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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 775-778

www.thepharmajournal.com
Received: 02-08-2021
Accepted: 28-09-2021

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Combined effect of cane regulation and crop load on quality parameters of wine grape cv. Chenin Blanc

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Abstract
A field experiment on effect of cane regulation and crop load on quality parameters of wine grape cv. Chenin Blanc was carried out during 2017-2018 at grape orchard, MHREC, UHS, Bagalkot. Vines with 25 canes, recorded significantly the maximum content of TSS (22.54 ° Brix), TSS to acid ratio (83.46), brix yield (7.55 ° Brix) and total sugar (19.28%).With reference to the different levels of bunch thinning with respect to quality parameters. Vines with 20 bunches, recorded significantly the maximum content of TSS (22.55 ° Brix), TSS to acid ratio (80.25), brix yield (7.02° Brix) and total sugar (18.99%). In interaction, the highest TSS (242.88 ° Brix) and total sugar (19.33%) was recorded in Chenin Blanc regulated at 25 canes/vine with 20 bunches/vine treatment.

Keywords: Combined, cane, regulation, parameters, Blanc

Introduction
Chenin Blanc is a white wine grape variety from the Loire valley of France. Chenin Blanc is a versatile white-wine grape variety that has been cultivated in France for nearly 1300 years. Its high acidity means it can be used to make everything from sparkling wines. The variety buds early and ripens late, making frost a risk in the cooler parts of the world. Chenin Blanc may be crafted to any level of sweetness, ranging from bone-dry, crisp and sparkling, through to sweet dessert wines.

Crop load manipulation techniques such as cane regulation and cluster thinning are often applied to influence quality parameters in grape.Vine balance, better described as the source/sink ratio, relates vine vegetative and reproductive growth, either through number of canes per vine or through the number of bunches per vine.Pruning and crop load adjustment were evaluated in order to improve the fruit quality.

Material and Methods
The present investigation was carried out during 2017-2018 at grape orchard, MHREC, UHS, Bagalkot to study the effect of cane regulation and crop load on quality parameters of wine grape cv. Chenin Blanc. Cultural practices were uniform for all the vines, irrespective of the treatments. The canes were regulated at four leaf stage after back pruning with secateursThe experiment consisting of two factors each at four levels was laid out in a Factorial Randomized Complete Block Design (FRBD) with two replications. The first factor included three cane regulation with a control. The second factor which included three bunch thinning with a control. In each vine, 3 canes were selected randomly and tagged for detailed observation after fore (fruiting season) pruning of 2018.

Treatment Details

Factor A: Number of canes per vine	Factor B: Number of bunches per vine
C_1: Control	B_1: Control
C_2: 40 canes/vine	B_2: 20 Bunches/vine
C_3: 33 canes/vine	B_3: 30 Bunches/vine
C_4: 25 canes/vine	*B_4: 40 Bunches/vine*

Treatment combination : C_1B_1, C_1B_2, C_1B_3, C_1B_4, C_2B_1, C_2B_2, C_2B_3, C_2B_4, C_3B_1, C_3B_2, C_3B_3, C_3B_4, C_4B_1, C_4B_2, C_4B_3, C_4B_4

The total soluble solids of juice (TSS) was recorded at fortnightly intervals from veraison with the help of Erma (0 to 32%) hand refractometer and it t was expressed in degree Brix (°B).

The acidity was determined in terms of tartaric acid by diluting the juice extracted from five gram of sample and filtered through muslin cloth and made up to known volume with distilled water (100 ml). From this, five ml of aliquot was taken and titrated against standard NaOH (0.1 N) using a phenolphthalein as indicator. The appearance of light pink colour was recorded as the end point. The values were expressed in terms of tartaric acid per cent titrable acidity of the fruits (Ranganna, 1977).

$$\text{Acidity \%} = \frac{\text{Titrable value} \times \text{Normality of NaOH} \times \text{volume made up} \times \text{Equivalent weight of acid}}{\text{Volume of sample for estimation} \times \text{weight or volume of sample taken} \times 1000}$$

The brix- yield per 15 berries was calculated at the time of harvest after harvesting by the following formula;

$$\text{Brix- yield/15 berries} = \frac{\text{Weight of 15 berries (g)} \times \text{T.S.S}}{100}$$

Total sugar was recorded according to its standard procedures (Ranganna., 1977). The data collected on different parameters were subjected to statistical analysis (Panse and Sukhatme, 1967).

Result and discussion

The data in the Table 1 &2 indicated the effect of cane regulation, bunch thinning and their interaction on the total soluble solids and titrable acidity of Chenin Blanc berries.

The significant increase in TSS and decrease in acidity of berries by cane regulation from control *i.e.*.without cane regulation treatment to 25 canes per vine. Among the various levels of cane regulation, the Chenin Blanc vines regulated at 25 canes per vine recorded the highest TSS (8.73^{0}Brix) and the lowest acidity (0.33%) of berries at 15th day after veraison, while, the lowest TSS (6.20^{0}Brix) and the highest acidity (0.42%) was recorded in vines without cane regulation treatment. Similar trend was recorded at 30th and 45th day after veraison. Similar result were reported by Singhrot *et al.*, (1977) [5] and revealed that, TSS was negatively correlated with number of buds per cane.

With respect to the various levels of bunch thinning at 15th day, the highest total soluble solids (9.06^0 Brix) and the lowest acidity (0.33%) was noted in 20 bunches per vine. Significantly, the lowest total soluble solids (6.53^0 Brix) and the highest acidity (0.43%) was recorded in control. Similar trend wasrecorded at 30th and 45th day after veraison.

The interaction effects between level of cane regulation and bunch thinning was found to be significant on only TSS. However, the highest TSS was recorded in Chenin Blanc vines regulated at 25 canes/vine with 20 bunches/vine treatment (9.33^0 Brix). The treatment without cane regulation and bunch thinning recorded the minimum total soluble solids (4.25^{0}Brix).Similar result was recorded at 30th and 45th day after veraison. These findings are in agreement with Bhujbal (1972) [1] in Thompson Seedless grape vine, when the vines were pruned to 4, 6, 8 and 10 buds per cane keeping 16 canes per vine, the highest total soluble solids (22.60°Brix) andthe lowest acidity (0.54%) recorded were 8 buds per cane level and minimum TSS (20.60°Brix) and maximum acidity (0.58%) were recorded 16 buds per cane.

The data in the Table 3indicates the effect of cane regulation, bunch thinning and their interaction on the TSS: acid ratio of berries.

Among the various levels of cane regulation, the vines regulated at 25 canes per vine reported the highest TSS: acid ratio of berries (26.77) during 15th day after veraison.The lowest ratio was recorded in vines without cane regulation treatment (15.39).Similar trend was recorded at 30th and 45th day after veraison. These findings are in agreement with Joon and Singh (1983) [3] in Delight and reported that TSS/acid ratio decreased significantly with a decrease in pruning intensity.

In the various levels of bunch thinning at 15th day after veraison, the highest TSS: acid ratio was recorded in 20 bunches per vine (27.90) while the lowest TSS: acid ratio was recorded in control treatment (15.38).Similar trend was recorded at 30th and 45th day after veraison.

The interaction effect between different levels of cane regulation and bunch thinning was found to be non-significant on TSS: acid ratio.

The data on the Brix yield are presented in Table 4. It is clear from the Table that there was significant difference among the cane regulation and bunch thinning levels.

The effect of cane regulation on Brix yield was significant. However, the highest Brix yield was recorded in vines regulated at 25 canes per vine (7.55^0 Brix) while, the minimum Brix yield was recorded in control *i.e.* vines with no cane regulation treatment (5.54^0 Brix). Similar results were reported by Shubangini (2016) in Red Globe.

The mean maximum Brix yield was recorded in vines regulated at 20 bunches per vine (7.02^0 Brix). Whereas, the minimum Brix yield was recorded in control *i.e.* vines with no bunch thinning (6.19^0 Brix).

The interaction effects between level of cane regulation and bunch thinning was found to be non-significant on brix yield. The deterioration in quality might be due to increase in yield in control treatment that leads to dilution of sugars in berries and increase in acid content of the berries. Similar findings have been reported by Chadha and Harish (1970) [2] in Perlette grape.

Significant difference was recorded among the cane regulation, bunch thinning and their interaction showed significant with respect to the total sugar of berries.

With respect to cane regulation, mean total sugar was highest in the vines regulated at 25 canes per vine (19.29%). While, the minimum was recorded in vines with no cane regulation (18.31%). These findings are in agreement with Velu (2001) [7] and recorded that, severely pruned vines registered the highest total sugars (14.36%), reducing sugars (12.72%) and non reducing sugars (1.64%) in grapes cv. Muscat Hamburg.

Irrespective of cane regulation, the maximum mean total sugar was recorded in the vines regulated at 20 bunches per vine (18.99%). While, the minimum per cent of total sugar was recorded in vines with no bunch thinning (18.56%).

The interaction effects between level of cane regulation and bunch thinning was found to be significant on total sugar of the berries. However, the highest total sugar was recorded in vines regulated at 25 canes/vine with 20 bunches/vine treatment (19.44%). While, the minimum total sugar was recorded in vines with no cane regulation and bunch thinning treatment (18.12%). Somkuwar and Ramteke (2006) [6] reported that to produce the quality grapes, it requires careful control of crop size to balance the amount of fruit to vegetative growth, fruit quality and adequate vine growth for consistent productivity. Excess fruit production lead to poor fruit quality and reduced vegetative growth resulting in poor yield in the later years.

Table 1: Combined effect of cane regulation and crop load on TSS (^{0}Brix) of berry at 15, 30 and 45 days after veraison in wine grape cv. Chenin Blanc

Treatment	Days after veraison														
	15th day					30th day					45th day (Harvesting stage)				
	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean
C_1	4.25	8.65	6.05	5.85	6.20	11.45	19.61	17.81	17.30	16.54	20.25	22.25	21.85	21.75	21.53
C_2	5.50	9.00	6.65	6.45	6.90	14.25	19.68	18.01	17.65	17.40	21.00	22.47	22.18	21.96	21.90
C_3	7.98	9.25	8.45	8.15	8.31	15.04	20.05	18.28	17.73	17.62	21.75	22.63	22.36	22.32	22.26
C_4	8.40	9.33	8.62	8.59	8.73	16.05	19.50	19.50	19.00	18.51	22.00	22.88	22.68	22.61	22.54
Mean	6.53	9.06	7.44	7.11		14.20	19.71	18.40	17.77		21.25	22.55	22.27	22.16	
	S.Em±		CD (5%)			S.Em±		CD (5%)			S.Em±		CD (5%)		
C	0.14		0.4			0.26		0.79			0.05		0.16		
B	0.14		0.4			0.26		0.79			0.05		0.16		
C × B	0.27		0.82			0.52		1.57			0.10		0.31		

- C_1-Control C_2-40 canes/vine C_3-33 canes/vine C_4-25 canes/vine
- B_1- Control B_2- 20 Bunches/vine B_3- 30 Bunches/vine B_4- 40 Bunches/vine

Table 2: Combined effect of cane regulation and crop load on titrable acidity (%) of berry at 15, 30 and 45 days after veraison in wine grape cv. Chenin Blanc

Treatment	Days after veraison														
	15th day					30th day					45th day (Harvesting stage)				
	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean
C_1	0.48	0.37	0.41	0.43	0.42	0.43	0.35	0.37	0.37	0.38	0.41	0.34	0.36	0.37	0.37
C_2	0.45	0.36	0.38	0.39	0.39	0.34	0.29	0.33	0.34	0.32	0.33	0.31	0.34	0.34	0.33
C_3	0.41	0.34	0.35	0.35	0.36	0.33	0.27	0.30	0.30	0.30	0.33	0.26	0.30	0.30	0.29
C_4	0.40	0.28	0.32	0.34	0.33	0.32	0.26	0.27	0.27	0.28	0.31	0.25	0.27	0.27	0.27
Mean	0.43	0.33	0.36	0.38		0.35	0.29	0.32	0.32		0.34	0.29	0.32	0.32	
	S.Em±		CD (5%)			S.Em±		CD (5%)			S.Em±		CD (5%)		
C	0.01		0.03			0.01		0.02			0.01		0.02		
B	0.01		0.03			0.01		0.02			0.01		0.02		
C × B	0.02		NS			0.01		NS			0.01		NS		

- C_1-Control C_2-40 canes/vine C_3-33 canes/vine C_4-25 canes/vine
- B_1- Control B_2- 20 Bunches/vine B_3- 30 Bunches/vine B_4- 40 Bunches/vine

Table 3: Combined effect of cane regulation and crop load on TSS to Acid ratio of berry at 15, 30 and 45 days after veraison in wine grape cv. Chenin Blanc

Treatment	Days after veraison														
	15th day					30th day					45th day (Harvesting stage)				
	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean
C_1	8.94	24.15	14.74	13.75	15.39	27.10	57.01	48.20	46.86	44.79	49.48	66.52	61.08	59.82	59.23
C_2	12.13	25.66	17.72	16.69	18.05	42.66	69.35	55.41	52.75	55.04	64.75	74.11	66.30	65.65	67.70
C_3	19.43	27.79	24.25	23.92	23.85	46.70	75.98	63.19	61.99	61.96	67.26	88.73	77.41	77.28	77.67
C_4	21.02	34.00	26.84	25.23	26.77	51.26	75.60	73.33	71.25	67.86	72.62	91.63	84.93	84.67	83.46
Mean	15.38	27.90	20.89	19.90		41.93	69.48	60.03	58.21		63.53	80.25	72.43	71.86	
	S.Em±		CD (5%)			S.Em±		CD (5%)			S.Em±		CD (5%)		
C	0.65		1.95			1.52		4.58			1.59		4.80		
B	0.65		1.95			1.52		4.58			1.59		4.80		
C × B	1.29		NS			3.04		NS			3.1		NS		

- C_1-Control C_2-40 canes/vine C_3-33 canes/vine C_4-25 canes/vine
- B_1- Control B_2- 20 Bunches/vine B_3- 30 Bunches/vine B_4- 40 Bunches/vine

Table 4: Combined effect of cane regulation and crop load on Brix yield and total sugar of the berry in wine grape cv. Chenin Blanc

Treatment	Brix yield (^{0}Brix)					Total sugar (%)				
	B_1	B_2	B_3	B_4	Mean	B_1	B_2	B_3	B_4	Mean
C_1	4.33	6.30	5.75	5.80	5.54	18.12	18.44	18.44	18.27	18.31
C_2	6.45	6.97	6.82	6.67	6.73	18.27	18.75	18.52	18.31	18.46
C_3	6.65	7.10	6.89	6.84	6.87	18.72	19.34	19.12	19.12	19.08
C_4	7.36	7.72	7.60	7.54	7.55	19.12	19.44	19.33	19.27	19.29

Mean	6.19	7.02	6.76	6.71		18.56	18.99	18.85	18.74	
	S.Em±			CD (5%)		S.Em±			CD (5%)	
C	0.13			0.40		0.02			0.05	
B	0.13			0.40		0.02			0.05	
C × B	0.27			NS		0.04			0.11	

- C_1-Control C_2-40 canes/vine C_3-33 canes/vine C_4-25 canes/vine
- B_1- Control B_2- 20 Bunches/vine B_3- 30 Bunches/vine B_4- 40 Bunches/vine

Conclusion

This study suggests that in Chenin Blanc, balanced canopies with number of canes as well as number of bunches per vine which could lead to tremendous improvement in quality parameters of wine grape and helpful for quality wine production.

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