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Short communication

Crop load regulation to improve yield and quality of Manjari Naveen grape

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ABSTRACT

The investigation was carried out to optimize the bunch load to harvest quality grape produce with better profit recovery in Manjari Naveen grapes. Four crop load levels *viz*. 40, 60, 80 and 100 bunches/vine at spacing of 3.0 m × 1.83 m were studied for quality traits. The data showed decreasing trend with increase in crop load levels for berry diameter, berry length, berry weight, bunch weight and total soluble solids. Higher acidity was recorded at 80 and 100 bunch load. Vines with higher bunch load took an extra one week to attain veraison and harvest. Although highest yield was recorded at 100 bunch load level, drastic reduction in marketable berry parameters such as berry size and TSS was recorded. Among the bunch loads treatments, 60 bunch load with 5.43 kg increased yield over 40 bunches maintaining the balance between yield and quality was found better.

Key words: *Vitis vinifera*, Bunch load, Quality parameters.

Grape is major remunerative fruit crop all over the world. Although it is a laborious crop, the area under this crop in Maharashtra is increasing at a pace of 6.68 % per year (Bhosale *et al*., 2016). The estimated production cost of most commercial variety 'Thompson Seedless' is approximately Rs. 2.0 to 2.5 lakhs/acre (Iyenger, 2018) excluding the vineyard establishment cost. The production cost can be fragmented into major components such as fertilizers (24%), labour cost (13%), plant protection measures (28%), use of plant growth regulators (20%) and other cost (15%). The major export market for India is Europe, where the opportunities to export quality produce is increasing. Throughout year, grapes are in demand in the European market. Considering the world market, the demand for seedless varieties with uniform berry size, without/minimum growth regulators application and different flavours (Annon., 2017) is increasing. To fulfill the requirement, the grower demands varieties with minimum cultural operations with better quality fruit as per the market demand. Manjari Naveen is a clonal selection from Centennial Seedless obtained at ICAR-National Research Centre for Grapes, Pune (Maharashtra) during 2008. It is a white seedless grape variety. The bunch has fresh green, uniform berry colour, naturally bold berries and loose bunch. The fruit develops flavour when total soluble solids (TSS) above 16°Brix. It is a short duration variety that in 110 days after fruit pruning. It requires only gibberellic acid application at size. Thus, it saves the colossal chunk of cultivation cost towards the labour for bunch/berry thinning. The profit margin can be expanded at maximum by optimizing the yield component with quality standards. Considering this, studies on standardization of bunch load in relation to berry quality and yield in Manjari Naveen was conducted.

The experiment was conducted at ICAR-National Research Centre for Grapes, Pune during 2014-2015 and 2015-2016. Ten year old Manjari Naveen vines grafted on Dogridge rootstock spaced at 3.0 m × 1.83 m and trained to Y trellises were used for study. The fruit pruning was done in first week of October during both the years. The cluster load was controlled by retaining 40, 60, 80 and 100 clusters/vine. The experiment was laid out in Randomized Block Design (RBD) with five replications and five vines in each replication. Observations on berry diameter (mm), berry length (mm), bunch weight (g), 50- berry weight (g), yield/vine (kg), days to veraison and days to harvest (DAP) were recorded at harvest. For determination of total soluble solids (TSS) and acidity, hundred berry samples randomly selected from each replicate and processed in a blender which strained through two layers of muslin cloth. Total soluble solid (°Brix) was determined from the juice using a digital refractometer (model ERMA of Japan), while acidity (%) was determined by titration against 0.1 N NaoH using phenolphthalein indicator. Statistical analysis was performed using GLM procedure of SAS System software, version 9.3.

The pooled analysis of two years data (2014-15 and 2015-16) was carried out for different bunch and berry parameters at four levels of crop load. All the nine showed significant differences at four different bunch load levels (Table 1). Self-evidently highest yield (27.25 kg/vine) was recorded at 100 bunch load followed by 80 bunch load (24.09 kg/vine). However, more number of bunches led to abrupt reduction

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in other parameters such as berry diameter, berry length, berry weight and average bunch weight. Whereas, minimum yield (16.31 kg/vine) at 40 bunch load with improved berry and bunch quality. This inverse relationship of bunch load with berry, bunch and quality parameters is presented in table 2. Bunch weight ranged from at 100 bunches/vine to at 40 bunch load/vine, respectively. The results suggested that lower bunch load was more effective in improving bunch weight. The results of the present study could be attributed to the effect of cluster thinning (reduced crop load) on increasing the carbohydrates for the growth and development of remaining bunches. Singh *et al*., (2017) reported greater bunch weight with increased cluster thinning along with canopy management in Perlette and Flame Seedless grapes.

In the present study, non-acceptable berry size (<16 mm diameter) was obtained at 80 and 100 bunch load level. Higher number of bunches resulted in significant decrease in berry size, berry and bunch weight. A review on pruning severity on yield and quality attributes in grapes had described the positive correlation of photosynthetic rate with yield (Senthilkumar *et al.,* 2015). Berries of lower bunch load on vine can accumulate more food material which is positively reflected in the berry size (diameter and length), berry weight and bunch weight. Also, more TSS and lower acidity was noted at 40 and 60 bunches/vine (Fig. 1). The enhanced bunch load reduced the sugar development. Results of the present study also supports our earlier work on Thompson Seedless where reduced clusters resulted in accumulation of more sugar (Somkuwar *et al*., 2014). Significant variation for acidity was recorded at studied bunch load levels indicating increasing trend with range of 0.67% to 0.73% in 40 and 100 bunch load, respectively. The sugar and acid

Table 1. Effect of crop load on bunch and berry quality parameter of grape var. Manjari Naveen) (Pooled analysis of 2014-15 and 2015-16).

S. No.	Parameters	Bunch load (Bunches/vine)				C.V. (%)	LSD	P value
		40	60	80	100			
1.	Berry diameter (mm)	18.82^{a}	17.69^{a}	15.77^{b}	14.69^{b}	3.73	1.25	0.0007
2.	Berry length (mm)	26.57^{a}	25.32^{b}	23.32^{c}	22.43^{c}	2.22	1.08	0.0003
3.	50 Berry weight (mm)	223.72^{a}	180.75^{b}	162.9^{c}	143.35^{d}	2.71	9.61	<.0001
4.	Bunch weight (g)	398.50^{a}	384.10^{a}	302.0^{b}	275.80^{c}	3.63	24.67	<.0001
5.	Yield/vine (kg)	16.31^{d}	21.74^{c}	24.09^{b}	27.25^{a}	2.32	1.04	<.0001
6.	TSS (^{o}B)	17.00^{a}	16.48^{a}	15.15^{b}	15.24^{b}	1.98	0.63	0.0008
7.	Acidity (%)	0.67^{c}	0.68^{c}	0.71^{b}	0.73^{a}	1.16	0.016	0.0002
8.	Days to veraison (DAP)	76.10^{c}	79.20^{bc}	80.50^{ab}	83.40^{a}	2.54	4.05	0.02
9.	Days to harvest (DAP)	110.70^{b}	112.60^{ab}	114.60^{ab}	118.50^{a}	2.73	6.23	0.09

Table 2: Correlation matrix of bunch load with berry/bunch physical and chemical parameters.

Pearson Correlation Coefficients, N = 4										
Parameter	Load	Berry diameter	Berry length	50 Berry weight	Bunch weight	Yield	TSS	Acidity	Days to veraison	Days to harvest
Load	1.00	-0.99	-0.99	-0.97	-0.96	0.98	-0.92	0.99	0.99	0.98
Berry diameter		1.00	0.99	0.96	0.99	-0.97	0.96	-0.99	-0.97	-0.97
Berry length			1.00	0.96	0.98	-0.97	0.97	-0.99	-0.96	-0.95
50 Berry weight				1.00	0.90	-0.99	0.91	-0.94	-0.98	-0.93
Bunch weight					1.00	-0.91	0.97	-0.98	-0.91	-0.94
Yield						1.00	-0.91	0.95	0.99	0.95
TSS							1.00	-0.93	-0.88	-0.86
Acidity								1.00	0.97	0.99
Days to veraison									1.00	0.98
Days to harvest										1.00

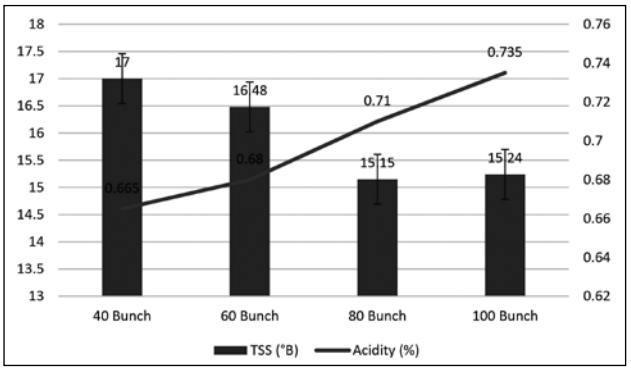

Fig. 1. Comparative TSS and acidity at different crop load level in grapes.

ratio was reported to be a good harvesting indicator of many fruit crops. A significant hike in liking of Crimson Seedless grapes with lower acidity was described by Jayasena and Cameron (2008) as organic acids are key factor in perception of flavour.

The veraison and fruit maturity was delayed by a week with increased bunch load to 100. Veraison commences in berry on attaining minimum values of elasticity and turgor in berries (Castellarin *et al*., 2015). This results into decline in solute potential, elevation in sugar content and development of colour. Up-regulations of many cell wall modifying enzymes encoding genes were observed at near to completion of berry softening. Mesocarp turgor pressure drops at veraison and afterwards become insensitive to water deficit allowing faster phloem influx. The transpiration rate in berry is driven by berry size or surface area and berry internal water potential which are cultivar and stage of development dependent (Zhang and Keller, 2015).

Although the highest yield was obtained at 100 bunches/vine, drastic reduction was recorded in berry size and other quality parameters *viz.*, sugar and acidity. Surpassing values for berry diameter, length and weight were registered at 40 and 60 bunch load level. Also a week early veraison and harvest was obtained in these two crop load with lower acidity (Table 1). The yield difference in these two treatments (40 and 60 bunches/vine) was 5.43 kg/vine. The differences for berry diameter, bunch weight, TSS and acidity were non-significant. Considering the yield and quality in Manjari Naveen, crop load upto 60 bunches/vine with a spacing of 3.0 m × 1.83 m (1 bunch/sq.ft) is economically convincing for fetching better profit margin. The potential of such short duration varieties can be well exploited in the north and north-east India, where popular variety like Thompson Seedless cannot be commercialized due to coincidence of crop maturity with rains. Further, there are three pruning patterns in India which will facilitate the grape availability in domestic and export market throughout the year.

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