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# STUDY OF THE EFFECT OF PRUNING LEVEL, GROWTH REGULATOR CPPU AND THE ADDITION OF ORGANIC FERTILIZER ON THE QUALITATIVE AND QUANTITATIVE YIELD CHARACTERISTICS (*VITIS VINIFERA* L.) OLIVETTE NOIER VARIETY

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## Abstract

The study was carried out in one of the orchards of the Yaiji District, Kompetler village in Kirkuk Governorate for the season 2019-2020, on the grape variety Olivette Noier variety cultivated on the cabin, to understand the response of grapevines to three levels of pruning (8-11-14 eye/ vine) with a fixed number of canes (10 cane/ vine). As well as, the spraying growth regulator CPPU with three concentrations (0, 2.5 and 5 mg.$L^{-1}$) and the addition of organic fertilizer with three concentrations (0, 3 (recommended) and 4.5 mg.$L^{-1}$) and their effect the qualitative and quantitative yield characteristics according to the Split- Split-plot design with three replicates. The results showed that the pruning level (140 eyes/ vine) caused a significant increase in the characteristic of the total yield, the number of clusters, and the total phenols by (21.72 kg/vine, 54.50 clusters/vine, and 15.79 mg.$100g^{-1}$), respectively. Furthermore, the pruning level (80 eyes/ vine) exceeded in the characteristic of the length of the cluster, the weight of 100 grains, the total sugars, and the percentage of TSS by (22.41 cm, 390.7 g, 21.83%, and 16.10%), respectively. Spraying CPPU at a concentration (5 mg.$L^{-1}$) caused a significant increase in the characteristic of the total yield, the number of clusters, clusters length, the weight of 100 grains, the total sugars and the percentage of TSS by (27.43 kg/ vine, 59.52 clusters/ vine, 24.13 cm, 468.8 g, 16.65 mg.$100g^{-1}$, 23.09% and 16.92%). respectively. Whereas, the addition of liquid organic fertilizer at a concentration (4.5 ml.$L^{-1}$) caused a significant increase in the characteristic of the total yield, the number of clusters, the weight of 100 grains, the total phenols, the total sugars and the percentage of TSS by (21.09 kg/ vine, 51.48 clusters/ vine, 22.06 cm, 388.7 g, 15.47 mg.$100g^{-1}$, 21.39% and 16.15%), respectively. The results also confirm that all the bilateral interactions recorded significant differences, as for the characteristic of the total yield, the bilateral interaction between (M × C) recorded significant differences between treatments, and the total phenols were recorded significant differences in treatment (C × E). The results also confirm that there were significant differences between the triple interactions except for the characteristic of the total yield, the number of clusters, and the percentage of total soluble solids of the characteristics under study.

***Keywords:*** Pruning level and Growth Regulator CPPU, The addition of organic fertilizer, Grapes, Olivette Noier Variety.

## Introduction

Grapes (*Vitis vinifera* L.) is one of the oldest cultivation of plants known to humans, which cultivated in most countries of the world. In Iraq, its cultivation has spread since ancient times and is considered one of the oldest grape-growing habitats in the world, and its cultivation has been known in the cabin during the Assyrians 'era before 2440 BC (Al-Saeedi, 2000). However, it has many varieties are all beneficial, and everything in its fruits from dandruff, pulp, and seeds is beneficial, as it has a laxative effect on the intestine and reduces the incidence of heart, liver, and colon diseases to show its properties against infections. Besides, its juice has many benefits that help to dissolve urolithiasis and for treating diarrhea and pulmonary lesions (Al-Mawsly, 2012). Statistics of the Food and Agriculture Organization of the United Nations showed that the areas planted with grapes in the world were 181658 hectares and the production amount reached 78901866 tons of grapes for the year (2017) (FAO, 2018). The production of grapes in Iraq was estimated to (99444) tons for the summer season (2017), and the average productivity of one tree was (28.16) kg for the year (2017) (Central Agricultural Statistics System, 2018). Several researchers have found, through recent studies and researches, that annual pruning, using the foliar application of growth regulator CPPU, and the addition of organic fertilizer to the soil has overcome some basic and major problems in decreasing the characteristics of vegetative growth (Zoffoli *et al*., 2009). Pruning is one of the most important agricultural processes upon which the success of cultivating and producing grapes depends and leads to a balance between vegetative and fruiting growth. It works to open the heart of the vine to light and air to reach every part of it, which increases the absorption of water and food and strengthens it and makes it carried good branches and fruits with a regular shape (Qasim *et al*., 2012). In a study of (Atrushi, 2009) on Zark grapes with three levels of pruning by 16-24-32 eye/ vine showed that the level 32 eye/ vine exceeded in the number of clusters, the total yield, and the total phenols, while the 16 eyes/vines exceeded in the weight of 100 grains and the percentage of TSS and total sugars. Furthermore, (Al-Douri, 2014) observed during the studying of three varieties of grapes (Halawani, Dess Al- Anz, and Black Hamburg) with three levels (72, 84, 96 eyes/ vine) that, the Halawani variety and the pruning level 96 eye/ vine exceeded over the rest of the varieties in the characteristic of total yield. As well as, the pruning level 72 eye/ vine for the same variety exceeded in cluster length, the weight of 100 grains, percentage of TSS and total sugars, while the variety Dess Al- Anz and the pruning level 96 eye/ vine exceeded in the characteristic of clusters number. The four levels of pruning (36, 44, 48, and 64 eyes/ vine) on grapes Mirane age 12 years showed that the level 36 eye/vine caused a significant increase in the weight of 100 grains, the percentage of TSS and the percentage of total sugars. As for the level 64 eye/vine, it gave the highest values for the vine yield and the number of clusters, (Al-Atrushy, 2019). Among the foliar application of plant growth regulators that leads to

improving the quality, size of grape grains, and vegetative growth (Nampila, 2010). The CPPU is a type of industrial Cytokinines and its common name is Forchlorfenuron, and its molecular formula $C_{12}H_{10}ClN_3O$, which is a white crystalline substance that was used in increasing vegetative growth and consequently increases the amount of yield because it increases cell division (Dimovska, 2014). The CPPU spraying in concentrations (0, 3, 5 PPM) by three spraying on grape vines at the age of 8 years of the Thompson Seedless showed that the concentration of 5 PPM resulted in a significant increase in the weight of 100 grains and an increase in the percentage of TSS (Rafaat *et al*., 2012). Also, (Khot *et al*., 2015) observed that the spraying a mixture of (GA3 at 40PPM + CPPU at 2 PPM) on grape vines of Thompson Seedless caused a significant increase in the total yield, total phenols and the percentage of TSS. (Samurai, 2016) found that the spraying growth regulator KT-30 on grape vines Halawani and the Balad Black variety at the age of 6 years with three concentrations (0, 0.25, 0.50 $ml.L^{-1}$) that, the concentration 0.50 $ml.L^{-1}$ and the Halawani variety caused a significant increase in weight of 100 grains. Besides, the number of clusters, while concentration 0.25 $ml.L^{-1}$ exceeded in average cluster length, ). The addition of the organic fertilizer EVERGREEN- Plus organic fertilizer that consists of (NPK, organic acids, amino acids and seaweed), which is one of the humus compounds. It has many chemical properties among them it contribute to improving plant growth directly or indirectly because it works as a bio stimulant (Al-Tai, 2010). It represents a medium that transferring nutrients from the soil to the plant and can bind with the positive ions and forming chelating compound and retaining ketones that are absorbable by the plant roots. As well as, stimulates the release of oxidizable substances that include insoluble substances in water such as tannins and beta-carotene and contains important nutrients, especially Nitrogen, Phosphorus, and Potassium. Besides, it improves soil structure and its physical and chemical properties and decrease the number of soil reaction (Al-Araji and Al-Hamdani, 2012). In a study conducted by (Mervat *et al*., 2010) on grape variety Black Monukka at the age of 15 years, where (30 $ml.tree^{-1}$ + 300 g/ vine + fungi) caused a significant increase in the total yield and the percentage of TSS. While (Shaheen *et al*., 2012) studied the grape vine variety Crimson Seedless using an organic fertilizer mixture, where (1 ml + 11 kg + 0.500 kg + NPK) caused a significant increase in the number of clusters, total yield, TSS and total sugars. Whereas (Al Kaabi, 2015) studied the grape vines, indicated the two varieties of Summer Royal and Crimson seedless by adding Kelp40 with four concentrations (0-20-40-60 ml/ vine), where the concentration 60 ml/ vine caused a significant increase in the average of 100 grains for summer royal, total grapevine, TSS, total sugars and cluster length for Crimson,. As for variety (Olivette Noier), it is distinguished as one of the table grape varieties, it has good conical or cylindrical-conical clusters, the grains are oval, similar to the olive. As well as, the thick crust is covered with a thick waxy layer of a dark red color, the leaves are triple lobed and smooth on both sides, the flowers are normal hermaphrodites, and require a pruning with long- canes, ripening in July (Al-Saeedi, 2000). Finally, this study aims to find out the grapevines respond to the pruning level, spraying CPPU, the addition of liquid organic fertilizer to increase the yield and improve its quality without affecting the vine's strength and production for the Olivette Noier variety.

## Materials and Methods

This study was carried out during the growing seasons 2019-2020 in one of the orchards of the Yaiji District, Kompetler village in Kirkuk Governorate. The main aim of this research was to study the effect of pruning levels (80, 110 and 140 eye/ vine) symbolized as ($M_1$, $M_2$, and $M_3$), respectively, by 10 fruit canes at the end of January, the vines were at the age of 7 years and were placed on the cabin with a height of 2.15 m. As well as, spraying CPPU in three concentrations (0, 2.5, and 5 mg. $L^{-1}$) symbolized as ($C_1$, $C_2$, and $C_3$), which sprayed twice at 15/3, and 30/3, respectively, in the early morning until full wetness, as for the comparison vines, they were sprayed with distilled water only. Finally, the adding of organic fertilizer at concentrations (0, 3 (recommended) and 4.5 $mg.L^{-1}$) symbolized as ($E_1$, $E_2$, and $E_3$), and was added on 10/3, 10/4, 10/5 after diluting it with a liter of distilled water, where it was added after making a half-circle hole near the stem of the vine. The split-split-plot design was used in this experiment, the main plots were used for the pruning level and the sub-plots were used for the CPPU, as for sub-sub-plot, they were used for the organic fertilizer with three replicates. Moreover, one grapevine was chosen as an experimental unit for each treatment, so the number of grapevines used equals (81) vines. The data were analyzed statistically using the commercial Gene state statistical program, the averages were compared using the least significant different LSD test at the 5% probability level (Mohammedi and Muhammadi, 2012), and the study included the following treatments

- **The total yield content ($kg.vine^{-1}$):** The weight of 100 grains was considered to be the maximum, and the percentage of the total soluble solids in the grains for the comparison treatment from 15 - 16% as evidence that the yield has reached maturity, which can be harvested (Constantinescu and Lazarescu, 1971). All clusters of each vine were weighed at the harvest and for each treatment separately for the 2019 season.
- **The number of clusters ($cluster.vine^{-1}$**): The number of clusters formed on the canes for each vine was calculated directly in the field at harvest.
- **The Cluster length (cm):** 5 clusters were taken for each treatment randomly to calculate the length of clusters using a graduated ruler and then measured their mean, for the 2019 season at the end of July at harvesting the yield.
- **Weight of 100 grains (g):** 100 grains were randomly taken from several clusters, and their weight was measured using a sensitive electrical balance, where this was done when the grains reached maturity at harvesting the yield.
- **Total Phenols ($mg.100g^{-1}$):** Total Phenols were determinate at harvesting, where the samples were prepared by placing them in the refrigerator until the next morning, and the grains were separated from the clusters. The seeds removed from them and cut into small pieces and placed in an Electric mixer for (15) sec, then transferred to a standard beaker size 250 ml and heated to 20 °C. Furthermore, the cups were covered with a glass cover, placed in a water bath at 85 °C for an hour, and allowed to cool to 40 °C and then the residue of the grains (pulp and shells) was removed by squeezing it through two layers of gauze. Then, 5 ml of juice was taken and diluting it to 100 ml with distilled

water and then centrifuging it for 3 minutes at 4000 rpm. Finally, the leachate was taken and the deposit removed, where the UV- spectrophotometer with a wavelength (280) nm was used as described by (Celotti *et al.* 2001) method. It is calculated according to the following equation:

$$A\ (absorbance) = \frac{UV - Spectrophotometer\ reading\ of\ the\ sample}{1\ x\ 0.966\ (constant)}$$

$$Concentration\ (C)\ total\ phenols\ (mg\ /\ 100g) = \left(\frac{A\ x\ 100}{1\ x\ 0.966\ (constant)}\right) x\ 100$$

- **The percentage of total sugars in grains (%)**: 1 ml of juice was taken and placed in a 50 ml glass beaker, and 1 ml of 5% Phenols solution, distilled water, and 5 ml of concentrated sulfuric acid were added with continuous shaking. The mixture was left to cool, and then light absorption was recorded with a Spectrophotometer of 490 nm wavelength according to the method of (Joslyn, 1970). Finally, the readings were written on a standard curve of glucose, where the concentration of total sugars as a percentage in the juice was calculated in the following equation:

$$Total\ sugars\% = \frac{Consentration\ from\ the\ standard\ curve\ x\ dilution}{The\ juice\ volume\ taken\ for\ decompostion\ x\ 1000}$$

- **Percentage of total soluble solids (TSS):** were determined in the grains juice using a Hand Refract meter for season 2019.
- **The results of quantitative yield characteristics:**
- **Total yield content (kg.vine$^{-1}$):**

The results in Table 1 indicated that the pruning levels have a significant effect, as the treatment $M_3$ exceeded and reached (21.72 kg.vine$^{-1}$) over the treatment $M_1$ which amounted to (18.94 kg.vine$^{-1}$). Moreover, the spraying CPPU resulted in a significant difference, as the treatment $C_3$ was superior significantly and gave the highest averages, as it reached (27.43 kg.vine$^{-1}$) over the treatment $C_1$ which reached (13.22 kg.vine$^{-1}$). However, the addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (21.09 kg.vine$^{-1}$) over the treatment $E_1$ that reached (19.27 kg.vine$^{-1}$). The results also confirm that there were significant differences between the bilateral interactions (M × E), as well (C × E), while the interaction (M x C) showed significant differences, where ($M_3$ × $C_3$) exceeded and reached (27.75 kg.vine$^{-1}$) compared to the treatment ($M_1$ × $C_1$) that reached (12.23 kg.vine$^{-1}$). Whereas the results showed that the triple interactions showed no significant differences between the treatments for the 2019 season.

**Clusters number (cluster.vine$^{-1}$)**

The results in Table 2 indicated that the pruning levels have a significant effect, as the treatment $M_3$ exceeded and reached (54.70 cluster.vine$^{-1}$) over the treatment $M_1$ which amounted to (43.15 cluster.vine$^{-1}$). Furthermore, the spraying CPPU resulted in significant differences, as the treatment $C_3$ was superior significantly and gave the highest averages, as it reached (59.52 cluster.vine$^{-1}$) over the treatment $C_1$ which reached (37.30 cluster.vine$^{-1}$). The addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (51.48 cluster.vine$^{-1}$) over the treatment $E_1$ that reached (48.00 cluster.vine$^{-1}$), while the results showed that all the bilateral and triple interactions did not record any significant differences between the treatments.

**Cluster length (cm)**

The results in Table 3 indicated that the pruning levels have a significant effect, as the treatment $M_1$ exceeded and reached (22.41 cm) over the treatment $M_3$ which amounted to (21.19 cm). The spraying CPPU resulted in a significant difference, as the treatment $C_3$ was superior significantly and gave the highest averages, which reached (24.13 cm) over the treatment $C_1$ which reached (19.31 cm). However, the addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (22.06 cm) over the treatment $E_1$ that reached (21.60 cm). The results also confirm that there were significant differences between the bilateral interactions (M × E), as ($M_1$ x $E_3$) exceeded and reached (22.62 cm) compared to the treatment ($M_3$ x $E_1$) which amounted to (20.92 cm), as well (C × E). The ($C_3$ x $E_3$) exceeded and reached (24.29 cm) compared to the treatment ($C_1$ x $E_1$) that reached (19.03 cm), while the interaction (M x C), ($M_3$ × $C_3$) was exceeded and reached (24.65 cm) compared to the treatment ($M_1$ × $C_1$) that reached (18.52 cm). As for the triple interactions, the results also showed that there were significant differences between the treatments, where the treatment ($M_3$ x $C_3$ x $E_3$) exceeded and reached (24.77 cm) compared to the comparison ($M_1$ x $C_1$ x $E_1$) which reached (18.08 cm).

**Weight of 100 grains (g)**

The results in Table 4 indicated that the pruning levels have a significant effect, as the treatment $M_1$ exceeded and reached (390.7 g) over the treatment $M_3$ which amounted to (313.6 g). Furthermore, the spraying CPPU resulted in significant differences, where the treatment $C_3$ was superior significantly and gave the highest averages, as it reached (468.8 g) over the treatment $C_1$ which reached (208.3 g). However, the addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (388.7 g) over the treatment $E_1$ that reached (313.0 g). The results also confirm that there were significant differences between the bilateral interactions (M × E), as ($M_1$ x $E_3$) exceeded and reached (371.5 g) compared to the treatment ($M_3$ x $E_1$) which amounted to (270.1 g), as well (C × E). Moreover, ($C_3$ x $E_3$) exceeded and reached (495.2 g) compared to the treatment ($C_1$ x $E_1$) that reached (179.3 g), while the interaction (M x C), ($M_3$ × $C_3$) was exceeded and reached (514.2 g) compared to the treatment ($M_1$ × $C_1$) that reached (158.8 g). As for the triple interactions, the results also showed that there were significant differences between the treatments, where the treatment ($M_3$ x $C_3$ x $E_3$) exceeded and reached (524.2 g) compared to the comparison ($M_1$ x $C_1$ x $E_1$) which reached (118.6 g).

**Total Phenols (mg.100g$^{-1}$)**

The results in Table 5 indicated that the pruning levels have a significant effect, as the treatment $M_3$ exceeded and reached (15.79 mg.100g$^{-1}$) over the treatment $M_1$ which amounted to (14.98 mg.100g$^{-1}$). Furthermore, the spraying CPPU resulted in a significant difference, as the treatment $C_3$ was superior significantly and gave the highest averages, as it reached (16.65 mg.100g$^{-1}$) over the treatment $C_1$ which reached (14.37 mg.100g$^{-1}$). However, the addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (15.47 mg.100g$^{-1}$) over the treatment $E_1$ that reached (15.32 mg.100g$^{-1}$). The results also confirm that there were significant differences between the bilateral interactions (M × E), while (C × E) caused a significantly different, where ($C_3$ x $E_3$) exceeded and reached (16.71 mg.100g$^{-1}$) compared to

the treatment ($C_1$ x $E_1$) that reached (14.34 mg.100g$^{-1}$). Finally, the interaction (M x C) did not show a significantly different, as for the triple interactions, the results showed that there were significant differences, where the treatment ($M_3$ x $C_3$ x $E_3$) exceeded and reached (16.97 mg.100g$^{-1}$) compared to the comparison ($M_1$ x $C_1$ x $E_1$) which reached (13.97 mg.100g$^{-1}$).

**Percentage of total sugars in grains (%)**

The results in Table 6 indicated that the pruning levels have a significant effect, as the treatment $M_1$ exceeded and reached (21.83 %) over the treatment $M_3$ which amounted to (20.53 %). Furthermore, the spraying CPPU resulted in a significant difference, as the treatment $C_3$ was superior significantly and gave the highest averages, which it reached (23.09 %) over the treatment $C_1$ which reached (19.14 %). However, the addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (21.39 %) over the treatment $E_1$ that reached (20.94 %). The results also confirm that there were significant differences between the bilateral interactions (M × E), as ($M_1$×$E_3$) exceeded and reached (21.88%) compared to ($M_3$×$E_1$) that reached (20.19%), while (C × E) caused a significantly different, where ($C_3$ x $E_3$) exceeded and reached (23.32%) compared to the treatment ($C_1$ x $E_1$) that reached (18.85%). While the interaction (M x C) recorded a significantly different, as ($M_3$ x $C_3$) exceeded and reached (23.80%) compared to the treatment ($M_1$ x $C_1$) that reached (18.64%). As for the triple interactions, the results showed that there were significant differences, where the treatment ($M_3$ x $C_3$ x $E_3$) exceeded and reached (23.94 %) compared to the comparison ($M_1$ x $C_1$ x $E_1$) which reached (18.27%).

**Percentage of total soluble solids (TSS)**

The results in Table 7 indicated that the pruning levels have a significant effect, as the treatment $M_1$ exceeded and reached (16.10%) over the treatment $M_3$ which amounted to (15.65 %). Furthermore, the spraying CPPU resulted in a significant difference, as the treatment $C_3$ was superior significantly and gave the highest averages, as it reached (16.92 %) over the treatment $C_1$ which reached (14.87 %). However, the addition of organic fertilizer, the treatment $E_3$ was exceeded and reached (16.15 %) over the treatment $E_1$ that reached (15.69 %). The results also confirm that there were significant differences between the bilateral interactions (M × E), as ($M_1$×$E_3$) exceeded and reached (16.32%) compared to ($M_3$×$E_1$) that reached (15.44%), while (C × E) caused a significantly different, where ($C_3$ x $E_3$) exceeded and reached (17.02%) compared to the treatment ($C_1$ x $E_1$) that reached (14.66%). Finally, the interaction (M x C) recorded a significantly different, as ($M_3$ x $C_3$) exceeded and reached (17.24%) compared to the treatment ($M_1$ x $C_1$) that reached (14.70%). As for the triple interactions, the results showed that there were no significant differences between the treatments for the season 2019.

**Table 1 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the total yield content (kg.vine$^{-1}$) of the Olivette Noier variety for the 2019 season

| **Total yield content (kg.vine$^{-1}$)** | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 12.26 | 11.96 | 12.47 | 12.23 |
| | $C_2$ | 16.72 | 18.33 | 19.75 | 18.26 |
| | $C_3$ | 26.29 | 26.03 | 26.63 | 26.32 |
| $M_2$ | $C_1$ | 12.82 | 12.90 | 14.29 | 13.34 |
| | $C_2$ | 20.89 | 21.46 | 22.91 | 21.75 |
| | $C_3$ | 27.86 | 28.54 | 28.23 | 28.21 |
| $M_3$ | $C_1$ | 14.19 | 14.08 | 14.00 | 14.09 |
| | $C_2$ | 23.28 | 23.14 | 23.55 | 23.32 |
| | $C_3$ | 28.08 | 27.16 | 28.01 | 27.75 |
| LSD 0.05 | | N.S | | | 0.727 |
| Organic fertilizer averages | | 19.27 | 20.40 | 21.09 | |
| LSD 0.05 | | 0.303 | | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 13.09 | 12.98 | 13.59 | 13.22 |
| $C_2$ | | 20.30 | 20.98 | 22.07 | 21.11 |
| $C_3$ | | 27.41 | 27.24 | 27.62 | 27.43 |
| LSD 0.05 | | N.S | | | 0.440 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 18.42 | 18.77 | 19.62 | 18.94 |
| M2 | | 20.52 | 20.97 | 21.81 | 21.10 |
| M3 | | 21.85 | 21.46 | 21.85 | 21.72 |
| LSD 0.05 | | N.S | | | 0.523 |

**Table 2 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the cluster number (cluster.vine$^{-1}$) of the Olivette Noier variety for the 2019 season.

| **Cluster number (cluster.vine-1)** | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 31.00 | 31.00 | 33.00 | 31.67 |
| | $C_2$ | 39.33 | 44.00 | 47.67 | 43.67 |
| | $C_3$ | 53.00 | 53.67 | 55.67 | 54.11 |
| $M_2$ | $C_1$ | 35.00 | 36.33 | 41.00 | 37.44 |
| | $C_2$ | 51.33 | 53.33 | 57.00 | 53.89 |
| | $C_3$ | 59.33 | 62.00 | 62.33 | 61.22 |
| $M_3$ | $C_1$ | 42.00 | 43.00 | 43.33 | 42.78 |
| | $C_2$ | 58.00 | 57.67 | 58.67 | 58.11 |
| | $C_3$ | 63.00 | 62.00 | 64.67 | 63.22 |
| LSD 0.05 | | N.S | | | N.S |
| Organic fertilizer averages | | 48.00 | 49.22 | 51.48 | |
| LSD 0.05 | | 0.695 | | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 36.00 | 36.78 | 39.11 | 37.30 |
| $C_2$ | | 49.56 | 51.67 | 54.44 | 51.89 |
| $C_3$ | | 58.44 | 59.22 | 60.89 | 59.52 |
| LSD 0.05 | | N.S | | | 1.077 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 41.11 | 42.89 | 45.44 | 43.15 |
| M2 | | 48.56 | 50.56 | 53.44 | 50.85 |
| M3 | | 54.33 | 54.22 | 55.56 | 54.70 |
| LSD 0.05 | | N.S | | | 1.**343** |

**Table 3 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the cluster length (cm) of the Olivette Noier variety for the 2019 season.

| **Cluster length (cm)** | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 18.08 | 18.37 | 19.11 | 18.52 |
| | $C_2$ | 21.17 | 21.39 | 21.58 | 21.38 |
| | $C_3$ | 23.51 | 23.66 | 23.81 | 23.66 |
| $M_2$ | $C_1$ | 19.26 | 19.49 | 19.62 | 19.46 |
| | $C_2$ | 21.82 | 22.12 | 22.26 | 22.07 |
| | $C_3$ | 23.91 | 24.08 | 24.27 | 24.09 |
| $M_3$ | $C_1$ | 19.76 | 19.87 | 20.26 | 19.96 |
| | $C_2$ | 22.39 | 22.64 | 22.84 | 22.62 |
| | $C_3$ | 24.48 | 24.67 | 24.77 | 24.65 |
| LSD 0.05 | | 0.087 | | | 0.049 |
| Organic fertilizer averages | | 21.60 | 21.81 | 22.06 | |
| LSD 0.05 | | 0.030 | | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 19.03 | 19.24 | 19.66 | 19.31 |
| $C_2$ | | 21.79 | 22.05 | 22.23 | 22.02 |
| $C_3$ | | 23.97 | 24.14 | 24.29 | 24.13 |
| LSD 0.05 | | 0.050 | | | 0.034 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 22.21 | 22.39 | 22.62 | 22.41 |
| M2 | | 21.66 | 21.89 | 22.05 | 21.87 |
| M3 | | 20.92 | 21.14 | 21.50 | 21.19 |
| LSD 0.05 | | 0.050 | | | 0.029 |

**Table 4 and 5 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the weight of 100 grains (g) of the Olivette Noier variety for the 2019 season

| Weight of 100 grains (g) | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 118.6 | 144.2 | 213.7 | 158.8 |
| | $C_2$ | 307.3 | 317.4 | 413.6 | 346.1 |
| | $C_3$ | 384.6 | 453.9 | 469.1 | 435.9 |
| $M_2$ | $C_1$ | 166.2 | 189.5 | 234.1 | 196.6 |
| | $C_2$ | 329.9 | 344.0 | 426.4 | 366.7 |
| | $C_3$ | 395.6 | 481.6 | 492.3 | 456.5 |
| $M_3$ | $C_1$ | 253.0 | 268.8 | 286.5 | 269.4 |
| | $C_2$ | 358.2 | 368.8 | 438.7 | 388.6 |
| | $C_3$ | 503.3 | 515.1 | 524.2 | 514.2 |
| LSD 0.05 | | 6.696 | | | 5.727 |
| Organic fertilizer averages | | 313.0 | 342.6 | 388.7 | |
| LSD 0.05 | | 1.656 | | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 179.3 | 200.8 | 244.7 | 208.3 |
| $C_2$ | | 331.8 | 343.4 | 426.2 | 367.1 |
| $C_3$ | | 427.8 | 483.5 | 495.2 | 468.8 |
| LSD 0.05 | | 5.494 | | | 5.593 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 371.5 | 384.2 | 416.4 | 390.7 |
| M2 | | 297.2 | 338.3 | 384.2 | 339.9 |
| M3 | | 270.1 | 305.2 | 365.4 | 313.6 |
| LSD 0.05 | | 3.202 | | | 2.358 |

**Table 5 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the Total Phenols (mg.100g$^{-1}$) of the Olivette Noier variety for the 2019 season.

| Total Phenols (mg.100g$^{-1}$) | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 13.97 | 13.95 | 14.00 | 13.97 |
| | $C_2$ | 14.76 | 14.82 | 14.90 | 14.83 |
| | $C_3$ | 15.96 | 16.04 | 16.41 | 16.14 |
| $M_2$ | $C_1$ | 14.45 | 14.49 | 14.54 | 14.49 |
| | $C_2$ | 15.00 | 15.05 | 15.12 | 15.05 |
| | $C_3$ | 16.53 | 16.66 | 16.76 | 16.65 |
| $M_3$ | $C_1$ | 14.61 | 14.65 | 14.71 | 14.66 |
| | $C_2$ | 15.75 | 15.82 | 15.89 | 15.82 |
| | $C_3$ | 16.85 | 16.90 | 16.97 | 16.90 |
| LSD 0.05 | | 0.305 | | | N.S |
| Organic fertilizer averages | | 15.32 | 15.38 | 15.47 | |
| LSD 0.05 | | 0.030 | | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 14.34 | 14.38 | 14.40 | 14.37 |
| $C_2$ | | 15.17 | 15.23 | 15.30 | 15.23 |
| $C_3$ | | 16.44 | 16.53 | 16.71 | 16.6**5** |
| LSD 0.05 | | 0.212 | | | 0.209 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 14.89 | 14.95 | 15.09 | 14.98 |
| M2 | | 15.33 | 15.40 | 15.47 | 15.40 |
| M3 | | 15.73 | 15.79 | 15.85 | 15.79 |
| LSD 0.05 | | N.S | | | 0.059 |

**Table 6 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the Percentage of total sugars in grains (%)of the Olivette Noier variety for the 2019 season.

| **Percentage of total sugars in grains (%)** | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 18.27 | 18.48 | 19.16 | 18.64 |
| | $C_2$ | 20.46 | 20.65 | 20.83 | 20.65 |
| | $C_3$ | 21.83 | 22.45 | 22.66 | 22.31 |
| $M_2$ | $C_1$ | 18.65 | 18.87 | 19.39 | 18.97 |
| | $C_2$ | 21.17 | 21.35 | 21.53 | 21.35 |
| | $C_3$ | 23.16 | 22.91 | 23.36 | 23.14 |
| $M_3$ | $C_1$ | 19.63 | 19.83 | 19.94 | 19.80 |
| | $C_2$ | 21.66 | 22.23 | 21.75 | 21.88 |
| | $C_3$ | 23.63 | 23.84 | 23.94 | 23.80 |
| LSD 0.05 | | | 0.071 | | 0.031 |
| Organic fertilizer averages | | 20.94 | 21.18 | 21.39 | |
| LSD 0.05 | | | 0.026 | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 18.85 | 19.06 | 19.50 | 19.14 |
| $C_2$ | | 21.09 | 21.41 | 21.37 | 21.29 |
| $C_3$ | | 22.87 | 23.06 | 23.32 | 23.09 |
| LSD 0.05 | | | 0.041 | | 0.020 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 21.64 | 21.97 | 21.88 | 21.83 |
| M2 | | 20.99 | 21.04 | 21.42 | 21.15 |
| M3 | | 20.19 | 20.53 | 20.88 | 20.53 |
| LSD 0.05 | | | 0.039 | | 0.017 |

**Table 7 :** The effect of pruning levels, spraying CPPU and the addition of organic fertilizers and their interactions in the Percentage of total soluble solids (TSS) of the Olivette Noier variety for the 2019 season

| **Percentage of total soluble solids (TSS)%** | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **CPPU mg.L$^{-1}$** | **Organic fertilizer (ml.L$^{-1}$)** | | | **M X C** |
| | | **$E_1$** | **$E_2$** | **$E_3$** | |
| $M_1$ | $C_1$ | 14.46 | 14.58 | 15.08 | 14.70 |
| | $C_2$ | 15.40 | 15.48 | 16.12 | 15.67 |
| | $C_3$ | 16.45 | 16.58 | 16.72 | 16.59 |
| $M_2$ | $C_1$ | 14.67 | 14.76 | 15.21 | 14.88 |
| | $C_2$ | 15.55 | 15.68 | 16.22 | 15.81 |
| | $C_3$ | 16.85 | 16.93 | 17.03 | 16.93 |
| $M_3$ | $C_1$ | 14.84 | 14.93 | 15.31 | 15.02 |
| | $C_2$ | 15.82 | 15.93 | 16.35 | 16.03 |
| | $C_3$ | 17.16 | 17.23 | 17.31 | 17.24 |
| LSD 0.05 | | | N.S | | 0.035 |
| Organic fertilizer averages | | 15.69 | 15.79 | 16.15 | |
| LSD 0.05 | | | 0.015 | | |
| C x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | C averages |
| $C_1$ | | 14.66 | 14.75 | 15.20 | 14.87 |
| $C_2$ | | 15.59 | 15.70 | 16.23 | 15.84 |
| $C_3$ | | 16.82 | 16.91 | 17.02 | 16.92 |
| LSD 0.05 | | | 0.035 | | 0.034 |
| M x E | | | | | |
| | | $E_1$ | $E_2$ | $E_3$ | M averages |
| M1 | | 15.94 | 16.03 | 16.32 | 16.10 |
| M2 | | 15.69 | 15.79 | 16.15 | 15.88 |
| M3 | | 15.44 | 15.55 | 15.97 | 15.65 |
| LSD 0.05 | | | 0.025 | | 0.014 |

## Discuss the qualitative and quantitative yield characteristics

The pruning levels increase the shoot, which increases the efficiency of photosynthesis that increases the number of clusters and thus an increase in the vine yield as shown in Tables 1 and 2 (Atroshi, 2009; Al-Bayati, 2015). The length increasing of the cluster as shown in Table 3, it can be attributed to an increase in the size of 100 grains as shown in Table 4. It can also be attributed to the high amount of photosynthesis products during the ripening stage because of the presence of active leaves, which reflects positively on the effectiveness of photosynthesis. This leads too many branches of the clusters and their axes because of the availability of photosynthetic products and hormones that affect the growth of clusters (Giorgessi and Calo, 2000; Abdul-Qader, 2006; Atrushi, 2009). Since the products of photosynthesis and hormones encourage the elongation of clusters due to the low number of clusters, the increase in the cluster's share of foodstuffs, and the lack of competition between these clusters on these materials (Al-Huwaisi, 2008; Al-Douri, 2014). Additionally, the increasing weight of 100 grains as shown in Table 4 was due to that the pruning increases the leaf area and the leaf area of the cluster, which is the center of production foodstuffs. Especially carbohydrates, and also moving it from vine parts to it, which leads to increasing the share of each cluster of these materials, especially in the growth stage of grains, which work to expand the cells of the grain cover and increase its weight, (Al-Hwizi, 2008; Atrushi, 2009). The increase in grains sugar as shown in Table 6 may be due to the decrease of the yield in the lower pruning level as shown in Table 1, where there is an inverse relationship, as whenever clusters number decreased, the sugars increases (Michailov 1983; Porika *et al*., 2015), and thus the phenols increase as shown in Table 5. Soluble solids percentage of (TSS%) increasing as shown in Table 7 was due to that the pruning works on the regular distribution of leaves. As well as removing cancer growth that has a negative effect on the accumulation of TSS percentage in the juice (Al-Douri, 2014; Al-Bayati, 2015), and these results are consistent with (Al-Atroshi, 2009; Al-Douri, 2014; Al-Atrushi, 2019). The increase in the total yield and the number of clusters on the vine is due to the effect of cytokinin in increasing the proportion of the nodes in the cluster and their weight. Besides, the stimulant role of this compound and its improvement the fruit characteristics that led to the increase in productivity as an outcome of these effects. Whereas the increase in cluster length as shown in Table 3 was due to the increase in leaf area and its chlorophyll content, which has a role in increasing the food production process and its transmission to the cluster. As the increase in weight of 100 grains and the percentage of total soluble solids as shown in Tables 4-7 is attributed to the role of the CPPU compound as an industrial cytokinin that works to withdraw food from the vine parts and supply the clusters with it. In addition to stimulating cell division and expansion and forming the chlorophyll and protein as a powerful engine for photosynthesis products leading to the transfer of mineral nutrients, amino acids, and hormones (Al-Saidi, 2007; Marschner, 2012; Rafaat *et al*., 2012; Al-Samarrai, 2016). Similarly, the increase in total sugars and phenols as shown in Tables 5-6 due to an increase in the formation of chlorophyll and thus an increase in photosynthesis rates. Consequently, an increase in carbohydrate production which resulted in the aggregation of total sugars and thus an increase in total phenols (Bentchikou *et al*., 1992, Aghdam *et al*., 2012), and these results are consistent with ( Rafaat *et al*., 2012; Khot, 2015, Al-Samurai, 2016). Finally, the liquid organic fertilizer, it works to reduce the soil PH, which increases the readiness of nutrients in the soil and their absorption by the roots, then increases the strength of the vine, the number of clusters and then increases the yield of the vine as shown in Tables 1-2 (Al-Araji and Al-Hamdani, 2012, Al-Bayati, 2015). Furthermore, the increase in the cluster length as shown in Table 3 was due to the role of fertilizer that improves the nutritional state of the vine and increases the cluster's share of food, therefore, it is reflected positively in increasing the length of the cluster. As for the weight of 100 grains as shown in Table 4 is due to the plant retains water and nutrients and making it with a high content of these substances, which leads to an increase in the weight of 100 grains (Taha, 2007; Kaabi, 2015). The reason for an increase in total sugars and the percentage of soluble solids (TSS%) as shown in Tables 6-7 is because the fertilizer increases the leaf area of the cluster, which leads to an increase in the activity of photosynthesis. Then, the food production process increases and its transfer from leaves to grains through the phloem which increases the accumulation of carbohydrates and other substances and then increases their weight as in Table 3. Thus, increases the percentage of soluble solids (TSS%) in the juice, and all the reasons mentioned above causes an increase in the total phenols as in Table 5 (Abu-Nukta, 2010; Mahdi, 2013; Al Bayati, 2015) and these results are consistent with (Mervat *et al*., 2010; Shaheen *et al*., 2012; Al-Kaabi, 2015).

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