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Impact of canopy management on fruit quality of wine grapes under northern dry zone of Karnataka

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Abstract
The study was conducted to know the "Impact of canopy management on fruit quality of wine grapes under northern dry zone of Karnataka" at division of fruit science, UHS, Bagalkot during 2015-16. For the study, varieties and cane regulation were considered as main and sub treatments respectively. The study showed significant differences within the varieties in quality parameters such as, TSS to acid ratio (36.92) and non-reducing sugars (1.92 %) were maximum in Shiraz. Grenache Blanc recorded the maximum per cent of titrable acidity (0.61 %). Significantly, the highest juice content of the berry (42.75 ml/50g) was recorded in Medika. Among the cane regulation treatments, significant differences were found between the different levels of cane regulation with respect to quality parameters. Vines with 25 canes, recorded significantly the maximum content of TSS (22.12^0 Brix), juice content of berry (43.22 ml/50g), total sugar (19.39 %) and reducing sugar (17.50 %).Hence, the cane regulation is essential form of thinning in vineyard operation and considered as a technique which could lead to tremendous improvement in quality parameters of wine grapes and helpful for quality wine production.

Keywords: Wine grape, canopy, cane regulation, fruit quality

Introduction
Grape (*Vitis vinifera* L.) belongs to the family Vitaceae, originated in Caucasia or Asia Minor. The grape is one of the ancient fruit crops of India and which is cultivated in an area of 1.19 lakh hectare with the production of 25.85 lakh tons and productivity of 21.80 MT/ha (NHB, 2014) [6]. Historically, it is grown mostly for wine making in the world over. Wine grape cultivation is gaining strong impetus in tropical climatic conditions of the world. In contrast, prominent area and production accounts for table grapes in India, while wine grapes are grown over an area of 5.00 thousand hectares with annual production of 50.00 thousand tones for production of 25.00 million liters of wine (NHB, 2014) [6].

In India, approximately 72-76 per cent of the production goes for table purpose, 22-24 per cent raisin, 3.50 per cent for wine and 0.50 per cent for juice due to limited domestic consumption of wine (annual per capita consumption of wine in the country is a mere 9 milliliters, approximately 1/8000th that of France).

In wine grapes, quality characters of grapes is more important than the yield. Quality is generally influenced by canopy management. Among the viticulture practices, crop load adjustment should be considered as one of the technical cultural practices suitable to modify grapevine physiology and plant production towards a defined goal (Mattii and Ferrini, 2005) [4]. Higher number of shoots per vine, *i.e*. increased shoot density impairs the productivity of shoots. Therefore, foundation pruning is done to develop shoots at this rate and their vigour may be curtailed by either pinching or thinning of shoots.

Taking into account, the fruit production habit wherein the plants produce clusters in the last growth branches (vine leaves) that originate in the development of the previous season (vine shoots), cane regulation is used to limit the number of canes, creating a balance between vigour and production, regulating the productive and vegetative potential and avoiding the aging of the vine. Therefore, cane regulation allows for the distribution of load units in the plants and yields in the good number of berry and size of the clusters with better quality.In the present investigation, attempts were made to know the impact on quality of vine by striking a balance between vigour and capacity through regulating the number of canes per vine in Shiraz Medika and Grenache Blanc.

Methodology

The study was conducted at the Division of Fruit Science, Sector 70, the Main Horticultural Research and Extension Center, Bagalkot during 2015-16. It is situated under northern dry zone of Karnataka (Zone-3 and Region II). The average annual rainfall of 548 mm, average temperature of 23.01°C and mean relative humidity ranged from 32-92 per cent. The experimental design adopted for the present investigation was split plot design with three main treatments (V_1-Shiraz, V_2-Medika and V_3-Grenache Blanc) four sub treatments- cane regulation (C_1- Control, C_2-40 canes/vine, C_3-33 canes/vine and C_4-25 canes/vine) and replicated four times.

Total soluble solids in berry juice (T.S.S.) were determined by means of digital hand refractometer having a scale of 0-50°Brix and expressed as degrees Brix. TSS/acid ratio was calculated by dividing TSS (°Brix) by acidity (%).Reducing sugars in the berry preserved in 80 per cent alcohol was estimated as per the Dintro salicyclic acid (DNSA) method (Miller, 1972). The total sugar content present in the berry was estimated by anthrone reagent method. The values obtained were expressed in percentage. The per cent non-reducing sugar was obtained by subtracting the value of reducing sugar from that of total sugar as given by Miller (1972). Juice content of the berries was noted by weighing fifty gram of berries and the juice was extracted. The juice content was measured in volume by weight basis.

Statistical analysis of the data was done by following the Fischer's method of analysis of variance as given by Panse and Sukhatme (1967) [7]. The level of significance used in 'F' and 't' test was p=0.05 and critical difference (CD at 5%) values were worked out whenever 'F' test was significant.

Results and Discussion

The total soluble solids of berry was significantly influenced by different levels of cane regulation and their interaction. Decrease in the number of canes increased the total soluble solids of berry. Vines with 25 canes recorded the maximum (18.97^0 Brix) TSS and minimum in control (16.47^0 Brix) because, as the shoot number is positively correlated to the bunch number but negatively with girth of the cane which impacted on impairment of accumulation of sugars due to insufficient assimilates for the higher crop load. These results are strongly supported by the findings of Main and Morris (2000) [3] that fruits exposed to sunlight are generally rich in total soluble solids and reduced titratable acidity, compared to non-exposed or canopy shaded.

The titrable acidity per cent differed significantly among the treatments (Table 1) Shiraz and Grenache Blanc recorded maximum (0.61 %) compared to Medika (0.59%) this might be due to high sugar and low acid content berries. Medika reported to have the maximum TSS which negatively correlated to the per cent titatble acidity. The per cent titrable acidity significantly increased with increase in number of shoots per vine. Among different levels of cane regulations, vines without cane regulation (control) maximum (0.66 %) and minimum (0.55 %) in 25 canes per vine treatment. The reason for this might be the higher number of canes per vine resulted the denser canopy and decreased the interception of light hence hindered the reduction of acid at the time of berry maturity. These results were in line with the report of Jogaiah *et al*. (2012) [2] and Shikhamani *et al*. (2008) [8].

Varieties and different cane regulation significantly impacted on the juice content of berry (Table 1). Among varieties, Medika (42.75 ml/50g) reported to significantly maximum and minimum in Shiraz (37.00 ml/50g). Medika being the vigorous reported to be superior in growth attributes and has been reflected in the bold berry size which might have contributed for maximum juice content. The genotypic character of Shiraz bearing three seeds per berry has negatively impacted on the juice content. With respect to cane regulation, significant difference in the juice content of the berry ranged from 43.22 ml/50g (25 canes per vine to 36.11 ml/50g (control). The higher crop lodged vines presented the minimum juice content due to smaller berry size leading to reduced pulp because of insufficient carbohydrates availability as well as shading effect of denser shoots impacted on the quality of berries. The similar results were noticed by Bravdo *et al*. (1984) [1] in Carignane grape vine.

TSS to acid ratio was significantly influenced by the varieties and cane regulation treatments, but interaction was resulted to be non-significant. Medika (30.59) had significantly, the highest TSS to acid ratio and the lowest in Grenache Blanc (29.03). This might be due to lesser leaf size of the lesser inter-nodal length of the Grenache Blanc might have created shade to bunches which resulted for the more acidic berries hence, the ratio was lowest. Similar findings were given by Veena *et al*. (2013) that, white varieties have the lesser inter-nodal length, lesser leaf size and more number of leaves compared to red varieties of grape. The vines from without cane regulation (to 25 canes per vine resulted significant difference this reduction in the quality by increase in the ratio is might be due to increase in number of bunches per vine and consequent dilution of sugars in berries and increase in acid content of the berry.

Sugar content of the berry was found to be non-significant with varieties (Table 1) but significantly influenced by the various levels of cane regulation except non-reducing sugar which was significantly differed by the varieties. Shiraz reported the more (1.92 %) of non-reducing sugar; this might be due to lesser amount of reducing sugar compared to total sugar. The canes regulated with 25 canes recorded significantly the maximum per cent of total (19.39 %) and reducing (17.50 %) sugars and minimum by control treatment.

Conclusion

Among the varieties with respect to quality for wine making Shiraz resulted better, with optimum TSS, acidity and TSS to acid ratio. Among the different level of cane regulation, vines regulated with 25 to 29 canes produce the good quality grapes for preparing quality wine. From the study, it can be clearly stated as, cane regulation is essential form of thinning in vineyard operation and considered as a technique which could lead to tremendous improvement in quality parameters of wine grapes and helpful for quality wine production.

Table 2: Influence of cane regulation on quality parameters of wine grapes (V*itis vinifera* L.)

Treatments	TSS (°Brix)	Acidity (%)	TSS to acid ratio	Juice content (v/w)	Total sugar (%)	Reducing sugar (%)	Non-Reducing sugar (%)
V_1- Shiraz	17.48	0.61	29.05	37.00	18.38	16.38	1.92
V_2- Medika	18.73	0.59	30.59	42.75	18.43	16.81	1.68
V_3-Grenache Blanc	17.13	0.61	29.18	38.17	17.25	15.56	1.67
C.D. at 5%	NS	0.02	0.63	2.42	NS	NS	0.05

C_1-Control		16.47	0.55	29.88	36.11	16.34	14.88	1.47
C_2- 33 canes/vine		17.47	0.56	31.15	31.15	17.76	15.74	1.91
C_3-29 canes/vine		18.23	0.64	28.61	28.61	18.6	16.88	1.8
C_4-25 canes/vine		18.97	0.66	28.8	28.8	19.39	17.5	1.87
C.D. at 5%		3.31	NS	1.20	3.16	0.21	0.18	NS
C.D. at 5%	V at same or different C	NS	NS	NS	NS	NS	NS	NS

V-Variety, C- Cane, NS- Not significant

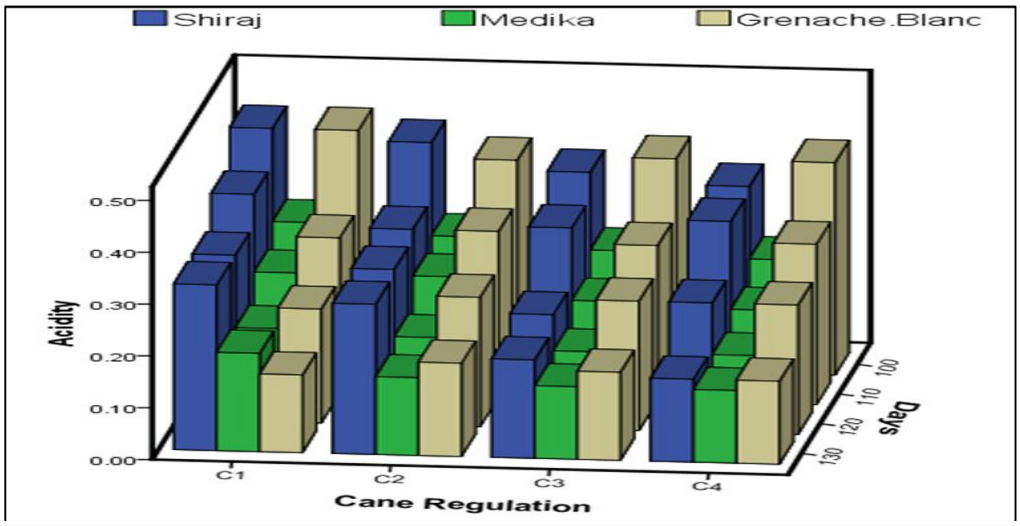

Fig 1: Influence of varieties and cane regulation on acidity (%) on berry of wine grapes

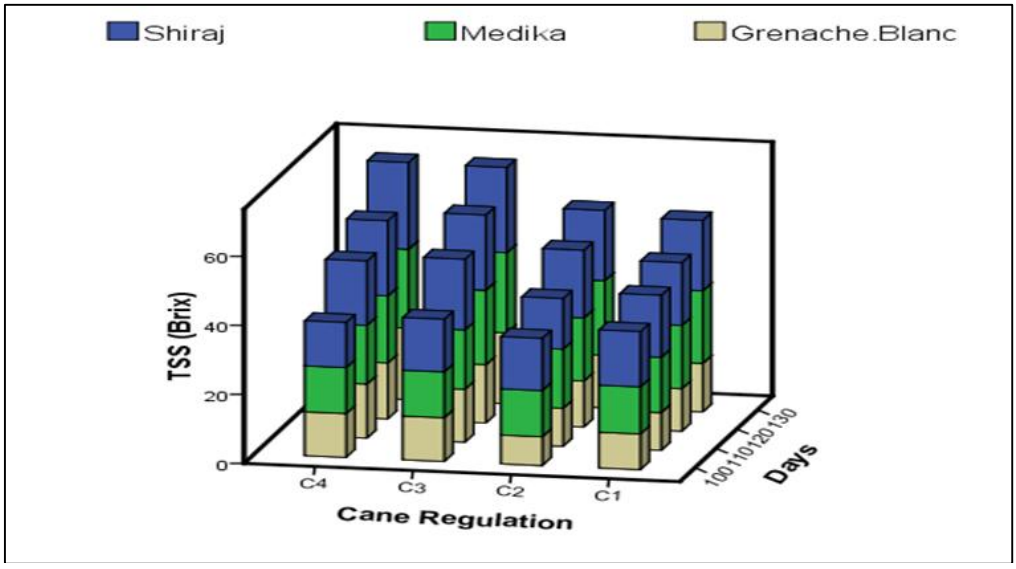

Fig 2: Influence of varieties and cane regulation on total soluble solids (^{0}Brix) on berry of wine grapes

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