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Nutritional status of "Flame Seedless" grape transplants as influences by soil application of O-DAP + microelements fertilizer

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Abstract

Nutrition status is very important for grapevines growth and production. An experiment was carried to study the impact of soil fertilization with local DAP fertilizer named" O-DAP + microelements" produced by the Agricultural fertilizer Factory, Faculty of Agriculture, Kufa University, at three levels: 0, 5, 10 g pot^{-1} added 3 times in two months between additions, on the nutritional status of grape saplings (*Vitis vinifera* L.) cv. Flame seedless. The difference in local DAP fertilizer (O-DAP + microelements) levels had a moral impact on leave contents of N, P, K, Ca, Mg, Fe, Zn, Cu, Mn nutrients especially with the level of 10 g. pot^{-1} ..

Keywords: Dap fertilizer, grapevine, sapling, soil fertilizer, nutritional status

Introduction

Nutrients soil addition has a key and effective role in the activity of microbiology, plant nutrition and improved fruit tree growth, including vineyards, where soil fertilization affects the growth and productivity of grapes, so seedlings fertilization in early stages is important practices in the management of vineyards and obtaining optimal growth and productivity [1]. Soil fertilization with the nutrients of young grapes is one of the most important foundations of the production of vines and the provision of nutrients in a balanced way, especially nitrogen and phosphorus elements, which are important for sustaining the vine life and its production because these two elements play an important role in all vital processes within the vine tissues and the role of other nutrients and organic acids in the soil cannot be overlooked in improving the growth of the vine as well[2]. 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. organic acids in this fertilizer gives it another advantage over traditional DAP fertilizer by improving soil properties and being a suitable source of large and micro nutrients. Because organic matter has an impact on the phosphorus availability in soil by reducing soil pH, which leads to increased phosphorus and micro-elements availability for plants [3]. One of the most important phosphate fertilizers commonly used is single superphosphate, Tri ammonium superphosphate, phosphoric acid, ammonium diphosphate and ammonium monophosphate. Abou-Zied and Abd El Latif [4]. studied the effect of an additional 40 kg P2o5/acre of various sources of phosphate fertilizers are multi-phosphate ammonium and urea phosphate on the leaf content of nutrients and found that the leaves grape content of P,Zn,Fe increased when fertilized with ammonium phosphate compared to urea phosphate. Muhammad Ali *et al.*,[5] 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 carbohydrate and N,P,K by achieving them the best results.Al-Akam et al.,[6] found that the addition of DAP chemical fertilizer at level 9 mg increased leve content of chlorophyll and N,P for grape saplings a "French" cultivar compared to the control treatment (without fertilization). Hussein [7] also found when studying the effect of soil fertilization of apricot seedlings *Prunus armeniaca* aged four levels of DAP fertilizer (0, 2, 4 and 6 g for seedlings) in three applications that the addition of 4g led to an increase in chlorophyll, nitrogen and phosphorus in the leaves. Schroiner and Osborne [8]. also tested the requirements of pinot noir vineyards of phosphorus four levels of phosphorus: 0.20%, 50%, and 100% of the recommended phosphorus requirements and found that reducing phosphorus t0 0 and 20% negatively affected N,P,K, iron, copper, manganese and zinc content of leaves. Shayal Alalam et al., [9] also carried out a study the effects of DAP fertilizer with three levels (0, 5 and 10 g. Seedling) on apricot seedlings "Zaginia" cultivar nutritional status , and found that 5 and 10 g Dap per seedlings morally affected the concentration of potassium and zinc in leaves. This study was conducted to test the impact of soil addition of new locally manufactured organic DAP fertilizer on grape saplings, improving their nutritional status, producing grape saplings with good vegetative growth and healthy.

Material And Methods

The present experiment was carried out under Saran lath house in the nursery of Al-Daghara district to the Directorate of Agriculture of Diwaniyah - Iraqi Ministry of Agriculture for the period from 1 January 2021 to 1/12/2021 to investigate the impacts of soil fertilization with O-DAP+ micronutrient fertilizer on nutritional status of Flame Seedless grape sapling. One-year-old saplings is planted in 10 kg plastic pots filled with river soil and one sapling for the pot. 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]. .Grape saplings shoots were pruned at the beginning of February,2021 by removing all shoots, except one branch with 2-3 eyes[11].

Table1: Soil Chemical and Physical characteristics

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

Experiment was arranged in randomized complete block design with three replicates and 4 saplings each treatments for each experimental unit. three levels is 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) was used[12].

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.

Total Chlorophyll and Carbohydrates

The relative content of chlorophyll in the leaves was estimated at 20 leaves per experimental unit from mid-branches, from different regions and from different

directions on 1 July 2021 by the Spade-502 Chlorophyll meter, Minolta Co. Ltd. of Japan Ltd. [13,14].

According to Joslyn[15] carbohydrate in canes was estimate beginning of December 2021 and was measured by the Spectrophotometer at wavelength of 490 nm wavelength.

Leaves minerals content estimation

The leaves were taken with their petioles from different areas of each experimental unit randomly on 1 July 2021 . The samples were thoroughly washed with tap water, rinsed twice with distilled water and oven dried at 70°C till a constant weight and finally ground and digestion according to the method proposed by Cresser and Parsons [16]. for determination of:

Nitrogen: estimated by using microKjeldahl as outlined by Al-Sahaf, [17].

Phosphorus: Estimated according to the method described by Al-Sahaf, [17].

Potassium: estimated by using flame photometer in accordance with the method proposed by Horneck and Hanson, [18].

Calcium: was estimated using Flame Photometer, as in Horneck and Hanson[18].

Magnesium: was estimated according to the method described by Al-Sahaf, [17].

Iron, copper, zinc and manganese were estimated using the Atomic absorption Spectrophotometer [19].

Statistical data analysis

The results were analysed using genstat12th [20] and the means were compared by LSD test at 0.05 probability level.

Results

Total Chlorophyll and Carbohydrates

Results in table (3) showed moral differences in the relative total chlorophyll leaf content in grape sapling when adding O-DAP fertilizer, especially at level 10 g. pot^{-1} which achieved the highest content of 36.1 934 SPAD units, which differed morally from the 5g. pot^{-1} (36,083 SPAD) fertilization treatment, while the control treatment (without fertilization) achieved the lowest relative content of 35,177 SPAD units. Also, The results in table 3 showed that the addition of O-DAP fertilizer to grape sapling had a clear effect on increasing the carbohydrates content of cane, as fertilization at the level 0g.pot^{-1} seedling achieved the highest percentage (13.790%), while the control treatment achieved 11.080%.

Table 3 : Effect of soil application of O-DAP+ microelements on relative total Chlorophyll in leaves(SPAD unit) and carbohydrate(%)in canes of flame seedless grape saplings

O-DAP+ microelements	chlorophyll	Carbohydrate

(g pot^{-1})	(SPAD)	%
0	35.177	11.08
5	36.083	12.34
10	36.934	13.79
LSD$_{(0.05)}$	0.019	0.1348

Leaves macro elements content

The results in table (4) showed a clear effect in increasing the percentage of nitrogen in the leaves when adding O-DAP, as the level 10 g pot^{-1} achieved 1.971% which differed significantly from other levels, while the control (0 g pot^{-1}) achieved 1.152%. Also the same fertilizer level has a significant effect on phosphorus, Potassium, calcium and magnesium in the leaves which achieved 0.7171, 1.209, 0.923 and 0.243% while the control (0 g pot^{-1}) achieved 0.4472 , 0.758, 0.758 and 0.213% .respectively.

Table 4 : Effect of soil application of O-DAP+ microelements on leaves content of Macro elements of flame seedless grape sapling

O-DAP+ microelements (g pot^{-1})	**%**				
	N	**P**	**K**	**Ca**	**Mg**
0	1.152	0.447	0.758	0.853	0.213
5	1.376	0.464	1.048	0.870	0.237
10	1.971	0.717	1.209	0.923	0.243
LSD$_{(0.05)}$	0.1346	0.0205	0.047	0.0038	0.0018

Leaves micro elements content

The results in table (5) showed obviously the significant variances in leaves micro elements content between fertilized saplings with different levels of O-DAP. Herein, It could be noticed that the most increasing effect on leaf - Fe, Cu, Zn and Mn content was detected by level fertilizer 10 g pot^{-1} where the highest increase in leaf - Fe, Cu, Zn and Mn content (134.85, 11.310, 27.187 and 81.867mg.kg^{-1} DW) was resulted, while the lowest leaf content(106.66, 10.557 , 22.583and 74.567 mg.kg^{-1} DW respectively.) was detected by flame seedless sapling without fertilizing(control) **.**

Table 5 : Effect of soil application of O-DAP+ microelements on leaves content of Macro elements of flame seedless grape sapling

O-DAP+ microelements (g pot^{-1})	**Fe**	**Cu**	**Zn**	**Mn**
	mg.kg^{-1} DW			
0	106.66	10.557	22.583	74.567

5	123.43	10.897	24.703	79.967
10	134.85	11.310	27.187	81.867
$LSD_{(0.05)}$	1.285	0.039	0.2106	0.3608

Disscussion

The results in table (3) clearly indicated an increase in the total relative chlorophyll content in grape sapling leaves, which may be due to the role of nutrients ,as nitrogen, magnesium, iron and manganese, contained in O-DAP fertilizer and its important roles in stimulating bio-synthesis of chlorophyll, which leads to an increase in their content in the leaves[21]. The fertilization coefficients of O-DAP in the present experiment achieved the highest leaf content of chlorophyll (3) and nitrogen Phosphorus, potassium, calcium, magnesium, iron, zinc, copper and manganese (tables4 and 5) this in turn reflects on the efficiency of the photosynthesis process and then increase carbohydrate manufactured in the leaves and the high percentage of carbohydrates. Some of which were consumed in vital processes and excess of it moved to the shoots where it is stored to benefit from them in the next growing season [22]. The presence of potassium and humic acid in O-DAP fertilizer activated carbohydrates translocation from the places of manufacture in the leaves to storage places such as shoots, caused increasing carbohydrates percentage in these organs[23]., Rsults are consistent with what Hammoud et al., [24]., Al-Akam et al., [6]. found in Grapes and Hussein [7]. in apricot sapling when fertilized with DAP and Noori et al., [25]., Imam and Al-Obaidi[26]. in grapes when fertilized with phosphate fertilizer or containing high concentrations of phosphorus, the results of these studies showed an increase in the content of leaves of chlorophyll and the percentage of carbohydrates in shoots when fertilized with phosphorus-rich fertilizer.

The concentration of nutrients in leaves is an important measure of plant growth as the accumulation of these nutrients in good proportions indicates its activity and increased ability to absorb these important nutrients to use in the processes of photosynthesis, respiration, cell division and elongation. The concentration of these nutrients within the plant varies with different stages of growth and the amounts of fertilizer added. The importance of micronutrients in plant growth may be due to the fact that they play a key role in plant processes and energy production in the cell as essential components of plant cells and stimulants for the events of many enzymes[21].

Increasing N, P,K nutrients in the leaves in sapling fertilized with O-DAP fertilizer (tables 3) may be due to the absorption of nutrients in fertilizer through roots. Strong vegetative parts and root group obtained by using of fertilizer increased the efficiency of root absorption of other nutrients, so the plant need more and more nutrients for photosynthesis and other events for its growth and development which caused increasing their concentration in the plant [27].

The presence of organic acids, humic and fulvic acid in fertilizer can also be another reason for the superiority of O-DAP as compared to the control treatment in all

measured indicators, including nutrient concentrations in leaves because organic compounds have a chelated effect on the macro and micronutrients if added with them and nutrients becomes more easily absorbed and transported within the plant [28]. as confirmed by some studies such as El-Boray *et al.,* [29]. (2013), Birjely and Al-Atrushy [30].,Aljabary *et al.,* [31]. and Imam and Al-Obaidi [26]. in terms of increasing the leaves nutrients content when adding humic acids to sapling with phosphate fertilizer, as organic acids and humic acids contained in studied fertilizer a role in increasing nutrient avaibility, as well as reducing soil pH and increasing soil CEC and then its absorption from the plant which may have increased the surface area of absorption at its roots, which is important for increasing the permeability of living cellular membranes in the roots for uptake nutrients and this will improved nutrient absorption.These results are similar to that achieved by Muhammad Ali *et al.,* [5]. in olive sapling, Hammoud et al., [24]., Hussein[7. in apricots, Al-Akaam et al., [6]., and Imam and Al-Obaidi [32]. in grape sapling in terms of increasing the content of leaves of micro and micro nutrients when fertilizering with DAP. Also, results are consistent with the findings of Al-Shihadat [33]. Khalifezadeh Koureh *et al.,* [34]. Imam and Al-Obaidi[26]. Dosoky-Hoda *et al.* [35]. when using NPK with some micro elements, which morally influenced the leaves content of nutrient of the grape seedling

References

[1] Brunetto G., Wellington Bastos De Melo G., Toselli M., Quartieri M., Tagliavini M. 2015. The role of mineral nutrition on yields and fruit quality in grapevine, pear and apple. Rev. Bras. Frutic. 37(4): 1089-1104, DOI: 10.1590/0100-2945-103/15

[2] Likar, M., Vogel-Mikuš, K., Potisek, M., Hančević, K., Radić, T., Nečemer, M., & Regvar, M. 2015. Importance of soil and vineyard management in the determination of grapevine mineral composition. *Science of the Total Environment*, *505*, 724-731.

[3] Abu Issa, A.A. H. and Alloush, G. A.. .2006. Soil fertility and plant nutrition. Tishreen University Publications, Tishreen University, Faculty of Agriculture, Lattakia, Syria, 382

[4] Abou-Zied, S. T., & Abd El Latif, A. L. 2016. Phosphorus Fertigation and preplant Conventional Soil Application of Drip Irrigated Grapevines. *Egyptian Journal of Soil Science*, *56*(1), 41-51.

[5] Muhammad Ali, T. J., T. H. K. Al-Salihi and A. H. J. Al-Khikani .2012. The effect of foliar fertilization with humic acid and chemical with diammonium phosphate on the growth of olive seedlings, Shami cultivar. Euphrates Journal of Agricultural Sciences, 3(2): 1-17.

[6] Al-Akaam . E. S., Yaqub,N.A and M.H.Hassan.2016.The effect of Diammonium phosphate (DAP) and spraying solution Grow green in growth of *Vitis vinifera* L. seedlings Cv. Frency. Karbala University Scientific Journal - 14 (3): 119 – 26.

[7] Hussein, M.M.2016.The impact Di Ammonium Phosphate (DAP) in growth of Apricot sapling *Prunus armeniaca* . Euphrates Journal of Agricultural Sciences,8(1):50-53.

[8] Schreiner, R. P., & Osborne, J. 2018. Defining phosphorus requirements for Pinot noir grapevines. *American Journal of Enology and Viticulture*, *69*(4), 351-359.

[9] Shayal Alalam, A.T.M.. N. N. Fadhil and M. A. Dawood .2020. THE ROLE OF BIO, ORGANIC AND CHEMICAL FERTILIZERS IN THE GROWTH OF BUDDED APRICOT SEEDLINGS CV." ZAGHINIA. *The Future of Agriculture*, (2): 8-19.

[10] Page, A. L. ; Miller, R. H. and Keeney, D. R. (1982). Methods of soil and plant analysis Part 2, 2nd ed, Agron. 9. Publisher, Madison, Wisconsin, USA.

[11] ALmamori, H. A.H.(2018). Effect of cow manure and foliar application of i Root promoter on growth of grape transplants "Halawani".MSc thesis. College of Agriculture, Baghdad university, Iraq.

[12] Al-Rawi, K. M. and A. A. M. Khalaf Allah, (2000). Design and analysis of agricultural experiments. Ministry of Higher Education and Scientific Research , University of Mosul.

[13] Castaneda, C. S., Almanza-Merchan, P. J., Pinzon E. H., Cely- Reyes, G. E., & Serano-Cely, P. A. 2018. Chlorophyll concentration estimation using non-destructive methods in grapes (*Vitis vinifera* L.) cv. Riesling Becker. *Revista Colombiana de Ciencias Hortícolas*, *12*(2), 329-337.

[14] Donnelly, A., Yu, R., Rehberg, C., Meyer, G., & Young, E. B. (2020). Leaf chlorophyll estimates of temperate deciduous shrubs during autumn senescence using a SPAD-502 meter and calibration with extracted chlorophyll. *Annals of Forest Science*, *77*(2), 1-12.

[15] Joslyn , M. A. 1970 . Methods in Food Analysis , Physical, Chemical and Instrumental Methods of Analysis 2nd ed. Academic press, New York and London

[16] Cresser , M. S. and Parsons, J. W. (1979) . Sulphuric-perchloric acid of digestion of plant material for determination of nitrogen , phosphorus , potassium , calicium and magnesium . Analytical Chimica Acta , 109: 431-436 .

[17] Al-Sahaf, F..1989.. Applied Plant Nutrition - Ministry of Higher Education and Scientific Research, University of Baghdad.

[18] Horneck, D. A., and Hanson, D. 1998. Determination of Potassium and Sodium by Flame Emission Spectrophotometry. Pp. 153-155. In: Kalra, Y. P., (ed.). Handbook of Reference Methods for Plant Analysis. Soil and Plant Analysis Council, Inc., CRC Press. FL., USA. Pp. 287.