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Article

Effect Of Summer Pruning, Fertilization And Growth Stimulator On The Quality Of Kamali Grapes And The Mineral Content Of Its Leaves

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Abstract
The research was carried out in one of the grape orchards belonging to Dujail District / Salah Al-Din Governorate for the agricultural season 2021 to study the effect of the fertilization program, some summer pruning and foliar spraying with a growth stimulator (commercial organic compound named Stimoleaf) in the quality of grapes of the Kamali variety and the content of its leaves from some mineral elements, the study factors were applied to vines of 10 years old, according to the design of the Nested-Factorial Experiment. The experiment included three factors: summer pruning with two levels, without pruning (P0) and Pruning (P1), fertilizing with recommended fertilizer (F0) and a suggested fertilization program according to the physiological stages of the vines (F1) and foliar spraying with a growth stimulator at concentrations of 0, 2 ml. L-1, 4 ml.L-1 and symbolized by S0, S1, and S2 in sequence. The results showed the significant effect of summer pruning and fertilization according to the proposed fertilization program in improving the quality of fruits and the degree of coloration, as it led to an increase in the percentage of total soluble solids, the percentage of total sugars, the percentage of sugars to acidity, and it reduced the percentage of acidity in Grape grains and an increase in the content of the fruit peel of anthocyanin and total phenols, as well as an increase in the content of the leaves from elements (nitrogen, phosphorous, potassium, calcium and boron) and an increase in the content of the trunk of carbohydrates. The treatment S2 also outperformed the above indicators, and the binary interactions (F1P1, F1S2, P1S2) and the triple F1P1S2 gave the highest rates relative to the comparison treatments, except for the triple interaction F1P0S2 which gave the highest potassium content of leaves and the triple interaction F1P1S1 which gave the highest carbohydrate content of the trunk.

Keywords: Fertilization program, anthocyanin, total phenols, Nitrogen, Phosphorous, Potassium, Calcium and Boron

Introduction

Grapes Vitis vinifera L. belongs to the Vitaceae family, which includes 14 general; the genus Vitis is the most important and is widely cultivated in the world [1]. According to the Central Agency for Agricultural Statistics statistics, the production of grapes was estimated at 421,868 tons for the summer season and increased by 0.33% over the previous season[2]. The Kamali variety is one of the late table grape varieties in Iraq and is desirable by the consumer; its clusters are almost conical in

shape, large in size, and large, elongated oval berries with a pink to purple color at full maturity. The degree of maturity of grapes depends on the various nutritional status and climatic factors as well as the service processes that affect the final chemical content of the berries. Chemical and organic fertilizers improve the nutritional status of plant growth, increase production, and improve crop quality. Using chemical fertilizers leads to an increase in production of about 50%. Fertilizers contain the necessary mineral elements, which are essential in a plant's life, especially in physiological stages such as vegetative growth, flowering, and fruit set, through a correlation between the proportion of balanced elements absorption and the rates of plant growth and development [3] as nutrition factors have a direct effect on flavor compounds and enhance the quality of fruits, while pruning is one of the essential agricultural processes on which the success of grape cultivation and production depends. Pruning achieves a balance between vegetative growth and fruiting. It opens the shrub's center to help penetrate light and air, increasing water and nutrient absorption, forming strong branches and good clusters with an organized shape [4,5]. With the increasing demand for organic agricultural products, the global trend has recently begun to use natural sources in fertilization, such as biostimulants of an organic source, which is characterized by its richness of nutrients and beneficial organic compounds to stimulate the growth and development of plants, so, an organic biostimulant is defined as a mixture of residual materials from plants or animals organisms and microorganisms that resulted during the process of their decomposition, partially or entirely, for a long period [6]. The foliar application of stimulants or irrigation water had a positive effect on the growth of many vegetables and fruit crops, including grapes [7] Grape berries are one of the richest sources of phenolic compounds, which are one of the most important secondary metabolic compounds, characterized by their beneficial effects on human health, especially resistance to diseases related to oxidative stress, including cancer and heart and neurodegenerative diseases. Phenolics include flavonoids and non-flavonoid compounds, and flavonoids include anthocyanins and flavonols. The importance of these compounds is that they resist the harmful effect of ultraviolet rays and pathological injuries in grapes and have antioxidant functions [8,9] Grape skin is the primary source of phenolic compounds that change depending on the degree of maturity, soil element content, climatic conditions, and geographic area as well as service operations [10,11], the cultivar controls the color degree. Variety controls the color degree and berry quality in the red grape varieties; this color is due to the accumulation of anthocyanin pigment in the berry peel [12]. Grape producers in Iraq suffer from a decrease in the amount of yield relative to the countries of the world, as well as a decrease in the coloration of the berries, and this may be due to the impact of service operations, including pruning and fertilization, as well as the impact of the climate, so to treat some of these problems experienced by grape producers in the central region of Iraq, especially the Kamali grape, research has been developed to intensify the horticultural pruning and fertilization service operations, as follows:

- Proposing a fertilization program using organic and chemical fertilizers according to the physiological growth stages of the vine.
- Summer pruning of suckers and removing basal leaves.
- Spraying the high carbon biostimulant on Kamali grape leaves.

Materials and Methods

The experiment was carried out in one of the grape orchards of Dujail District / Salah al-Din Governorate, which is located 60 km north of Baghdad, in the Spring and Autumn of 2021 to study the effect of the fertilization program, some summer pruning, and foliar spraying with an organic compound (Stimoleaf), In the Kamali grape berries quality, their content of phenols and anthocyanins as well as leaves

content of mineral elements, study factors were applied to vines of 10 years age on wired arbors, 72 identical and homogeneous vines were selected as much as possible with a height of 2.15m from the soil surface, distributed alternately on the irrigation Canal, with a distance of 2 m between vines, and 3 m between canals. Winter pruning was carried out in mid-January by leaving 5 fruiting canes with eight eyes for each cane, five renewals spurs with two eyes for each one, with controlling pests to serve the vines. A factorial nested experiment is designed as follows:

First factor: Vines fertilization

1. Recommended fertilizer, symbolized as F1: The fertilization used by grape growers in the region was applied to the vines. It included using a balanced fertilizer (NPK) (15-15-15), added twice, the first when the buds began to open and the second three weeks after the contract.
2. Fertilizing with a suggested fertilization program, symbolized as (F2): The fertilization includes organic and chemical fertilizers containing macro and microelements in different quantities and concentrations, according to the requirements of the physiological stage that the vine is going through; the fertilization process was done by soil and foliar application, as shown in Table 1.

	Growth stage	Type and quantity of fertilizer and method of addition			
		Ground Fertilization	Quantity g. Tree^{-1}	Foliar spray	Quantity
1	Vegetative growth stage	NPK Fer. 20.20.20	250	MgO	2 ml L^{-1}
				Micro element	1 g. L^{-1}
2	Flowering stage	High K, Fer. 18.9.36 + Micro E.	200	Ca and B	1 ml L-1
3	Fruit set	High K, Fer. 18.9.36 + Micro E.	200	Ca and B	1ml L^{-1}
				MgO	2 ml L^{-1}
4	Fruit ripening and discoloration	High K, Fer. 18.9.36 + Micro E.	200	Calcium and Boron	1 ml L^{-1}
5	post-harvest stage	High P, Fer. 12.44.12 + Micro E.	250	MgO	2 ml L^{-1}
6	Before fertilization	Humic acid	2	_____	_____

Table 1: The fertilization program used in the experiment.

Humic acid was applied by hand watering before each time of fertilization, according to the program at a concentration of 0.2 g.L-1, 10 liters per tree. By digging around the trunk 30 cm away and 20 cm deep, Humic acid was added to the hole in conjunction with the watering of the orchard after a day of watering.

The second factor: summer pruning:

- Without a pruning symbolized as (P0).
- Pruning vines with some types of summer pruning symbolized as (P1): It was carried out in three stages, the 1st of May (1/5) included suckers removal, the second at 1stof June (1/6) included removal of water sprout, (which grow from buds on more than one-year-old canes) and full-grown basal, old age leaves, half number of leaves.

The third factor: foliar spraying with an organic biostimulant (Stimoleaf, which is a liquid commercial organic fertilizer containing 24.65% organic carbon, 2.7 organic nitrogen as well as glycerin and some free amino acids) in three concentrations as follows:

- Control (spraying with distilled water only) is symbolized as (S0).

- Spraying with 2ml. L^{-1} (the manufacturer's recommendation) is symbolized as (S1).
- spraying with 4 ml. L^{-1}, symbolized as (S2)

The vines were treated with a biostimulant spray after the fruit set was completed in mid-May, and the spraying was repeated four times, with a difference of three weeks between the sprays.

Studied traits:

- Leaves content of mineral elements (N, P, K, Ca, B).
- Fruit characteristics in July 2020:
- The percentage of total dissolved solids (Tss %).
- Berries total sugar percentage (TS).
- Berries acidity percentage (TA).
- Sugars: acidity (TS: A).
- Anthocyanins, (Anth).
- Total phenols, (TPh),
- In January 2021:Cane content of Carbohydrate, Nitrogen, and C: N ratio.

Results

Total Soluble Solids (TSS %)

Results of Table 2 clarified that the fertilization program had a significant effect on the Tss%, as the treatment F1 outperformed the highest rate of 16.26% compared with F0, which amounted to 15.36%, the results show that P1 (pruning) was superior by giving the highest Tss 16.59%, While P0 (without pruning), amounted to 15.03%. Treatment S1 Recorded the highest value (2 ml. L-1), which amounted to 15.89%, compared to (S0), which amounted to 15.55%. The results also confirm the existence of significant differences between the bilateral interactions, where the bilateral interaction of the F1P1 was superior with a value of 16.85% of the rest of the treatments, where the F1S2 was significantly superior by giving the highest percentage of 16.49% compared to F0S0, which amounted to 15.20%, P1S2 was significantly superior with a value of 16.67%. Results showed that F1P1S2 was superior by giving it the highest percentage. It reached 16.92% compared to the comparison treatment F0P0S0, which amounted to 14.22%.

Total acidity (T.A.%)

Table 2 shows that the study factors significantly affected grape berry acidity, as F1 outperformed with the lowest percentage of TA, 1.00%, compared to F0, which amounted to 1.08%. Summer pruning led to significant differences, as P1 outperformed by giving the lowest TA, 0.95%, compared to P0, which amounted to 1.13%. Spraying with Stimoleaf bio stimulator, the results indicated the superiority of S2 (4 ml. L-1) By giving it the lowest TA valued at 1.00% compared to the non-spraying treatment S0, which was 1.07%. The low acidity was found in grape berries of vines treated with F1P1 of 0.92%, while the treatment F0P0 recorded the highest rate of total acidity reaching 1.19%. The results indicate the superiority of the F1S2 treatment by giving the lowest TA of 0.92% compared to F0S0, which amounted to 1.09%. The triple interactions resulted in a significant difference between the treatments, as F1P1S2 outperformed by giving the lowest TA of 0.86% compared with F0P0S0, which amounted to 1.20%.

Total sugars (T. S%)

Results in Table 2 showed a significant increase in the berry's total sugars (9.58%) with The fertilization program (F1), while the lowest sugars in F0 amounted to 9.21%. The results showed that the summer pruning operations led to significant differences, as Treatment P1 excelled by giving the highest TS, 9.87%,

while the TS in Treatment P0 amounted to 8.93%, S2 was superior in TS amounting to 9.57%compared to the non-spray-treatment (S0), which amounted to 9.23%. The two-interference treatment F1P1 showed the highest concentration of sugars, which reached 9.99%, F1S2 treatment was superior by giving the highest TS of 9.84%, and P1S2 had the highest value of TS, which was 9.89%. The results showed significant differences in TS between the treatments, as the triple interaction F1P1S2 excelled by giving the highest TS, reaching 10.04% compared to F0P0S0, which amounted to 8.35%.

The ratio of S: A in berries:

It is clear from the results in Table 2 that the study factors had a significant effect on the ratio of sugars to acidity in the berries, as F1 was superior by giving the highest ratio of 9.8. In contrast, F0 had the lowest amount of 8.6, P1 outperformed by giving the highest ratio of 10.4 than the P0, which amounted to 8.0, and S2 recorded the highest rate, which was 9.1, compared to S0, which amounted to 8.7. The results confirmed the existence of significant differences between the bilateral interactions, where it was noted that the F1P1 had the highest rate of 10.9. In contrast, F0P0 had the lowest (7.3), treatment F1S2 was superior by giving the highest rate of 10.8 over the treatment F0 S0, which amounted to 8.4, P1S2 also was superior by providing the highest rate of 10.8 Regarding the P0S0, which amounted to 7.3. The results showed that the triple interactions showed significant differences between the treatments, as F1P1S2 outperformed with a higher ratio of 11.7 than the comparison F0P0S0, which amounted to 7.0.

The anthocyanin in berry skin (mg. 100 gm-1):

Table 2 results indicated that the fertilization program, summer pruning, biostimulant, and their interactions had a significant effect on the anthocyanin pigment content of the berries, as it was noted that F1, P1, and S2 achieved the highest content of anthocyanin amounted to 79.22, 85.97, and 76.54 mg. 100 g-1 respectively, when compared with F0, P0, and S0 which had the lowest values were 64.53, 57.78, and 67.75 mg. 100 g-1 respectively. F1P1, F1S2, and P1S2 were significantly superior by giving the highest anthocyanin 96.67, 87.33, and 89.92 mg.100 gm-1, respectively. F1P1S2, as the triple interaction treatment, was superior by giving the highest anthocyanin, which amounted to 105.33 mg.100 gm-1, than the F0P0 S0, which amounted to 49.33 mg. 100 gm-1.

Total phenols in berry skin (mg. 100 gm^{-1})

The results in Table 2 clear that F1, P1, and S2 outperformed by giving the highest content of phenols amounting to 600.95, 610.84, and 600.66 mg, respectively, compared with F0, P0, and S0, which were 580.58, 570.69, and 582.98 mg respectively. The results also confirmed that F1P1, F1S2, and P1S2 significantly increased the total phenol content of the berries by 615.77, 608.10, and 614.18 mg. 100 gm-1. F1P1S2 treatment excelled by giving the highest content of phenols, which amounted to 618.30 mg.100 gm-1 compared with the. F0P0S0, which amounted to t540.83 mg.100 gm-1.

Treatment		TSS %	T.A.%	TS %	TS: TA	Anth (mg.100gm^{-1})	Tph mg.100 gm^{-1}
F	F0	15.36	1.18	9.21	8.64	64.53	580.58
	F1	16.26	1.00	9.58	9.75	79.22	600.95
LSD		0.023	0.003	0.019	0,049	0.78	1.54
P	P0	15.03	1.13	8.93	7.96	57.78	570.69
	P1	16.59	0.95	9.87	10.43	85.97	610.84
LSD		0.026	0.010	0.044	0.065	0.59	1.48

S	S0	15.55	1.07	9.23	8,75	67.75	582.98
	S1	15.89	1.05	0.39	9.09	71.33	588.66
	S2	15.98	1.00	9.57	9.77	76.54	600.66
LSD		0.035	0.007	0.043	0.069	0.86	1.16
P × F	F0P0	14.40	1.19	8.68	7.31	53.78	555.26
	F0P1	16.33	0.98	9.75	9.7	75.28	605.91
	F1P0	15.66	1.07	9.17	8.61	61.78	586.13
	F1P1	16.85	0.92	9.99	10.89	96.67	615.77
LSD		0.029	0.003	0.043	0.069	0.82	1.77
S × F	F0S0	15.20	1.09	9.03	8.43	62.50	570.72
	F0S1	15.41	1.08	9.31	8.74	65.33	577.82
	F0S2	15.47	1.08	9.30	8.77	65.75	593.22
	F1S0	15.91	1.06	9.43	9.07	73.00	595.25
	F1S1	16.38	1.02	9.47	9.42	77.33	599.50
	F1S2	16.49	0.92	9.84	10.77	87.33	608.10
LSD		0.043	0.008	0.051	0.086	1.14	1.80
S × P	P0S0	14.62	1.18	8.63	7.33	53.67	559.52
	P0S1	15.18	1.13	8.90	7.87	56.50	565.43
	P0S2	15.30	1.08	9.25	8.69	63.17	587.13
	P1S0	16.49	0.97	9.83	10.17	81.83	606.45
	P1S1	16.61	0.96	9.88	10.29	86.17	611.88
	P1S2	16.67	0.92	9.89	10.77	89.92	614.18
LSD		0.044	0.011	0.059	0.092	1.08	1.76
S × P × F	F0P0S0	14.22	1.20	8.35	6.96	49.33	540.83
	F0P0S1	14.44	1.18	8.82	7.45	55.00	548.57
	F0P0S2	14.53	1.18	8.86	7.53	57.00	576.37
	F0P1S0	16.18	0.98	9.71	9.90	75.67	600.60
	F0P1S1	16.38	0.98	9.79	10.02	75.67	607.07
	F0P1S2	16.42	0.97	9.74	10.00	74.50	610.07
	F1P0S0	15.02	1.16	8.91	7.70	58.00	578.20
	F1P0S1	15.91	1.08	9.97	8.28	58.00	582.30
	F1P0S2	16.06	0.98	9.64	9.86	69.33	597.90
	F1P1S0	16.79	0.95	9.95	10.43	88.00	612.70
	F1P1S1	16.84	0.95	9.97	10.57	96.67	616.70
	F1P1S2	16.92	0.86	10.04	11.67	105.33	618.30
LSD		0.061	0.004	0.077	0.126	1.56	2.45

Table 2: Effect of fertilization, summer pruning, and growth stimulator on the qualitative characteristics of the Kamali grape berry.

Leaf content of N, P, K, Ca and B minerals:

Table 3 shows that the fertilization program, summer pruning, biostimulant, and their interactions significantly affected the NPK content of the leaves. Nitrogen: F1, P1, and S1 achieved the highest N content at 2.23, 2.07, and 2.06%, compared with F0, P0, and S0, which had the lowest N at 1.72, 1.89, and 1.86% respectively. Binary interaction F1P1, F1S2, and P1S2 were significantly superior by giving the highest N, which was 2.32, 2.31, and 2.14%, respectively; the results of the table showed that F1P1S2 outperformed by giving the highest N 2.44% while F0P0S0, amounted the lowest N was 1.44%.

Phosphorous:

The leaf content of P increased significantly with F1, P1, and S2 (0.329, 0.379, and 0.297%) when compared with F0, P0 and So that they had the lowest content of P were 0.241, 0.190, and 0.273%. The results also confirmed the existence of significant differences between the bilateral interactions, as F1P1, F1S2, and P1S2 were 0.420, 0.344, and 0.385%, respectively. F1P1S2 outperformed by giving the highest P of 0.424%, while F0P0S0, the lowest, amounted to 0.140%.

Potassium:

The results in Table 3 showed a significant effect on the K content of leaves, as F1, P1, and S2 outperformed by giving it the highest content of 2.19, 1.71, and 1.79% compared with F0, P0, and S0, which were 1.16, 1.64, and 1.59%, respectively. F1P0, F1S2, and P1S2 were significantly superior by giving the highest content of K (2.19, 2.25, and 1.79%), whereas the lowest were in F0P0, F0S0, and P0S0 (1.09, 1.02, and 1.54%) respectively. The triple interaction F1P0S2 outperformed by giving the highest content of K 2.29%, whereas F0P0S0 had the lowest amount to 0.95%.

Calcium:

The results of Table 3 indicated that the fertilization, pruning, and spraying with Stimoleaf bio stimulator had a significant effect on the leaves' content of calcium, as F1, P1, and S2 outperformed by giving the highest calcium content (2.28, 2.27, and 2.25%), compared with F0, P0, and S0 which had the lowest values were 1.85, 1.86, and 1.91%, respectively. The binary interaction F1P1, F1S2, and P1S2 results indicated the highest content of Ca, which were (2.45, 2.54, and 2.51%); the results of triple interactions showed that there were significant differences between the treatments, as F1P1S2 outperformed by giving the highest content 2.84% compared with F0P0S0, which amounted to 1.58%.

Boron:

The leaf content of boron increased significantly with F, P, and spraying with Stimoleaf bio stimulator (table 3). F1, P1 and S2 achieved the highest boron content (54.5, 41.0, and 38.2 mg.Kg-1 respectively. Results cleared that F1P1, F1S2, and P1S2 were significantly superior by giving the highest leaf content of boron were 61.1, 55.8, and 42.1 mg.kg-1 respectively, F1P1S2 as triple interactions gave a higher content of B which was 62.7 mg.kg-1 than the F0P0S0, which amounted to 18.9 mg.Kg-1.

Tret		N%	P%	K%	Ca%	B mg.Kg-1
F	F0	1.72	0.241	1.16	1.85	20.0
	F1	2.23	0.329	2.19	2.28	54.5
LSD		0.025	0.0017	0.020	0.057	0.28
P	P0	1.89	0.190	1.64	1.86	33.5
	P1	2.07	0.379	1.71	2.27	41.0
LSD		0.018	0.0016	0.028	0.030	0.25
S	S0	1.86	0.273	1.59	1.91	36.4
	S1	2.06	0.284	1.66	2.03	37.1
	S2	2.00	0.297	1.79	2.25	38.2
LSD		0.017	0.0014	0.023	0.034	0.25
F x P	F0 P0	1.62	0.144	1.09	1.70	19.1
	F0 P1	2.15	0.237	2.19	2.02	47.8
	F1 P0	1.82	0.338	1.24	2.00	21.0
	F1 P1	2.32	0.420	2.18	2.45	61.1

LSD		0.026	0.0019	0.029	0.056	0.31
F x S	F0 S0	1.62	0.236	1.02	1.78	19.5
	F0 S1	1.85	0.236	1.15	1.80	20.0
	F0 S2	1.70	0.249	1.33	2.00	20.5
	F1 S0	2.11	0.310	2.16	2.05	53.3
	F1 S1	2.28	0.332	2.17	2.26	54.3
	F1 S2	2.31	0.344	2.25	2.54	55.8
LSD		0.028	0.0021	0.030	0.060	0.35
P x S	P0 S0	1.77	0.172	1.54	1.70	32.7
	P0 S1	2.02	0.190	1.60	1.90	33.4
	P0 S2	1.87	0.208	1.78	2.00	34.2
	P1 S0	1.96	0.374	2.64	2.13	40.1
	P1 S1	2.11	0.378	1.72	2.17	40.9
	P1 S2	2.14	0.385	1.79	2.51	42.1
LSD		0.024	0.0020	0.035	0.045	0.34
F×P×S	F0 P0 S0	1.44	0.140	0.95	1.58	18.9
	F0 P0 S1	1.87	0.138	1.03	1.78	18.9
	F0 P0 S2	1.56	0.153	1.28	1.75	19.5
	F0 P1 S0	1.79	0.333	1.09	1.99	20.1
	F0 P1 S1	1.83	0.334	1.26	1.82	21.1
	F0 P1 S2	1.84	0.346	1.38	2.18	21.6
	F1 P0 S0	2.10	0.205	2.13	1.82	46.6
	F1 P0 S1	2.16	0.242	2.16	2.01	48.0
	F1 P0 S2	2.18	0.264	2.29	2.24	49.0
	F1 P1 S0	2.12	0.415	2.18	2.27	60.1
	F1 P1 S1	2.39	0.421	2.17	2.51	60.6
	F1 P1 S2	2.44	0.424	2.20	2.84	62.7
LSD		0.036	0.0029	0.045	0.073	0.48

Table 3: Effect of the fertilization, summer pruning and spraying with Stimoleaf bio stimulator on the leaves content of the N, P, K, Ca and B.

Canes Content of Carbohydrates, Nitrogen %, and the C: N ratio :

Canes Carbohydrates:

It is clear from the results in Table 4, that the study factors have led to a significant increase in the canes carbohydrate content, as F1, P1, and S2 were superior by giving the highest carbohydrates of 10.497%, 10.612%, and 9.763% respectively, compared to F0, P0, and S0 which amounted to 8.567%, 8.452%, and 9.205% respectively.F1P1, F1S2, and P1S2 were superior with the highest content of 11.243%,10.645%, and 10.870%, respectively, while F0P0, F0S0, and P0S0 had the lowest which amounted to 7.153%, 8.145%, and 8.195%, respectively. F1P1S1 outperformed by giving the highest content of 11.290% compared to F0P0S0, which amounted to 7.110%.

Canes Nitrogen:

Table 4 shows the absence of significant differences between the fertilization program (F1) and the traditional fertilization (F0) in the nitrogen content of the canes. The results showed that the pruning (P1) led to significant differences, giving it the highest N content, which amounted to 1.237%, compared to P0, which amounted to 1.215%. S2 was superior by giving it the highest content of 1.238%, compared to S0, which amounted to 1.213%. F0P1 excelled with an average of 1.243% more than the rest of the averages, while F1S2 excelled by giving the highest N of 1.230%, and P1S2 was significantly superior by the highest N (1.255%). The

results showed that F1P1S2 outperformed by providing the highest N content of 1,250% compared to the F0P0S0, which amounted to 1,200%.

C: N ratio:

As Table 4 shows, fertilization, summer pruning, biostimulant, and their interactions significantly affected the canes' ratio of carbohydrates to nitrogen. F1, P1, and S2 treatments achieved the highest rate (8.58, 8.577, and 7.878), while the lowest ratio was in F0, P0, and S0, which were 6.946, 6.953, and 7.58. F1P1, F1S1, and P1S1 interactions were significantly superior by giving the highest ratio, 9.137, 8.66, and 8.668 compared to the others. As for the triple interactions, the results of the table showed the presence of significant differences, F1P1S0 outperformed by giving the highest ratio of 9.290.

Treat		CHO%	N %	C: N
F	F0	8.567	1.230	6.946
	F1	10,497	1.222	8.584
LSD		0.0084	NS	0.0701
P	P0	8.452	1.215	6.953
	P1	10.612	1.237	8.577
LSD		0.0119	0.0092	0.0621
S	S0	9.205	1.213	7.583
	S1	9.628	1.228	7.834
	S2	9.763	1.238	7.878
LSD		0.0081	0.0072	0.0483
F*P	F0 P0	7.153	1.217	5.876
	F0 P1	9.750	1.213	8.030
	F1 P0	9.980	1.243	8.016
	F1 P1	11.243	1.230	9.137
LSD		0.0123	0.0126	0.0781
F*S	F0 S0	8.145	1.210	6.720
	F0 S1	8.675	1.235	7.007
	F0 S2	8.880	1.245	7.118
	F1 S0	10.256	1.215	8.445
	F1 S1	10,580	1.220	8.661
	F1 S2	10.645	1.230	8.645
LSD		0.0112	0.0128	0.0786
P * S	P0 S0	8.195	1.210	6.760
	P0 S1	8.505	1.215	7.000
	P0 S2	8.655	1.220	7.098
	P1 S0	10.215	1.215	8.405
	P1 S1	10.750	1.240	8.668
	P1 S2	10.870	1.255	8.658
LSD		0.0132	0.0110	0.0736
F×P×S	F0 P0 S0	7.110	1.200	5.920
	F0 P0 S1	7.140	1.220	5.850
	F0 P0 S2	7.210	1.230	5.857
	F0 P1 S0	9.180	1.220	7.520
	F0 P1 S1	10.210	1.250	8.163
	F0 P1 S2	10.550	1.260	8.367
	F1 P0 S0	7.280	1.220	7.600
	F1 P0 S1	9,870	1.210	8.150
	F1 P0 S2	10.100	1.210	8.340
	F1 P1 S0	11.250	1.210	9.290
	F1 P1 S1	11.290	1.230	9.173
	F1 P1 S2	11.190	1.250	8.950
LSD		0.0169	0.0162	0.0484

Table 4: Effect of the fertilization, summer pruning and spraying with Stimoleaf bio stimulator on the cane content of the Carbohydrates, Nitrogen %, and the C: N ratio.

Discussion

The results presented in Tables 2 -4 presented that the study factors, (fertilization program, summer pruning, and biostimulant and their interactions) showed a significant superiority in the percentage of total dissolved solids, total acidity, total sugars, sugars to acidity, anthocyanin pigment concentration and total phenols in the berries skin, also led to a significant increase in the cane carbohydrate content, the increase in the TSS% (Table 2) may attributed to the positive effect of the fertilizing program, with its contents of major and minor elements, in improving the growth of the vine and increasing the content of the leaves from elements (nitrogen, phosphorous, potassium, calcium and boron) (Table 3) as a result of an increase in the avalubilty and absorption of nutrients, and organic materials with ground additives (the fertilization program contains humic acid) as well as foliar spraying, which leads to an increase in the efficiency of the photosynthises, and carbohydrates production, which leads to an increase in sugars (Table 2) and its transfer to clusters during the maturity stage, while the acidity percentage decreases (Table 2) It is due to the high content of potassium in the leaves, which mainly causes a decrease in acidity as a result of its interaction with citric acid to form potassium salts of low soluble citric acid [12,13] The increase in the ratio of sugars to acidity (Table 2) was the result of the increase in total sugars and the decrease in the acidity of the berry juice, while the increase in anthocyanin pigment (Table 2) was due to the increase in sugars and the percentage of total soluble solids (Table 2). in the juice of the berries and that the formation of pigments requires the availability of sufficient amounts of soluble sugars and thus the increase in total phenols (Table 2) [14,15] As for the effect of summer pruning operations on the qualitative characteristics of the crop, it may be attributed to its role in increasing the efficiency of photosynthesis, which leads to an increase in carbohydrate production and thus increase the formation of sugars and their transfer to clusters during the maturity stage, which leads to an increase in the percentage of total soluble solids and total sugars, and thus Increasing the concentration of anthocyanins as well as decreasing the percentage of total acidity Probably the increase in the cane carbohydrate content (Table 4) is attributed to the positive effect of summer pruning on vegetative growth by reducing competition for photosynthetic products by removing basal branches, water sprouts, and old leaves, which leads to an increase in the carbohydrate stock in the canes [8]. The increase in the ratio of carbohydrates to nitrogen (Table 4) resulted from the increase in carbohydrates and the decrease in the percentage of nitrogen in the canes.

Conclusions

Research has been developed to intensify the horticultural pruning and fertilization service operations.

References

1. The Iraqi Central Agency for Agricultural Statistics. Summer fruit production report. Ministry of Planning, Baghdad , Iraq, **2021**.
2. Al-Saidi, I. H. M. Grape production. part One. University of Al Mosul . Ministry of education higher education and scientific research. House of books for printing and publishing. Iraq, **2000**.
3. Al-Kaabi, M. M. H. M. Effect of adding seaweed extract and spraying with nutrient solution on growth and yield of two grape cultivarsSummer royalAnd theCrimson. Master Thesis . faculty of Agriculture . Anbar University, **2015**.
4. Hashem, A. H. H. Effect of organic fertilization (sheep waste) and spraying with the solution (MICRO NATE 14) on some vegetative, quantitative and qualitative

characteristics of Vitis vinifera L. French variety. *Al-Furat Journal of Agricultural Sciences* **2016**, 8. 24-19 :(1)

5. Ali , M. A.; El-Gendy, S. S.; El- Shal, S. A..The role of humic acid in reducing mineral fertilizer rates applied in vineyards. *Journal of Agriculture Sciences. Mansoura University* **2006**, *21(11).* p202-224.
6. Ali, N. S. Fertilizer technologies and their uses. Ministry of Higher Education and Scientific Research, University of Baghdad **2012**.
7. Abd-Salam, M. M. Effect of foliar application with humic acid and two antioxidants on ruby seedless grapevine. *Middle East J Agric Re*s **2016**, 5: 123-131
8. Bassiony, S. S. Effect of Bud Load Levels and Summer Pruning on Vine Vigor and Productivity of "Flame Seedless" (Vitis vinifera, L.) *J. of Plant Production, Mansoura Univ*. **2020**, Vol. *11 (4):*301 – 310.
9. Allegro, G.; Pastore, C.; Valentini, G.; Filippetti I. The Evolution of Phenolic Compounds in Vitis vinifera L. Red Berries during Ripening: Analysis and Role on Wine Sensory—A Review. Agronomy **2021**, 11, 999: Number of Pages
10. Bergstrand, K. J. Organic fertilizers in greenhouse production systems–areview. *Scientia Horticulturae* **2022**, 295,110855
11. Bin, T.; Roland, H.; James, M.; Marlene, J. Changes in pathogenesisrelated proteins and phenolics in Vitis vinifera L. cv. 'Sauvignon Blanc' grape skin and pulp during ripening. *Scientia Horticulturae* **2019**, 243, 78–83.
12. Cheng, H.; Ma, T. T.; Wang, P. P.; Liang, Y. Y.; Zhang, J. X.; Zhang, A.; Chen, Q. Y.; Li, X. W. P.; Ge, Q.; Sun, X. Y.; Fang, Y. L. Foliar nitrogen application from veraison to preharvest improved flavonoids, fatty acids and aliphatic volatiles composition in grapes and wines. *Food Research International* **2020**, 109566. 10.1016/j.foodres.2020.109566 .
13. Cosme, F.; Pinto, T.; Vilela, A. Beverages 4, 22.Phenolic Compounds and Antioxidant Activity in Grape Juices: A Chemical and Sensory View, **2018**.
14. Garrido, J.; Borges, F. Wine and grape polyphenols—A chemical perspective. *Food Res. Int* **2013**, 54,1844–1858.
15. Grigg, D.; Methven, D.; de Bei, R.; Rodríguez López, C.; Dry, P.; Collins, C. Effect of vine age on vine performance of Shiraz in the Barossa Valley, Australia. Aust. *J. Grape Wine Res* **2018**, 24, 75–87.

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