate was extracted per experimental unit[9].

Shoots number

According to the number of side shoots on the canes at the beginning of October 2021.

Leaves area

The leaves area of the sapling was calculated depending on the size of the leaves and the number of leaves, as the average size of the full-sized leaves was calculated first by taking 5 full-sized sheets from different parts of each sapling and each experimental unit at the beginning of Augest 2021, photographing it with scanner scanner and inserting computer-based images into image J program[13], and took the average after obtaining the area of leaf and after calculating the number of leaves per sapling hit the area of one sheet in the number of leaves per sapling to extract the paper area of the single sapling according to the following Eq.:
Total leaves area of saplings = number of leaves per sapling × average leaf area

Shoots dry weight (g)

The vegetative group (shoots and stem) was separated from the root group of the sapling and four plants, cut into small parts, and dried by oven at a temperature of 65 ^{0}C until the weight was constant and the dry weight was calculated with a electric balance.

Roots dry weight

The roots of two plants were separated from each experimental unit, the soil mass was removed by running water, and then the roots were dried by oven and at a temperature of 70 ^{0}C until the weight stabilized and the dry weight of the roots was calculated with a sensitive electric balance.

Results

It is clear from the data shown in table 3 that the length of the main branch was morally affected by o-DAP fertilization, as the fertilization treatment exceeded the level of 10 g. pot^{-1} and achieved75.3 cm, which in turn differed from other fertilization and achieved the saplings that were fertilized at a level of 0 g.pot^{-1} the lowest rate of 57.1 cm, an increase of 31.9% . Through the data shown in table (3) the diameter of the stem was shown to be morally affected by the addition of O-DAP fertilizer, as saplings that were fertilized at 10g pot^{-1}exceeded the main stem diameter rate (10.930 mm) compared to non-fertilized saplings that achieved the lowest rate of 9,263 mm, an increase of 101.3%. The addition of O-DAP fertilizer has a moral impact on shoots number, as all levels used have exceeded the level of 0 g pot^{-1}, the saplings fertilized at the level of 10g pot^{-1} achieving the highest rate of 5.01 shoots sapling^{-1}, while saplings fertilized at the level of fertilization achieved 0 g. pot^{-1} the lowest rate of 3.12 shoots.sapling^{-1}. Also, O-DAP fertilizer has a moral impact on leaves area as fertilization transactions at all levels caused a moral increase in leaves space and increased impact with the increase in the level, and the level 10g. pot^{-1} was achieved the highest leaves area (1697.2 cm^2 sapling^{-1}) compared to a leaves area of 1431.0 cm^2 sapling^{-1} for control**.** For shoots dry weight, results in table (3) indicated that there are moral differences in shoots dry weight of grape saplings when fertilized with O-DAP fertilizer, as the treatment of fertilization exceeded the level of 10g. pot^{-1} on all other levels by achieving the highest shoots dry weight of 24,326g, while the treatment (0 g pot^{-1}) achieved less dry weight of 21.037 g. On the other hand, O-DAP fertilizer had a clear effect on roots dry weight, with the treatment exceeding 10g.pot^{-1} reaching 50.42g. This was followed by a 5g pot^{-1} (48.41g), which did not differ morally compared to the control treatment, which showed the lowest roots dry weight (33.60 g).

Table 1 : Effect of soil application of O-DAP+ microelements on vegetative parameters of flame seedless grape saplings

O-DAP+ microelements	canes length (cm)	canes diameter (mm)	Shoots number	Leaves area (Cm^2)	Shoots dry weight (g)	root dry weight (g)
0	57.1	9.263	3.12	1431.0	21.037	33.60
5	68.1	10.247	4.03	1623.9	22.810	48.41
10	75.3	10.930	5.01	1697.2	24.326	50.42
LSD(0.05)	6.38	0.1597	1.130	1556.7	0.3203	1.685

Discussion

The growth and development processes in plants continue as the production of new cells, tissues and plant organs continues and continues, such as leaves and the stem, with the presence of growth factors represented by mineral elements and plant hormones to control the processes of development[14], both are influenced by the physiological and vital processes that occur in the vegetative part of it.

Therefore, managing the growth requirements of one of them, the availability of nutrients, is important for this purpose. The results in the tables 1 for some indicators of vegetative and roots growth, including: main stem length and diameter, total leaves area, shoots and roots dry weight, show a moral effect of O-DAP at various levels compared to the control treatment saplings at level ($10g.pot^{-1}$) which achieved superior results. The superiority of saplings that have been fertilized by different concentrations of O-DAP fertilizer over control treatment plants is indicative of the benefit of using this fertilizer, which contains the macro elements(N and P,K), micro elements, and humic acids (Table 2). which positively influenced indicators of vegetative and roots growth in general, accompanied by increased concentrations of mineral materials contained in fertilizer(data unpublished), as the fertilizer used contains the large and small mineral elements mentioned and needed the plant has a big deal, The increase in indicators of vegetative growth under study with the use of increasing levels of O-DAP fertilizer is due to the vital role of each of the fertilizer-in-house elements in meeting the need of the plant and the macro mineral elements necessary for photosynthesis, breathing and various metabolic processes that play a macro role in the process of cell division and elongation[15].

For example, nitrogen in O-Dap fertilizer is one of the basic materials needed by the plant in the construction process, as it increases the activity of the sediment peaks that increase cell division and prolongation, which increases the size of the plant, represented by the height of the plant, the diameter of its stem, its soft and dry weights and leaves area, which has already occurred in the current experiment indicated by the results in the tables (3), as a result of increased activity of plant hormones or increased construction of materials for growth such as amino acids and some enzymatic accompaniments such as NAD and NADP which the nitrogen element enters into their composition,

In addition to the role of phosphorus processed by fertilizer, which has a fundamental effect on vegetative growth, the two elements together (in addition to the large and small

elements it contains) have a role in increasing the effectiveness of the plant to carry out the process of photosynthesis, which leads to increased vegetative and roots growth, and nitrogen and phosphorus are involved in the construction of cellular membranes and the formation of energy compounds[16].

Other macro nutrients in the O-DAP fertilizer formula, such as potassium, magnesium, calcium and micro-elements (iron, zinc, copper and manganese) were needed for plant growth stimulating the enzymes of the photosynthesis process and activating the distribution of photosynthesis products and their use in growth of the shoots and roots groups and thus reflected in the improvement of these growth indicators.

The effect of organic acids, humic and fulvic acid in O-DAP fertilizer in increasing vegetative and roots growth may be due to their impact on increasing the nutritional content of the soil, improving root susceptibility to water absorption and nutrients availability that provide growth requirements and stimulate the growth processes in plant tissues related to the biosynthesis of photosynthesis products in the leaves, which encourage the growth of the plant group[17], which helped to increase the growth of the total vegetative parameters of the saplings.

Accordingly, the abundance of nutrients in fertilizer with its various effects contributes to increasing the vital activity of the plant and activating it by stimulating the enzyme systems and the formation of the necessary nuclear acids for the plant such as DNA and RNA[15], which increase the vegetative growth activity of plant height, total leaf area, dry weights of vegetative and root groups and root length described in the table mentioned earlier.

On the other hand, the provision of appropriate environmental conditions surrounding the plant, such as the provision of mineral elements in the soil and the physiological state of the plant, affects the total leaves area, especially the fertilization of compound fertilizer, including DAP fertilizer, as is evident from the results of the study in Table 3. As a result of its improvement indicators of roots and vegetative growth, including the number of shoots on the main stem (Table 3), leading to an increase in the number of leaves, as well as the vital role played by the macro elements in the construction of chlorophyll and stimulate the enzymes of the photosynthesis process[15], which activate the biosynthesis of photosynthesis products in the leaves and use them in the construction of the vegetative growth, including the increase in leaves area resulting from the increase in the number of cells and their large size and expansion.

The increase in the dry weight of the vegetative total, which has been positively affected by the fertilizer soil fertilization, may be due to the role of each element guaranteed by fertilizer, which includes nitrogen, phosphorus, potassium and micro-elements, as these elements affect the growth of the meristems, and the promotion of the stabilization of CO2 gas and thus the increased efficiency of the process of photosynthesis and the use of the products of this process in building the vegetative parts and storing the surplus of it in the various vegetative parts of the sapling. Focus on these elements functions and the parallel between the three macro and micro-elements, they have improved the vegetative growth of saplings, in particular the increase in the leaves area of saplings, the increase in the number of shoots (table 3), and the increase in the content of saplings of chlorophyll and carbohydrates, resulting in increasing shoots dry weight.

Roots dry weight gain of the roots (tables 3) may be due to the important elements of O-DAP fertilizer for root growth, particularly phosphorus and nitrogen elements and their physiological effect in increasing and improving the vegetative indicators (tables 3) which was reflected in increased efficiency of photosynthesis and thus increased manufacture of food and its movement to roots leading to increased growth of the roots total and accumulation of food in it and thus increase the roots dry weight.

The results of the current study are consistent with Muhammad Ali *et al,*. [6] in olive saplings, Hammoud *et al,*.[20], Al-Akaam *et al.*,[7], Imam and Al-Obaidi[21] to add chemical fertilizer DAP alone as a fertilizer rich in phosphorus with or without the presence of organic acids, it has increased the height and diameter of the canes, the number of shoots, leaves, leaves area and shoots,roots dry weight in the fertilized grape saplings compared to the control (without fertilization).

Conclusion

Organic nutrition was influenced by the addition of organic DAP fertilizer supported by small elements produced locally by the fertilizer plant at the Faculty of Agriculture - Kufa University at different levels used in all measured qualities, as increased the leaves area of the sapling and the root part, which improved the growth of saplings by adding 10 g in particular. The main objective of the cultivation of grape orchards is to form a vine structure in the early years of its life cycle, so we recommend using organic DAP fertilizer supported by the micro elements produced locally by the fertilizer factory at the Faculty of Agriculture - Kufa University at 10 g per sapling every two months from the beginning of the growing season to obtain a strong vegetative structure and a good roots for saplings to speed up their training program and in particular for flame seedless grape.

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