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The Effect of Spraying with the Foliar Nutrient NPK MILLER on the Mineral and Chemical Content of Two Varieties of Young Grape Seedlings Shatur Al-anz and Olivette Noire (*Vitis vinifera* L)

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Abstract

The study was conducted in the grape orchard/Horticulture and Landscape Department, College of Agriculture - Tikrit University. During the growing season (2022) with the aim of knowing the effect of spraying with the foliar nutrient NPK MILLER on the mineral and chemical contents of the leaves of young vines of Shatur Al-anz and Olivette noire varieties. The experiment was carried out with the split plot system according to the factor design of the randomized complete block Design (RCBD), the first factor was spraying with the NPK MILLER foliar nutrient (0, 3, 6) g liter^{-1}, the spraying repeated three times with 15 days between each other. The first treatment was on 15/4/2022, the Second one includes grape varieties (Shatur Al-anz and Olivette noire). The spraying with foliar nutrient achieved a significant effect in most mineral and chemical content characteristics, especially the F_2 (6 g liter^{-1}), treatment, which achieved the highest levels in the content of the leaves of the elements N, P and K and the percentage of carbohydrates and protein in the leaves, and values amounted respectively (2.03, 0.37, 2.18, 7.29, 12.66 %), and the difference of the two varieties under study led to a significant effect in some of the studied traits, as the Olivette noire variety significantly outperformed the Shatur Al-anz in the content of the leaves N and protein, While the Shatur Al-anz variety significantly outperformed the Olivette noire variety in the content of the leaves of Chlorophyll. The study aimed to determine the effect of the best level of NPK MILLER foliar nutrients on the mineral and chemical content of two grape vine varieties.

Keywords: foliar nutrient, grape, Shatur Al-anz, and Olivette noire.

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Introduction

Grapes (*Vitis vinifera* L) belongs to the Vitaceae family, are one of the most famous and popular types of summer fruit, which human relied on it as a food source for thousands years, and for its high nutritional value, flavor and wonderful taste, it is consumed mainly as fresh fruit or raisins or used in the production of juices and wine. Grapes contain many mono saccharides such as glucose, fructose, organic acids and important nutrients such as Potassium, Calcium, Phosphorus, Iron, Magnesium, Vitamins, and various phenolic compounds, and grapes are one of the most important economic crops adapted to drought stress and grown globally[1-3].

The study of varieties is one of the important factors in the cultivation and production of grapes, to determine the suitability of these varieties to environmental conditions, by studying the difference between them in terms of the strength of vegetative growth, mineral and chemical content, fertilization methods and the selection of appropriate fertilizer combinations for each variety, where blueberries and cultivated belong to the family Vitaceae Amelidae, which includes fourteen genotypes, the most important of which is the Vitis genotype, which includes the most important types of grapes cultivated around the world, which is European grapes. *Vitis vinifera* L, and the number of grape varieties cultivated is estimated at more than 700 species and about 10,000 cultivated varieties around the world, these varieties differ morphologically among themselves, and this difference is due to the interaction between the genetic background of each variety and the environmental conditions which it grows in. Therefore, the total genetic and partial biochemical variations are reflected in morphological variations such as the area and thickness of the leaf and the size of the root system, which may lead to a variation in the ability of varieties to absorb nutrients. Where the total of these variations are reflected in the mineral and chemical content, and the varieties vary in their need for nutrients according to the requirements [4-5].

Grape fertilization is a major issue for increasing growth, where the availability and abundance of nutrients plays a major role in the productivity and quality of grapes, nutrients are found naturally in the soil and absorbed by the roots of the plant, but the ready ones are hardly enough to meet the plant's growth requirement, as the interactions that occur in the soil reduce the readiness of these nutrients, as some elements are exposed to stabilization and loss by volatilization and leaching in light soils or sometimes consumed by Microorganisms. Because grape has a deep roots, they may not respond to fertilization through the soil well, so foliar fertilization is resorted to for its importance in processing and supplying the plant with some of its need for nutrients, whether major or micro, which are absorbed by the leaves ,as well as, other parts of the plant such as stems, and the main benefit of foliar feeding is to allow the leaves to absorb the nutrients used quickly and remove the symptoms of deficiency visible on the leaves resulting from the lack of one or more nutrients And note the increase in growth, as it is possible through foliar feeding to meet 85% of the plant's need [6-9].

The importance of NPK elements is indicated for its great role in the physiological growth of grape vines, which they need to sustain the life and grow optimally, and without these elements the plant can't grow to its full potential, and be more susceptible to diseases, and the soil often lacks of NPK nutrients, whether naturally, or due to loss and stabilization processes as a result of medium cultivation or other environmental factors, so these nutrients must be returned to the plant by fertilization, whether through the vegetative system or through In order to create an ideal environment for growth, these nutrients are often found in the form of fast-dissolving compound fertilizers containing the three elements NPK and the proportions of these elements are usually equal, and are suitable for use in all irrigation systems, whether sprinkler, immersion or drip [10-12]. [13] Informed in their study, that the effect of spraying Nano fertilizers and chemicals on some growth and productivity characteristics of the Khalili grape variety, where the foliar fertilizer exceeded 20:20:20 PROSOL NPK in

the nitrogen content of the leaves at a concentration of 20 mg L^{-1}.[14].

Used urea and spraying with organic fertilizer NATURWIN on vines of the Kemali variety, they obtained a significant increase in the mineral content of nitrogen, phosphorus and potassium leaves at a concentration of 10 g $vine^{-1}$ of urea fertilizer compared to untreated vines. [15] Studied the effect of NPK on the growth of Thompson young vines seedless and Olivette noire, spraying with NPK Nano foliar fertilizer at a concentration of 2 g nL^{-1}. The study led to a significant increase in the percentage of protein in the leaves and the concentration of nitrogen, Phosphorus and Potassium in the leaf petioles. In a study on the effect of fertilization with NPK Nano fertilizer and traditional NPK fertilizer on the growth and study showed that, yield qualities of the perfectionist and sectarian grape varieties [16]. The results of the statistical analysis showed that the Al-Kamaly variety significantly outperformed the Al-Taafi variety in the leaves chlorophyll content and the percentage of carbohydrates in the annual branches and the content of Phosphorus and Potassium in the leaf petioles.

Materials and methods

The experiment was carried out in the grape orchard/Horticulture and Landscape Department, Collage of Agriculture, Tikrit University . The study aimed to identify the effect of spraying foliar nutrient 20:20:20 NPK MILLIR, on leaves mineral and chemical content for young vines (two years old) of the Shatur Al-anz and Olivette noire varieties. The experiment included two factors, the first foliar nutrient at three levels (0, 3, 6) g $liter^{-1}$, where distill water was used as a control treatment. The spraying was repeated three times with 15 days between the treatments, the first spray was on 15/4/2022. The second include two varieties, with three replicates. The experimental unit includes three vines, planted on lines with a distance of (2×3) m, the orchard management was conducted throughout the research period, winter pruning was carried out by uniting all the vines on three eyes, the foliar nutrient NPK was sprayed after full expansion of the leaves and three levels, the application done in early morning until the full wetness of leaves upper and lower surfaces. Soil samples were taken from different sites at depth of 0-40 cm, for physical and chemical analyzes Table (2).

Study factors:-

The first factor: spraying foliar nutrient at three levels as a: (F):-

1. 0 g $liter^{-1}$ (F_0) (control treatment).
2. 3 g $liter^{-1}$ (F_1)
3. 6 g $liter^{-1}$ (F_2)

The second factor: variety included two varieties as a: (V) :-

1. Shatur Al-anz (V1).
2. Olivette noire (V2).

Table (1) Foliar nutrient contents NPK MILLIR 20:20:20 as mentioned by the manufacturer (Miller Chemical & Fertilizer, LCC) USA

No.	Material	Concentration
1	Total nitrogen (N):	20%
	Nitrogen in the form of ammonium	5.4%
	Nitrogen in the form of nitrate	5.5%
	Urea	9.1%
2	Diluted Phosphor P_2O_5 in water	20%
3	Potassium K_2O	50%

Table (2) Soil physical and chemical characteristics for growing season 2022

Characteristic	Unit	Value
Textur	……	silt loam
Sand	%	25.8%
Clay	%	26.0%
Silt	%	48.2%
Organic matter	%	1.10
Calcium Carbonate (Lime)	%	29.7
Available Nitrogen	mg kg^{-1}	49
Available Phosphor	mg kg^{-1}	6.8
Available Potassium	mg kg^{-1}	123
Soil sample PH	……	7.45
EC	des m^{-1}	4.20
Cation-exchange capacity (CEC)	cmol/kg	11.6

Studied traits:

Eight leaves from each vine were taken from the center of the branches in June, and after washing the leaves from the dust stuck to them with distilled water and drying them airily, the wet digestion process was performed using the method [17] and the mineral content of the leaves was estimated:

1- Nitrogen content of leaves %:
The percentage of total Nitrogen in leaves was estimated by the Kjeldahl method using a Micro Kjeldahl device as mentioned [18].
2- Phosphorous content of leaves %:
The phosphorus content was determined using Ammonium Molybdate and measured with a Spectrophotometer at a wavelength of 882 nm according to [19].
3- Potassium content of leaves %:
The percentage of Potassium in digested leaf samples was estimated using a Flame Photometer using the method [20].
4- Leaves total chlorophyll content (mg. g^{-1} soft weight):The total chlorophyll content of the leaves was estimated on June 20, at the rate of 12 sheets per experimental unit, and after washing the leaves from the dust stuck in them with distilled water and drying them by air, the samples were digested according to the method [17] and were read by the Nabi- microdigital Spectrophotometer and at a wavelength of 665-645 nm.
5- Leaves Carbohydrate content %:
Estimate the total Carbohydrate content of leaves at the beginning of November for the growing season 2022 as mentioned in [21].
6- Leaf Protein content (%):
The percentage of Protein was estimated according to the following formula: protein percentage = percentage of Nitrogen × 6.25 according to [22].

Results and discussion

1. Leaves Nitrogen content %:

Table (3) shows that, the varieties showed a significant effect on the percentage of Nitrogen element in the leaves, as the Olivette noire variety significantly outperformed the value of 2% on the Shatur Al-anz variety, which amounted to 1.86%, and it is clear from the same table that the foliar fertilizer has significantly affected the studied characteristic, as the spraying treatment for the third level morally with a value of 2.03% outperformed the comparison treatment and amounted to 1.81%. It did not differ morally with the third level, as well as the bilateral overlap between the variety and foliar fertilizer achieved a significant effect, as the third level of foliar fertilizer achieved the highest significant difference for the Olivette noire variety with a value of 2.07%, outperforming the comparison treatment for the category of the Shatur Al-anz variety, which amounted to 1.68%, while there was no significant difference between it and the rest of the interventions.

2. Leaf Phosphorus content %:

The data in Table (3) show that the varieties did not show any significant differences in this characteristic, as we note from the same

table that foliar fertilizer has significantly affected the studied trait, the third level has significantly outperformed the second level and the comparison treatment, as its value reached 0.37%, while the second level also significantly outperformed the value of 0.34% on the comparison treatment, which achieved 0.31%. The bilateral overlap between the variety and foliar fertilizer also achieved significant superiority, as the two overlaps in the third level of the two varieties, the Shatur Al-anz and Olivette noire, achieved significant superiority over all overlaps, as they gave a value of 0.37%.

3. Leaves Potassium content%:

It is clear from the data of Table (3) that there were no significant differences in the effect of varieties on the Percentage of Potassium, and it is clear from the data of the same table of foliar fertilizer has significantly affected the studied characteristic, as the spraying treatment for the third level significantly exceeded the value of 2.18% on the comparison treatment of 1.86%, while the second level did not differ significantly with the third level. We also note from the bilateral overlap between the variety and foliar fertilizer that the overlap between the category of the Shatur Al-anz variety and the third level has significantly outperformed some of the overlaps, as its value reached 2.22%.

Table (3) Effect of Foliar Nutrient Spraying on leaves Nitrogen, Phosphorus and Potassium content

F	N%			P%			K%		
	Varieties		foliar nutrient effect	Varieties		foliar nutrient effect	Varieties		foliar nutrient effect
	V1	V2		V1	V2		V1	V2	
F_0 0 ml	1.68 b	1.94 a	1.81 b	0.32 c	0.30 d	0.31 c	1.85 c	1.87 c	1.86 b
F_1 3 ml	1.91 a	1.99 a	1.95 a	0.34 b	0.34 b	0.34 b	2.13 ab	2.08 b	2.11 a
F_2 6 ml	1.99 a	2.07 a	2.03 a	0.37 a	0.37 a	0.37 a	2.22 a	2.14 ab	2.18 a
Effects of variety	1.86 b	2.00 a		0.35 a	0.33 a		2.07 a	2.03 a	

4. Leaves total Chlorophyll content (mg. g-1 soft weight)

The data of Table (4) noticed that the varieties showed significant superiority in the trait under study, as the variety of the Shatur Al-anz variety significantly outperformed with a value of 2.30 mg g-1 soft weight over the Olivette noire variety, which gave a value of 1.97, mg g-1 soft weight, and the table data indicates that foliar fertilizer achieved an increase in the content of leaves of Chlorophyll, but did not reach the moral limit. The data of the same table indicates that the bilateral overlap between the variety and the foliar fertilizer has achieved significant superiority, as we find that the overlap between the Shatur Al-anz variety and the third level of foliar fertilizer significantly exceeded most of the interventions with a value of 2.34 mg g1 - soft weight and did not achieve any significant difference with the interference of the second level and the comparative treatment of the Shatur Al-anz variety.

5. Leaves Carbohydrate content %:

The data of Table (4) indicate that, the varieties did not show any significant effect on the percentage of carbohydrates in the leaves, and the same data show that foliar fertilizer has significantly affected the studied characteristic, as the third level and the second level have significantly excelled with a value of 7.29% and 7.08%, respectively, while the comparison treatment gave the lowest percentage, reaching 6.26%, and we also note from the bilateral overlap between the variety and foliar manure that the overlap between the category of the Shatur Al-anz and the third level has given a value of 7.30%, and thus He would have significantly outperformed the comparative treatment of the Shatur Al-anz split and Olivette noire

variety and did not show any significant superiority over the rest of the interventions.

6. Leaf Protein content %:

The data in Table (4) indicates that the varieties have significantly affected the percentage of protein in the leaves, as the Olivette noire variety significantly outperformed by 12.52% over the Shatur Al-anz variety, which amounted to 11.61%, Table (5) The effect of foliar nutrient spraying on the content of leaves of Chlorophyll, Carbohydrates and Protein The data of the same table shows that spraying with foliar manure has a clear moral effect on the studied characteristic, as it surpassed the third and second levels, where they achieved a significant superiority of 12.69% for the third level and 12.18% for the level The second thus outperformed the comparative treatment of 11.32%.

Table (4) Effect of Foliar Nutrient Spraying on Leaf Chlorophyll, Carbohydrates and Protein Content

F	Chlorophyll mg gm^{-1} soft weight			Carbohydrates %			Protein %		
	Varieties		foliar nutrient effect	Varieties		foliar nutrient effect	Varieties		foliar nutrient effect
	V1	V2		V1	V2		V1	V2	
F_0 0 ml	2.26 ab	1.84 d	2.05 a	6.42 b	6.11 b	6.26 b	10.51 b	12.13 a	11.32 b
F_1 3 ml	2.31 ab	2.10 bc	2.21 a	7.00 a	7.15 a	7.08 a	11.93 a	12.43 a	12.18 a
F_2 6 ml	2.34 a	1.97 cd	2.16 a	7.30 a	7.28 a	7.29 a	12.34 a	12.98 a	12.66 a
Effect of variety	2.30 a	1.97 b		6.9 a	6.85 a		11.61 b	12.51 a	

As well as the effect of the interaction between the variety and foliar fertilizer, the third level of foliar fertilizer for the Olivette noire variety recorded the highest significant difference, as its value reached 12.98%, outperforming the comparative treatment for the Shatur Al-anz variety and did not differ significantly with other interactions.

It is clear from the results of the two tables (3,4) a significant increase in the mineral and chemical content of the leaves of the grape varieties Al-Anz and Olivette Noire , it may explain the positive role of foliar fertilizer NPK by increasing the concentration of Nutrients Nitrogen, Phosphorus and Potassium by repeating the number of sprays of foliar manure, or it may be attributed to an increase in the amount of processed Carbohydrates Table (4), where part of it is used to provide the energy necessary for the growth and spread of roots and this may lead to increased absorption of Nutrients and their concentration in the leaves, or perhaps the reason is due to the role of Nitrogen in increasing the size of the root system as a result of its effective role in the formation of some Phythormones such as IAA, which increase cell division and meristem activity, and this also leads to an increase in nutrient absorption and concentration in the leaves [24,23].

The increase in the proportion of Carbohydrates may also be attributed to the increase in Nutrients Table (3) and their role in various metabolic processes, as Nitrogen and Phosphorus enter the construction of most cell membranes, especially chloroplasts, which increases the efficiency of photosynthesis, which in turn leads to an increase in the rate of production of Carbon skeleton materials, in shade the role of Potassium in increasing Carbohydrates [26,25], Or perhaps the reason is due to the role of the important element Phosphorus in plant growth, which contributes to the formation of energy-rich compounds that the plant needs in the manufacture of Carbohydrates such as Enzymatic conjugates and Phosphorous lipids [27].

The increase in the content of leaves of protein, as shown in Table (4), may also be due to the increase in the concentration of foliar fertilizer NPK with an increase in the number of sprays, which leads to an increase in the effect of these Nutrients in Protein synthesis, especially the role played by the element Nitrogen in building Protein through the representation of inorganic Nitrogenous

compounds, where nitrates, which are one of the forms of Nitrogen absorbed by the plant inside its tissues, are reduced to Ammonia NH3. Ammonia, in turn, combines with dissolved Carbohydrates to form Amino acids which are linked to each other by amino bonds to form Proteins that are the most important components of a living cell, and Phosphorus participates in the synthesis of nuclear proteins, as well as the role of indirect Potassium in the construction of basic organic compounds, including proteins [28,27].

The variation in the mineral content of the leaves of the major Nutrients Nitrogen and Potassium of the two varieties under study and the Protein content of the leaves may be attributed to genetic differences, especially the variation of the genetic structures of each variety and the extent of their interaction with environmental conditions and different fertilizer additives, which may lead to an increase in the absorption of mineral elements to meet the requirements of growth further, or the reason for the difference in the mineral content of the leaves of the two varieties studied is due to the different need for microelements according to the variety and the requirements of its vegetative growth [30,29].

The reason for the increase in the content of the leaves of Chlorophyll may also be attributed to the increase in the concentration of Nitrogen, Phosphorus and Potassium elements in the leaves, especially the element Nitrogen, 70% of which enters the formation of Chlorophyll through its direct participation in the formation of porphyrins groups involved in the formation of Chlorophyll and Cytochrome pigment, which depends on it in the process of photosynthesis, as well as the prominent role of Phosphorus and Potassium in the metabolism of Carbohydrates resulting from the photosynthesis process and their role in the formation of Amino Acids and Proteins and the activation of Enzymes that help build chloroplasts [31,27].

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تأثير الرش بالمغذي الورقي NPK MILLER في المحتوى المعدني والكيميائي لصنفين من شتلات العنب الفتية Shatur Al-anz و Olivette noire (*Vitis Vinifera* L)

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- البحث مستل من رسالة ماجستير للباحث الاول

الملخص

أُجريت الدراسة في بستان العنب التابع لقسم البستنة وهندسة الحدائق كلية الزراعة – جامعة تكريت، خلال موسم النمو (2022) بهدف معرفة تأثير الرش بالمغذي الورقي NPK MILLER في المحتوى المعدني والكيميائي لأوراق كرمات العنب الفتية لصنفي شطر العنز والزيتوني، نفذت التجربة بنظام القطع المنشقة Split plot وفقاً لتصميم القطاعات العشوائية الكاملة للتجارب العاملية RCBD، كان العامل الأول الرش بالمغذي الورقي NPK MILLER وبثلاث مستويات (0، 3، 6) غم لتر$^{-1}$، كُرر الرش ثلاث مرات وبفاصل 15 يوم بين رشةٍ وأُخرى، كانت المعاملة الأولى في 15/4/2022، وكان العامل الثاني استخدام صنفين من العنب للمقارنة فيما بينهما وهما شطر العنز والزيتوني، حقق الرش بالمغذي الورقي تأثيراً معنوياً في معظم صفات المحتوى المعدني والكيميائي، لاسيما المعاملة F2 (6 غم لتر$^{-1}$) والتي حققت أعلى مستوياتها في محتوى الأوراق من عناصر N و P و K و نسبة الكربوهيدرات والبروتين في الأوراق، وبقيم بلغت على التوالي (2.03 ، 0.37 ، 2.18 ، 7.29 ، 12.66 %)، كما أدى اختلاف الصنفين تحت الدراسة الى حدوث تفوق معنوي في بعض الصفات المدروسة، إذ تفوق الصنف الزيتوني معنوياً على الصنف شطر العنز في محتوى الأوراق من عنصر N والبروتين، فيما تفوق الصنف شطر العنز معنوياً على الصنف الزيتوني في محتوى الأوراق من الكلوروفيل. كان هدف الدراسة لمعرفة تأثير المستوى الأفضل من المغذي الورقي NPK MILLER في المحتوى المعدني والكيميائي لصنفين من كرمات العنب الفتية.

الكلمات المفتاحية: المغذي الورقي، العنب، شطر العنز، الزيتوني.