IMPACT OF PRUNING LEVEL ON THE PRODUCTIVITY AND QUALITY PARAMETERS OFCARIGNAN WINE GRAPE CULTIVAR UNDER AS-SWEIDA GOVERNORATE CONDITIONS

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ABSTRACT

This research was carried out in the fields and laboratories of Apple and grapevine Research Department in Sweida Governorate- Syria during the period 2016-2018 on 20 years old Carignan wine grape cultivar grafted on Paulsen 1103 rootstock, in order to study the impact of the pruning level on productivity, and quantitative and qualitative characters of bunches and berries. The vines were pruned with three levels 4, 6 and 8 nodes/cane, with a total of 48 fruitful buds/vine. The results showed that the highest average of fertility rate was at 8 nodes/cane (76%). Productivity varied by the applied Pruning treatments as the pruning treatment 4 buds/cane significantly revealed the highest production (15 Kg/vine). Concerning the average of bunch weight, there were no significant variance among all pruning levels, and the highest bunch average weight was in 8 buds/cane treatment (163g), which also significantly revealed the highest weight of 100 berries (195.6 g), as well as the average ratio of juice (66.2 ml/100g). However, the effect of pruning levels varied in the average of total soluble solids (TSS), total sugar (TS), and titratable acidity (TA). Consequently, the results indicate the effective role of determining the level of pruning in Carignan wine grape cultivar and its impact on fertility, production characteristics and quality characters of this wine grape cultivar.

Keywords: *Grape, pruning, wine cultivar, fertility, productivity*.

INTRODUCTION

Grape is considered as one of the most important fruit crops in the world and in Syria. However, Grape cultivation in Syria has been taken up under different soils and climate conditions, the total cultivated area 44802 Ha produced 223383m ton (Annual statistics abstract, 2019). Grape production with high quality especially in the steady trend of climate changes and the variation of environmental regions required special treatments lead to the optimal size of canopy that effects on the production and bunch and berry traits through the correct practices of pruning and fertilization, in addition to suitable rootstocks (Bates, 2008). Wine grapes revealed distinct success under rainfed conditions in Sweida governorate at the south of

Syria (Al-Halabi *et al*., 2017). Pruning and the precision of grape yield is an important culture treatment to get the balance between different growth and fruitage and lead to high qualitative and quantitative characters of bunches and berries. Hence, the incorrect management of farms will reduce the productivity and the quality of fruits (Bem *et al*., 2016). Fruitfulness of any variety is of considerable importance in viticulture as it has direct impact on productivity of vines. An increase in the severity of pruning will increase the vigor of individual shoot at the expense of total growth and crop (Winkler *et al*., 1974). Pruning is one of the important cultural operations in grape production and standardized the pruning severity for any grape varieties is of utmost meaning for obtaining optimum yield and quality, and the vine should carry a sufficient number of canes, in order to maintain the uniform vigor throughout its life span (Kumar *et al*., 2017). Canopy vigor and productivity can be balanced through pruning levels which related to the variety and fruiting buds (Almanza *et al*., 2012; Allebrandt *et al.*, 2017). The application of three pruning levels (2,4,6 buds/cane) with a total number 12 canes/vine on Pusa Navrang grape cultivar showed that the 6 buds/cane treatment revealed the highest bunch numbers and weight (Palanichamy *et al*., 2004). However, production technology is yet to be standardized in Syria for wine grapes, as well the introduced wine grape cultivars have an essential importance due to their adaptation with environmental conditions and their benefits in wine making field, which require to standardize cultural practices especially pruning which is of immense importance. Carignan is an important wine grape cultivar requires enough labor for canopy management. Since, the present investigation was carried out to study the influence of different pruning levels on yield and qualitative traits of bunches and berries of Carignan wine grape cultivar.

MATERIAL AND METHODS

The present research was carried out during 2016-2018 in grapevine orchards at Pome and grapevine Division- GCSAR in Sweida Governorate, which located in the south of Syria at 1200-1500 m altitude. The mean rainfall 525mm.

Plant materials

-Carignan: is an introduced wine grape cultivar from Spain, the bunch is broad conical, the berry is short oval, with dark purple- black skin (Dokoozlian, 2003). The vines 20 years old, grafted on the rootstock Polsen 1103, the training system is cordon, the distance between vineyards and between the rows is 2.5 x 3 m under rainfed system agriculture.

Methods

Three winter pruning levels were applied with a total number 48 buds per vine. The three treatments were:
- Short pruning 4 buds/cane with 12canes per vine
- Moderate pruning 6 buds/cane with 8 canes per vine
- Long pruning 8 buds/cane with 6 canes per vine

Studied indicators

- Buds behavior: Bud burst ratio, fertility buds ratio, fertility coefficient according to (Bessis, 1960)
- Vine yield through calculation of the mean average of bunch weight (kg/vine) at maturity time (when total soluble solids range between 18-20° Brix.
- Physical characters of bunches: Mean number of bunches per vine, mean bunch weight (g), mean bunch length (cm), mean number of berries per bunch(10 bunches per vine were used for each pruning level)
- Physical characters of berries: Mean weight of 100 berries (g), mean number of berries in 100g, berry firmness, must yield per 100g.
- Chemical characters of berries: % Total soluble solids according to (Schwallier, 2005), % total sugar (Lane and Eynon 1923), % titratabe acidity(Graham,2004). pH.

Data analysis

experiment was designed in complete randomized blocks, using 3 treatments in three replicates. The variance among varieties was analyzed for each trait by one way ANOVA analysis, LSD5% was calculated to compare means.

RESULTS AND DISCUSSION

Buds behavior

The results showed that the highest bud burst percentage was (71.5%) in 4 buds/cane treatment, without significant variance among treatments and years. While as, the highest fertility buds percentage was (76.0%) in 8 buds/ cane treatment with significant variance with 6 buds/cane treatment (Table 1), the first year of study showed also significant variance in fertility percentage (86.9%) with the second and third year (60.3% and 65.6% respectively). Fertility coefficient was insignificantly the highest in 4 buds/cane treatment (170.8) among treatments, however the first year of study showed significant variance in fertility coefficient (221.8) with the second and third year (118.7 and 72.2 respectively). This result was in accordance with (Al-Halbai *et al*.,2017), they demonstrated that the highest fertility buds laid in the fifth based buds in wine grape cultivars like Cabrenet Sauvignon and Quartz treminer. Varieties responded differently for different levels of pruning, Grenache variety revealed the highest fertility buds in 8 buds/cane pruning treatment, while it was minimum (60%) in the variety Cabernet Sauvignon in 4 buds/cane pruning treatment (Chalak *et al*., 2011)

Table 1. Effect of different pruning levels on the mean of Bunch physical traits Caringnan cultivar

treatment	of Bud burst (%)	Fertility buds (%)	Fertility coefficient
4 buds / cane	71.5	70.6 ab	170.8
6 buds / cane	63.6	66.4 b	109.7
8 buds / cane	64.6	76.0 a	132.2
LSD5%	**-**	**9.5**	**-**

Different letters (a,b)in the same column indicate to significant variance

Yield

The data presented in Figure 1 revealed that the 4 and 8 buds/ cane treatments were significantly higher than 6 buds / cane treatment during the years of study, the mean yield was 15.0, 9.2 and 14.0 kg/vine in 4 buds, 6 buds and 8 buds/cane respectively. It is clear from Figure 1 the differences in yield between years but without significant variance, The effect of pruning levels on yield parameters is not always consistent from year to year as shown in a four years study conducted by Freeman *et al*. (1979). This result was in accordance with (Chalak *et al*., 2008), they found that the maximum yield (3.80 kg/vine) was recorded in the variety Pinot Noir in 4 buds/cane pruning treatment. Also, long pruning treatment gave the chance to more fertility buds which contributed to increase the yield (Almanza-Merchán *et al*., 2014). Hence, the effect of pruning treatment on yield differed due to the studied cultivar and pruning level (Chalak et al., 2011).
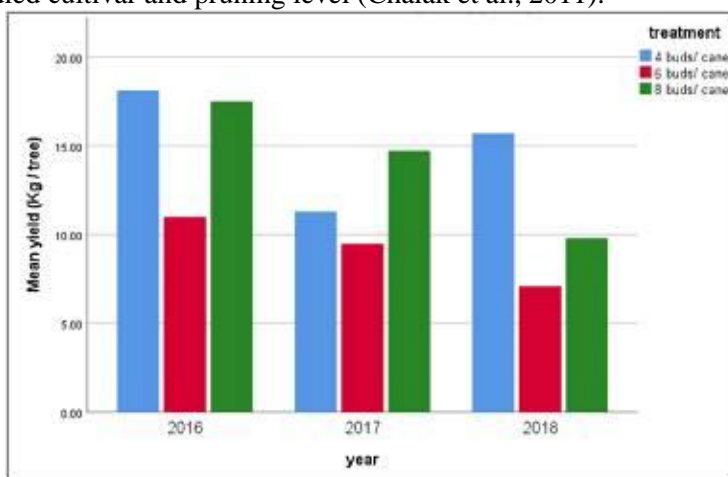

Figure (1): Effect of different pruning levels on yield of
Caringnan cultivar. LSD5% between pruning levels = 4.82

Bunch physical traits

The highest mean number of bunches was in 4 buds/cane treatment (109.0 bunches), followed by treatment 8 buds/cane (99.7 bunch). While the lowest mean bunch weight was in treatment 4 buds/cane (133.8 g), and the highest mean bunch weight was (163.0 g) in treatment 8 buds/cane. This result was in line with (Chalak et al., 2011) in Cabernet Franc cultivar, it was the maximum (121.87 g) in 8 buds/cane pruning treatment. On the other hand, the 6 buds/cane treatment revealed the highest mean bunch length (17.0 cm) and berries number/ bunch (132.8 berries). The results in Table 2 showed that the differences between pruning levels were insignificant in all studied bunch physical traits, as well as between studied years in mean bunch number, while in mean bunch weight the second year was significantly higher (167.3 g) than first year (134.5 g), and also showed significant variances with third year in bunch length and berries number / bunch.   Chalak *et*

al. (2011) found that the two pruning levels 4 and 8 buds/cane recorded the maximum number of bunches in Cabernet Franc cultivar (69.7 and 76.16 bunches/vine). Light pruning treatments lead to produce more number of sprouted buds than in severe pruning treatments. This increased total number of sprouted buds in light pruning treatments ultimately reflected into more number of bunches (Main and Morris, 2008).

Table 2. Effect of different pruning levels on bunch physical traits of Caringnan cultivar.

treatment	Mean No. of Bunches/vine	Mean Bunch Weight (g)	Mean Bunch Length (cm)	Mean No. of Berries/Bunch
4 buds / cane	109.0	133.8	14.9	107.7
6 buds / cane	78.7	144.4	17.0	132.8
8 buds / cane	99.7	163.0	16.7	119.0
LSD5% between pruning levels	-	-	-	-

Berry physical traits

The data presented in Table 3 showed that the mean weight of 100 berries was the highest in 8 and 4 buds/cane treatments (195.6 and 189.4g, respectively) with significant variance with 6 buds /cane treatment. The 6 buds/ cane pruning treatment revealed the highest mean berries number/100g (66.0 berries) with significant variance in the comparison with the two other treatments. However, mean berry firmness and must yield showed insignificant variance among all studied treatments which is in line with (Souzaleao and Lima, 2016). When we compared between the years of study, the second year showed significant differences with the two other years for all studied berry physical traits .Sabbatini *et al*. (2015) stated that the increase of bunches number negatively reflected on bunches and berries weight. However, the number of berries in 100g affected by the nutrition status of vine and pruning level (Zheng Song *et al*.,2015).

Table 3. Effect of pruning levels on berry physical traits of Caringnan cultivar.

treatment	Mean 100 berries weight (g)	Mean berries number/100 g	Mean berry firmness (kg/cm^2)	Mean must yield (ml/100 g)
4 buds / cane	189.4 a	56.0 b	0.7	58.8
6 buds / cane	170 b	66.0 a	0.5	59.3
8 buds / cane	195.6 a	55.7 b	0.6	66.2
LSD5% between pruning levels	**18.2**	**3.82**	-	-

Different letters (a,b) in the same column indicate to significant varianceBerry chemical traits

The 4 buds/ cane pruning treatment significantly showed the highest values of TSS, total sugar and pH (23.1 %, 20.5 % and 3.90, respectively), followed by 6 buds / cane treatment (21.2 %, 18.8 % and 3.72 respectively) which in turn differed significantly than 8 buds / cane except in pH (Table 4). While as, the 6 buds/ cane treatment significantly showed the highest total acidity (0.71 %). When we compared between the years of study, the difference were significant in TSS, total sugar and total acidity, while in pH the third year significantly revealed the maximum value. Kilby *et al*. (1999) found that the total soluble solids decreased with the increase of buds/cane.

Table 4. Effect different pruning levels on berry chemical traits of Caringnan cultivar

Treatment	TSS (%)	Total sugar (%)	Total acidity(%)	pH
4 buds / cane	23.1 a	20.5 a	0.50 c	3.90 a
6 buds / cane	21.2 b	18.8 b	0.71 a	3.72 b
8 buds / cane	19.3 c	18.0 c	0.60 b	3.75 b
LSD5% between pruning levels	**0.9**	**0.79**	**0.02**	**0.09**

Different letters (a,b,c) in the same column indicate to significant variance

CONCLUSION

It is evident from the results the effective role of determining the level of pruning treatments in Carignan wine grape cultivar and its impact on fertility, production characteristics and quality characters of this wine grape cultivar.

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