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# Influence of pruning severity on quality attributes in berries of grape cv. Italia

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**ABSTRACT**

Pruning is one of the important cultural operations in grape and standardization of pruning levels for any grape cultivar is of utmost importance for obtaining optimum yield and quality. It tends to influence growth control, crop load and also the bunch quality in any cultivar. Proper canopy management in grapevine not only influences the photosynthetic activity and yield, but also the quality. A field experiment was conducted to study the effect of pruning severity on quality related attributes in grape (Vitis vinifera L.) cv. Italia at Horticultural College and Research Institute, TNAU, Coimbatore in two seasons namely summer and winter season crop. The pruning treatments were replicated four times with four vines per replication in a randomized block design. The results revealed that for optimum berry quality, the treatment 'T3' i.e., Pruning 50% of the canes for crop yield and 50% of the canes for vegetative growth was found to perform better in both the seasons.

**Keywords:** Grape, Pruning severity, Crop load, Quality.

## 1. INTRODUCTION

In India, grape is considered as one of the most lucrative fruit crops, which is grown in a variety of climates and soils. The berries are a good source of sugars and minerals like Ca, Mg, Fe, and vitamins like B1, B2, and C. Grape has so many uses and are so unique that no fruit can challenge their superiority. It is the most widely cultivated fruit and was carried from region to region by civilized man in all the temperate climates. More than 80 per cent of the area of grape cultivation is under the tropical region, totally different from its natural habitat. The prevailing tropical climate in Tamil Nadu is tributary for certain varieties of grape that it is possible to obtain two crops in a year, and in certain parts of Tamil Nadu, even five crops in a period of two years is also possible (Rao, 1969).

Crop load is the most important factor affecting yield and cluster quality as well as vine vigor of both seeded and seedless varieties (El-Baz et al., 2002) in which, pruning found to influence the growth, crop load and also directly with the quality of bunches. In grape vines, striking a balance between vigour and capacity to produce quality bunches is highly essential. Otherwise, the vines become exhausted resulting in poor quality bunches besides the vines become increasingly susceptible to pests and diseases. Heavy bearing of vines results in poor quality fruits with low TSS and high fruit acidity.

Velu (2001) standardized the canopy management practices for the predominantly grown cultivar 'Muscat' and recommended pruning of 67 per cent of the canes to 5 bud level for fruiting and 33 per cent of the canes to 2 bud level for vegetative growth, as the best treatment for high yield and quality of bunches.

Pruning all the matured canes to 4 - 5 bud level for fruiting, as adopted by grape growers of Tamil Nadu results in gradual depletion of reserved food materials leading to loss of vigour, quality and early setting of senility in vines. So, proper level of pruning must be practiced in any of the grape cultivar for overcome these constraints and achieving better fruit quality. Recently, an exotic cultivar 'Italia', a green coloured seeded table grape variety is introduced and its performance under Tamil Nadu conditions in both summer and winter seasons is unknown. Keeping the above points in view, it is essential to get scientific information on the impact of various pruning levels on quality related aspects in newly introduced grape cultivar Italia.

## 2. MATERIALS AND METHODS

The present investigation was conducted at the Department of Fruit Crops, Tamil Nadu Agricultural University, Coimbatore. The eight years old grape (Vitis vinifera L.) cv. Italia raised on Dog Ridge rootstocks were trained on the bower system. The field experiment was laid out in randomized block design (RBD) with six treatments and replicated four times. The pruning treatments imposed were as follows: (T1) Pruning all (100%) the canes to 5-6 bud level for crop yield in both summer and winter season, (T2) Pruning 75% of the canes to 5-6 bud level for crop yield and 25% of the canes to 2 bud level for vegetative growth in both summer and winter season, (T3) Pruning 50% of the canes to 5-6 bud level for crop yield and 50% of the canes to 2 bud level for vegetative growth in both summer and winter season, (T4) Pruning 75% of the canes to 5-6 bud level for crop yield and 25% of the canes to 2 bud level for vegetative growth in summer season; Pruning 25% of the canes to 5- 6 bud level for crop yield and 75% of the canes to 2 bud level for vegetative growth during winter season, (T5) Pruning all (100%) the canes to 2 bud level for vegetative growth in summer season; Pruning all (100%) the canes to 5-6 bud level for crop yield during winter season and (T6) Pruning all (100%) the canes to 5-6 bud level for crop yield in summer season; Pruning all (100%) the canes to 2 bud level for vegetative growth during winter season crop.

The influence of pruning severity on several quality parameters such total soluble solids, titrable acidity, TSS: acid ratio, total, reducing and non-reducing sugars, Sugar: acid ratio were recorded during both the seasons. Randomly selected berries in each treatment were used for assessing these quality parameters. The methodologies followed were described as follows;

**Total Soluble Solids:** Total Soluble Solids of the juice squeezed from the pulp were determined by using Carl-Zeiss hand refractometer and expressed as degree Brix at 21°C.

**Titrable acidity:** Titrable acidity was estimated by adopting the method of A.O.A.C (Association of Official Analytical Chemists) (1975) by titrating against 0.1 N NaOH using phenolphthalein indicator and expressed in terms of percentage tartaric acid equivalent.

**TSS:** acid ratio

**TSS:** acid ratio was calculated by dividing TSS (°Brix) by acidity (%).

**Estimation of sugars:** The total, reducing and non-reducing sugars were estimated as per the method suggested by Somogyi (1952) in randomly selected berries from bunches under each treatment and expressed in percentage.

**Sugar-acid ratio:** The Sugar-acid ratio was calculated by dividing total sugar content with acidity.

## 3. RESULTS

Quality in grape has historically been defined by berry maturity, the concentration of soluble solids in fruits and the sugar-acid ratio. Generally, quality could be judged by certain chemical components like total soluble solids, acidity and sugar-acid ratio etc.

**Total Soluble Solids:** The data recorded on 'Total soluble solids' in grape berries of cv. Italia revealed that during summer, 'Total Soluble Solids' showed no significant difference among the treatments (Table 1). However, the maximum 'Total Soluble Solids' was recorded in the treatment T5 (14.82°Brix) and the minimum 'Total Soluble Solids' was observed in T6 (14.33°Brix). In winter season, 'Total Soluble Solids' significantly differed between the treatments. Among, T6 registered the maximum 'Total Soluble Solids' (13.75°Brix), which was followed by T4 (13.67°Brix). The minimum 'Total Soluble Solids' was registered in T1 and T5 (12.93 and 12.95°Brix), which were on par with each other.

**Titrable acidity:** The data recorded on 'Titrable acidity' in grape berries of cv. Italia showed that significant differences were observed among the treatments during summer (Table 1). In summer, the treatment T5 registered the least 'Titrable acidity' content (0.59 per cent) followed by T3 (0.60 per cent), which were on par with each other. The maximum 'Titrable acidity' was registered in both T1 and T6 (0.63 per cent), that were found to be on par with each other. During winter, there was no significant difference observed among the treatments. However, the treatment T6 and T4 exhibited the minimum 'Titrable acidity' (0.63 per cent). The maximum 'acidity' content was recorded in both T1 and T5 (0.65 per cent).

**TSS: acid ratio:** The data recorded on 'TSS: acid ratio' in grape berries of cv. Italia revealed that Significant difference among the treatments were recorded in both seasons (Table 1). During summer season, the maximum 'TSS: acid ratio' was observed in T5 (25.12), followed by T3 (24.50). The minimum 'TSS: acid ratio' was recorded in T6 and T1 (22.75 and 22.78), which were on par with each other. In winter, maximum 'TSS: acid ratio' was noticed in T6 (21.83), followed by T4 (21.70). The minimum 'TSS: acid ratio' was observed in T1 (19.82), which was on par with T¬5 (19.92).

**Table.1.Effect of pruning severity on 'TSS (°Brix)', 'Titrable acidity (%)' and 'TSS: acid ratio' in grape cv. Italia**

| Treatments | 'TSS (°Brix)' | | 'Titrable acidity (%)' | | 'TSS: acid ratio' | |
|---|---|---|---|---|---|---|
| | Season I (Summer crop) | Season II (Winter crop) | Season I (Summer crop) | Season II (Winter crop) | Season I (Summer crop) | Season II (Winter crop) |
| **T1** | 14.35 | 12.93 | 0.63 | 0.65 | 22.78 | 19.82 |
| **T2** | 14.52 | 13.20 | 0.61 | 0.64 | 23.80 | 20.63 |
| **T3** | 14.70 | 13.58 | 0.60 | 0.64 | 24.50 | 21.22 |
| **T4** | 14.55 | 13.67 | 0.61 | 0.63 | 23.85 | 21.70 |
| **T5** | 14.82 | 12.95 | 0.59 | 0.65 | 25.12 | 19.92 |
| **T6** | 14.33 | 13.75 | 0.63 | 0.63 | 22.75 | 21.83 |
| **SEd** | 0.19 | 0.17 | 0.01 | 0.01 | 0.30 | 0.27 |
| **CD (0.05%)** | NS | 0.36 | 0.02 | NS | 0.65 | 0.57 |

Treatment details:

T1: Pruning 100% of the canes to 5-6 bud level for fruiting in both summer and winter crops.

T2: Pruning 75% of the canes to 5-6 bud level for fruiting and 25% of the canes to 2 bud level for vegetative growth in both summer and winter crops.

T3: Pruning 50% of the canes to 5-6 bud level for fruiting and 50% of the canes to 2 bud level for vegetative growth in both summer and winter crops.

T4: Pruning 75% of the canes to 5-6 bud level for fruiting and 25% of the canes to 2 bud level for vegetative growth in summer; Pruning 25% of the canes to 5-6 bud level for fruiting and 75% of the canes to 2 bud level for vegetative growth during winter crop.
T5: Pruning 100% of the canes to 2 bud level for vegetative growth in summer; Pruning 100% of the canes to 5-6 bud level for fruiting during winter crop.
T6: Pruning 100% of the canes to 5-6 bud level for fruiting in summer; Pruning 100% of the canes to 2 bud level for vegetative growth during winter crop.

**Reducing sugar:** Observations recorded on 'reducing sugar' in berries are presented in Table 2. Significant differences were exhibited among the treatments in both seasons. In summer, the treatment T3 registered the maximum percentage of 'reducing sugars' (13.02 per cent). The minimum 'reducing sugar' content was recorded in T6 and T1 (12.25 and 12.28 per cent), which were on par with each other. During winter also, the treatment T3 recorded the maximum 'reducing sugar' content (12.07 per cent). The minimum 'reducing sugar' content was observed in T5 (11.11 per cent), which was on par with T1 (11.13 per cent).

**Non-reducing sugar:** Observations recorded on 'non-reducing sugar' in berries are presented in Table 2. Significant difference among the treatments were recorded in both seasons. During summer season, the treatments T6 recorded the highest 'non-reducing sugar' content (1.55 per cent) and the lowest 'non-reducing sugar' content was shown by the treatment T3 (1.30 per cent). In winter, the treatment T1 recorded the highest 'non-reducing sugar' content (1.35 per cent). The minimum value on 'non-reducing sugar' was recorded in T3 (1.05 per cent).

**Table.2.Effect of pruning severity on 'Reducing and Non-reducing sugar' content (%) in grape cv. Italia**

| Treatments | 'Reducing sugar (%)' | | 'Non-reducing sugar (%)' | |
|---|---|---|---|---|
| | Season I (Summer crop) | Season II (Winter crop) | Season I (Summer crop) | Season II (Winter crop) |
| $T_1$ | 12.28 | 11.13 | 1.54 | 1.35 |
| $T_2$ | 12.70 | 11.54 | 1.46 | 1.21 |
| $T_3$ | 13.02 | 12.07 | 1.30 | 1.05 |
| $T_4$ | 12.73 | 12.00 | 1.45 | 1.08 |
| $T_5$ | 12.62 | 11.11 | 1.43 | 1.32 |
| $T_6$ | 12.25 | 11.92 | 1.55 | 1.13 |
| SEd | 0.16 | 0.15 | 0.02 | 0.03 |
| CD (0.05%) | 0.34 | 0.32 | 0.04 | 0.06 |

Treatment details
T1: Pruning 100% of the canes to 5-6 bud level for fruiting in both summer and winter crops.
T2: Pruning 75% of the canes to 5-6 bud level for fruiting and 25% of the canes to 2 bud level for vegetative growth in both summer and winter crops.
T3: Pruning 50% of the canes to 5-6 bud level for fruiting and 50% of the canes to 2 bud level for vegetative growth in both summer and winter crops.
T4: Pruning 75% of the canes to 5-6 bud level for fruiting and 25% of the canes to 2 bud level for vegetative growth in summer; Pruning 25% of the canes to 5-6 bud level for fruiting and 75% of the canes to 2 bud level for vegetative growth during winter crop.
T5: Pruning 100% of the canes to 2 bud level for vegetative growth in summer; Pruning 100% of the canes to 5-6 bud level for fruiting during winter crop.
T6: Pruning 100% of the canes to 5-6 bud level for fruiting in summer; Pruning 100% of the canes to 2 bud level for vegetative growth during winter crop.

**Total sugar:** Observations recorded on 'total sugar' in berries were given in Figure-1. Significant differences among the treatments were recorded in both seasons. In summer, the treatment $T_3$ recorded the maximum percentage of 'total sugar' (14.32 per cent). The minimum percentage of 'total sugar' was recorded in treatment $T_6$ and $T_1$ (13.80 and 13.82 per cent), which were on par with each other. During winter, the treatment $T_3$ showed the maximum percentage of 'total sugars' (13.12 per cent) followed by $T_4$ (13.08 per cent), that were on par with each other. The minimum 'total sugars' was registered in $T_5$ (12.43 per cent), which was found to be on par with $T_1$ (12.48 per cent).

**Sugar-acid ratio:** Observations recorded on 'Sugar-acid ratio' was computed and presented in Figure-2. Significant differences among the treatments were observed in both seasons. In summer season, among the treatments, T3 recorded the highest 'Sugar-acid ratio' (23.87) followed by T5 (23.81). The minimum 'Sugar-acid ratio' was recorded in T6 and T1 (21.90 and 21.94), which were on par with each other. In case of winter, $T_4$ recorded the highest 'Sugar-acid ratio' (20.76). The minimum 'Sugar-acid ratio' was registered in $T_5$ and $T_1$ (19.12 and 19.13), which were on par with each other.

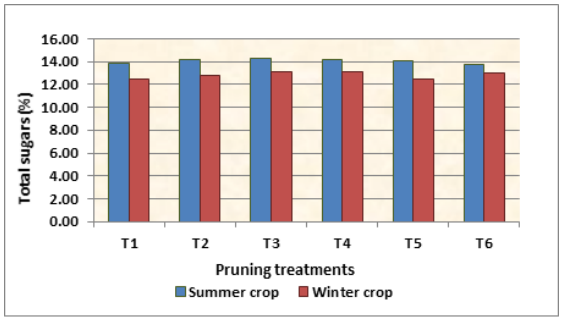


**Figure.1.Effect of pruning severity on 'Total sugar content (%)' in grape cv. Italia**

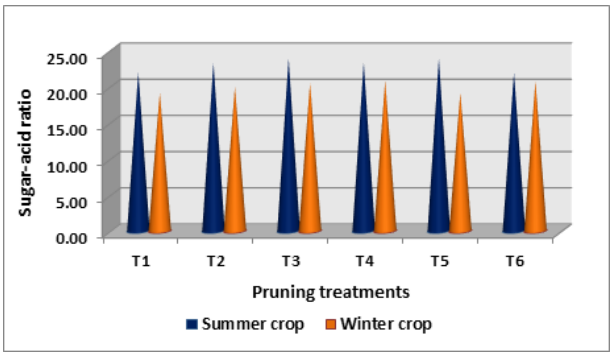


**Figure.2.Effect of pruning severity on 'Sugar-acid ratio' in grape cv. Italia**

## DISCUSSION

In the present study, invariably, severely pruned vines had produced bunches with higher 'TSS', 'TSS: acid ratio' and lesser acidity in both seasons than minimally pruned vines. This clearly indicates that crop load has a negative effect on the quality of bunches and therefore, regulation of crop load is essential in order to produce quality bunches. This was evident with the report of Zabadal *et al.* (2002) that the vines with heavy fruit loads may not ripen to desired soluble solids in climates with short growing season. Cus (2004) also reported that higher crop load per vine causes lower soluble solids and higher titrable acidity. Thus, the severity of pruning has a profound effect on the quality in grape.

The data in respect of sugars such as 'total sugars' and 'sugar-acid ratio' showed that among the treatments, $T_3$ registered the maximum percentage of reducing sugars and total sugars in both the seasons, but sugar-acid ratio in summer alone. The reason for accumulation of high reducing and total sugar content in balanced pruning for reproductive and vegetative growth might be due to the occurrence of optimum number of bunches per vine and there was a lesser competition for metabolites. These results are in accordance with the lines of Mohanakumaran *et al.* (1964) and Singh and Kumar (1980). The predominant acids of grape *viz.*, malic and tartaric acids are synthesized in leaves. These acids are translocated from leaves to bunch. This higher quantum of acids might have deposited in bunch during development and this could have caused higher acidity in less intensive pruning treatments (Brar *et al.*, 1986; Sehrawat *et al.*, 1998; Chougule, 2004; Somkuwar and Ramteke, 2007 and Harikanth, 2013).

Considering the seasonal effect, in the present study, it is evident that there was an increased sugar levels in summer than in winter. This might be due to lower amount of sun light intercepted by the grape berries in winter which emphasize the necessity of solar radiation for conversion of starch into sugars. The prevalence of high temperature during summer encouraged more respiration, thus ultimately resulting in higher utilization of organic acids in the catabolic process of the plants (Sumathi, 2007).

## 4. CONCLUSION

So, based on the performance of grape cv. Italia through certain quality related parameters by various pruning levels, it is inferred that the treatment $T_3$ (*i.e.*, pruning 50% of the canes to 5-6 bud level for fruiting and 50% of the canes to 2 bud level for vegetative growth) in both summer and winter season crops is found to be best.

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