J. Hortl. Sci.
Vol. 11(1):27-32, 2016

Assessing efficiency of white seedless grape vineyards for table grape production

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ABSTRACT

Efficiency of two table grape vineyards each of Thompson Seedless and Tas-A-Ganesh located around Nashik, Maharashtra, were assessed over two cropping seasons based on a score-card developed assigning weights and matrices for various attributes of yield and quality, in accordance with their relative contribution going by established facts on a 100 point scale. The objectives of the study were to draw up a benchmark to evaluate the efficiency of table grape vineyards, analyze the reason for low efficiency, and suggest remedial measures. In addition to the yield, bunch and berry characters are important in table grape production. Skilful management of attributes for yield and quality using available technologies determines efficiency of a vineyard. In general, the efficiency of vineyards was better during the 2014-15 cropping season compared to 2013-14, and that of 'Thompson Seedless' vineyards was higher than Tas-A-Ganesh. In 'Thompson Seedless', efficiency of Vineyard-1 was better than Vineyard-2 as also in Tas-A-Ganesh. Based on their total score, individual vineyards were ranked as Excellent/Very good/ Good/ Average/ Below average, year-wise. Lacunae in management leading to poor scores were identified to serve as a guide to improvement.

Key words: Vineyard efficiency, white table grape, score card, evaluation, analysis

INTRODUCTION

Orchard efficiency analysis is an approach to evaluate production potential of an orchard against an ideal orchard, with reference to the established norms of contributing factors. Some efforts have been made in the past to analyze orchard efficiency in mango (Rao and Mukherjee, 1982), litchi (Roy *et al*, 1984) and citrus (Srivastava and Singh, 2007). Findings in these efforts were limited to identification of factors contributing to higher yield, in terms of leaf nutrient content, pest and disease incidence, and, feeder root density in mango and litchi; while, in citrus, this was in terms of soil physico-chemical character, and available nutrient content in soil. In grapevines, nutrition makes limited contribution to yield. Shikhamany *et al* (1984) observed little difference in nutrient status of high- and low-yielding vines of 'Thompson Seedless'. In addition to yield, quality is an important aspect in commercial value of grapes. Quality in table grapes is assessed not just in terms of ^{o}Brix and acid content, but also physical appeal and berry firmness, attributes managed by standard cultural practices. Yield and quality in grapes depends on efficient management of the inputs. Thus, efficiency of a vineyard basically means efficiency in vineyard management. The present study was carried out to set a benchmark for efficiency, and to analyze reasons for poor scores, to suggest remedial measures.

MATERIAL AND METHODS

To assess the efficiency of vineyards, two vineyards each of 'Thompson Seedless' and 'Tas-A-Ganesh' were selected around Nashik, Maharashtra. Twenty five vines were selected at random while walking diagonally in North-West to South-East and South-West to North-East (13 in one diagonal, and 12 in another) in each vineyard measuring about four acres. All the vines selected were in prime bearing age (6-7 years), spaced at 2mx3m and trained onto extended Y trellises.

Observations on vine growth parameters yield and quality attributes reflecting efficiency in vineyard management were recorded in each variety during the cropping seasons of 2013-14 and 2104-15. Average yield of 25 vines was used for arriving at yield/acre. Vine growth parameters were recorded in five canes selected at random on each vine. Bunch and berry characters were recorded in five replicates of ten bunches each, collected @ two representative bunches from each vine. Observations on cvs. Thompson Seedless and Tas-A-Ganesh are presented in Tables 1 and 2, respectively.

Table 1. Performance of 'Thompson Seedless' vineyards

S. No.	Parameter	2013-14		2014-15	
		VY-1	VY-2	VY-1	VY-2
1.	Yield/acre (tonnes)	29.76	12.4	40.0	40.0
2.	Vine growth characters				
a.	Cane diameter (mm)	2.0	1.5	2.0	2.0
b.	No. of canes/m^2	4.0	5.0	4.0	4.0
c.	Sub-cane/cane ratio	2.81	2.64	2.80	2.42
d.	Cluster/cane ratio	1.48	1.35	1.44	1.23
e.	Uniformity in bud break (%)	84.1	82.0	79.3	76.1
3.	Bunch characters				
a.	Mean bunch-weight (g)	349.7	420.7	452.8	389.7
b.	Compactness Index	32.7	36.3	31.7	32.16
c.	Total length of rachis (cm)	2.0	1.0	3.0	3.0
d.	No. of berries/bunch	82.5	83.1	48.8	91.2
e.	Un-uniform berry size (%)	2.6	4.7	0.54	4.83
f.	Blemished berries (%)				
4.	Berry characters				
a.	Diameter (mm)	16.6	19.3	19.2	18.2
b.	Specific gravity	1.07	1.08	1.03	1.02
c.	TSS (°Brix)	16.0	17.9	14.8	14.7
d.	Acidity (g%)	0.52	0.48	0.54	0.42

VY = Vineyard

Table 2. Performance of 'Tas-A-Ganesh' vineyards

S. No.	Parameter	2013-14		2014-15	
		VY-1	VY-2	VY-1	VY-2
1.	Yield/acre (tonnes)	29.88	21.76	29.52	22.84
2.	Vine growth characters				
a.	Cane diameter (mm)	7.4	7.2	6.8	6.9
b.	No. of canes/m^2	5.4	5.4	6.6	4.6
c.	Sub-cane/cane ratio	3.40	3.46	2.50	2.32
d.	Cluster/cane ratio	1.62	1.73	1.19	1.22
e.	Uniformity in bud break (%)	82.9	82.6	79.9	78.8
3.	Bunch characters				
a.	Mean bunch-weight (g)	342.9	338.1	306.4	315.7
b.	Compactness Index	31.9	35.7	31.3	29.9
c.	Total length of rachis (cm)	49.7	43.8	45.4	47.4
j.	No. of berries/bunch	75.9	89.9	79.0	80.5
k.	Un-uniform berry size (%)	3.5	3.2	5.4	4.7
l.	Blemished berries (%)				
4.	Berry characters				
a.	Diameter (mm)	17.5	17.4	17.9	17.6
b.	Specific gravity	1.06	1.06	1.03	1.04
c.	TSS content (°Brix)	16.1	17.1	16.5	18.1
d.	Acidity (g%)	0.54	0.58	0.57	0.54

VY = Vineyard

Table 3. Score card for assessing vineyard efficiency

S. No.	Parameter	Metrics	Weight
1.	Yield/acre	>12t/ acre = 40 pointsReduction of 4 points for every 1.0t reductionin yield from 12t/ acre	40
2.	Vine parameters		20
a.	Cane diameter	7.1- 7.5mm = 2; 6.1-7.0 or 7.6-8.0mm = 1.5;6.1-6.5 or 8.1-8.5mm = 1.0;5.6-6.0 or 8.6- 9.0mm = 0.5	02
b.	No. of canes/m^2	6.1-7.0 canes = 55.1-6.0 or 7.1-8.0 =44.1-5.0 or 8.1-9.0 = 33.1-4.0 or 9.1-10 =2<3.1 and >10.0 =1	05
c.	Sub-cane/cane ratio	1.0 point for 1.0 ratio 0.1 point for every increase of 0.1ratio, maximum being 3.0 for 3.0	03
d.	Cluster/cane ratio	>1.6=5; 1.41-1.60=4; 1.21-1.40=3 1.01-1.20=2; 0.81-1.00=1; <0.81=0	05
e.	Uniformity in bud break (%)	>80%=3; 71-80%=2 ; 61-70%=1	03
f.	Uniformity in flowering (%)	>90%=2; 86-90%=1.5; 81-86%=1.0; 76-80%=0.5; <76%=0)	02
3.	Bunch characters		25
a.	Mean bunch-weight	400-450g=3. For reduction of every 50g below 400g, and increase over 450g, a reduction of 0.5 point made	03
b.	Compactness Index	30-32= 5; for reduction of every 1.0 index value below 30 and above 32, a reduction of 1.0 point made	05
c.	Total length of rachis (cm)	0.05 points for every cm of length	03
d.	No. of berries/bunch	0.02 points for each berry	02
e.	Un-uniform berry size (%)	0% =6; 0.1-1.0%=5; 1.1-2.0%=4; 2.1-3.0%=3; 3.1-4.0%=2; 4.1-5.0%=1; >5% =0	06
f.	Blemished berries (%)	0% =6; reduction of 0.3 points for increase of every 0.1%; 0 point for >2%	06
4.	Berry characters		15
a.	Diameter	15.1-16.0mm = 116.1- 17.0mm =217.1- 18.0mm =318.1- 19.0mm =419.1- 20.0mm =5	05
b.	Specific gravity	For increase of every 0.01 in Specific Gravity, 1.0 additional point earned, with 0 score for Specific Gravity1.0	05
c.	TSS / acid ratio	14° Brix =1.0; For increase of every 1°Brix over 14°B, 0.5 additional point earned, with maximum at 3.0 for 18°B	03
d.	Titrable acids (g%)	0.51-0.55 g% = 2.00.46– 0.50 or 0.56 – 0.60 = 1.0<0.46 or > 0.60 = 0	02
	TOTAL		100

A score-card was devised by assigning 60% weight to yield and yield attributes (vine growth parameters contributing to yield) and 40% to quality parameters of bunch and berry, based on weightage as suggested by Chadha and Shikhamany (1989) for evaluating table grape varieties/ hybrids. Weight and the other metrics concerning various attributes of yield and quality are based on their relative contribution as per established norms (Table 3).

Cane diameter: This was measured midway between 3rd and 4th node. Total shoot-length and leaf area on a cane are related positively (Shikhamany, 1983). Cluster weight and total soluble solids (TSS) content of berries is determined by leaf area available/bunch (Chelvan *et al*, 1985; Purohit *et al*, 1975). Cane diameter in the range of 7.0-7.5 was found to be optimum for both the varieties under study (Shikhamany, unpublished data).

No. of canes/m^2: Number of canes is a unit of production in grapes. Number of canes/vine was positively correlated with yield/vine, mediated through number of clusters/vine. Higher number of canes is an outcome of higher number of shoots which result in shading the buds, consequently, reducing their fruitfulness (Buttrose 1970). Cane density of 5-6/m^2 is considered optimum (Shikhamany, 1983).

Sub-cane/cane ratio: Significance of the sub-canes in production lies in the fact that basal buds on lateral branches of the canes are highly fruitful. The number of lateral shoots on main shoot depends upon the stage and level of pinching of the main shoot and treatment with CCC prior to pinching. A higher number of sub-canes/cane translates as more number of clusters/cane.

Cluster/cane ratio: In addition to number of sub-canes, the number of clusters/cane depends on management of bud-fruitfulness, coupled with increased bud-break and retention of the emerged clusters. Cluster/cane ratio is positively correlated with yield/vine, but negatively with cluster weight (Shikhamany *et al*, 2015). On the other hand, increase in this ratio reduces TSS content in the berries (Shikhamany, 1983). Optimum ratio of clusters to cane was found to vary between 2.0-2.5 per cane, in diameter ranging 7.0-7.5mm, with reference to bunch-size and sugar content in berries for table grape purpose in these varieties (Shikhamany, unpublished data).

Uniformity in bud-break: Uniformity in phenological development of shoot and cluster depends upon uniformity in bud-break. Efficiency of GA_3 sprays for cluster-elongation depends on this phenomenon. Judicious shoot-pinching after back-pruning to develop fruiting units (sub-canes) of uniform diameter, pre-pruning defoliation (and removal of canes of abnormal size) and, judicious use of hydrogen cyanamide at forward-pruning, are cultural operations applied to obtain uniform bud-break. Uniformity in fruit-set, to a large extent, depends on uniformity in flowering. Thresh-hold level of uniformity is 70-75% in these varieties (Shikhamany, unpublished data).

Uniformity in flowering: Uniformity in phenological stages of berry growth and development depend on uniformity in berry-set, which is determined by uniformity in bud-break. Effect of GA_3 for berry-thinning (Turner, 1972) and growth regulators / girdling for berry size are stage-specific. Thus, for effective and economical berry-thinning and sizing, uniformity in cluster development is very important. Optimum level of uniformity was in the range of 90-95% for these varieties (Shikhamany, unpublished data).

Bunch characters

Mean bunch-weight: Yield per vine is a function of mean bunch-weight in any variety. While the number of clusters/ cane, excess vigour of the bearing-shoot, and inadequate leaf area available/ bunch reduce bunch weight, number of berries/bunch and mean berry size increase it (Shikhamany *et al*, 2015). Cluster-thinning in relation to cane diameter (Shikhamany *et al*, 2015), shoot-topping (Chelvan *et al*, 1985), girdling (Bhujbal and Wavhal, 1972) and use of growth regulators (Shikhamany, 1996) have all been shown to increase bunch weight.

Bunch Compactness Index: Loose and well-filled bunches are preferred for table purpose in domestic as well as international markets. Compact bunches rot due to mutual berry pressure during ripening, and are bruised in boxes when packed and transported. Bunch Compactness Index was derived by the following formula:

$$\text{Bunch Compactness Index} = \frac{\text{Number of berries in a bunch/total length of rachis of the bunch (cm)} \times}{\text{mean berry diameter (mm)}}$$

Bunches with >35 Compactness Index were graded as compact; between 31-35 a well-filled; 25-30 a loose, and <25 as straggly.

Total length of rachis: This is the sum of length of the main rachis and all its branches, measured in cm. Pre-bloom GA_3 sprays at the right concentration and right stage elongate the main rachis and its branches. Ineffective sprays result in inadequate elongation and higher bunch compactness, indicating inappropriate spray of GA_3.

No. of berries/bunch: Number of berries in a bunch not only increases bunch weight, but also its compactness. Berries are thinned manually at 6-7mm dia stage, or, GA_3 sprays just before and at calyptras-fall stage. Manual thinning is not only expensive, it is also less effective. Achieving uniformity in flowering and identification of the correct stage for thinning sprays, are the main tasks in chemical thinning. Two to three sprays of GA_3 at 10/15ppm on alternate days, commencing from the fourth day prior to full-bloom (depending upon uniformity in the stages of cluster development) effectively reduces the number of berries in a bunch. Optimum number of berries was 90-100, depending upon the diameter of berries in a bunch. Early spray/ high concentration of GA_3 and spray under cloudy or humid weather results in the drop of almost all flower buds, while, delayed sprays/low GA_3 concentration results in less thinning and, may be, more number of shot berries.

Uniformity of berries in a bunch: Uniformity refers to an absence of un-uniform berries with reference to shot berries and water berries. While shot berries are attributed to a faulty stage/ coverage of GA_3 spray on the bunches (for either berry-thinning or berry-enlargement, water berries result from a higher fruit/leaf ratio. Maximum permissible limit of un-uniform berries in a bunch in overseas markets is 5%.

Blemished berries: Berries with blemishes of powdery mildew, sun-burn or pink pigmentation are grouped under this trait. Maximum permissible limit for such berries in a bunch is just 2%.

Berry characters

Berry diameter: Bold berries are preferred for table purpose. Berries with a diameter more than 16mm alone are accepted in EU markets. Timely berry-thinning (before 6mm stage), coupled with girdling and growth-regulator treatments, are ways for increasing berry diameter.

Specific gravity of berry: Berries with more sugar and pulp have a greater specific gravity at harvest. This trait is decided mainly by leaf to fruit ratio. Berries with a higher specific gravity are less prone to chilling-injury and stay longer in the cold-chain in transit and storage.

TSS content of berries: Eating quality and consumer preference are determined mostly by total soluble solids (TSS) content of the berries. Leaf to fruit ratio and stage of harvest mainly determine TSS content of berries. Optimum TSS is 16^{o}B for these varieties in the overseas market, but is more than 18^{o}B in the domestic market. Low TSS content is associated with low specific gravity. With even an adequate leaf to fruit ratio, grapes harvested early tend to have lower TSS content.

Content of titratable acids in berry: Acid content in the berry straightaway indicates the stage of harvest. Early harvest is indicated by high level of acids and results in reduced bunch-weight and yield/vine. Optimum range of acids is 0.5 – 0.6g/100ml of juice.

RESULTS AND DISCUSSION

Efficiency evaluation

Efficiency of the selected vineyards was assessed as per a score card and values are presented separately for 'Thompson Seedless' (Table 4) and Tas-A-Ganesh (Table 5) vineyards. As per the score-card, vineyard efficiency across vineyards and varieties, was higher in the 2014-15 cropping season (73.13 score), compared to 2013-14 (68.05 score). Average score for 'Thompson Seedless' over the years and vineyards (75.35) was higher compared to that in 'Tas-A-Ganesh' (67.2). Although a comparison between varieties is not appropriate, 'Tas-A-Ganesh' (being

Table 4. Assessment of efficiency of 'Thompson Seedless' vineyards

S. No.	Parameter	Score			
		2013-14		2014-15	
		VY-1	VY-2	VY-1	VY-2
1.	Yield/acre	29.76	12.4	40.0	40.0
2.	Vine growth characters	(16.81)	(15.64)	(16.8)	(14.92)
a.	Cane diameter (mm)	2.0	1.5	2.0	2.0
b.	No. of canes/m^2	4.0	5.0	4.0	4.0
c.	Sub-cane/cane ratio	2.81	2.64	2.80	2.42
d.	Cluster/cane ratio	4.0	3.0	4.0	3.0
e.	Uniformity in bud break (%)	3.0	3.0	2.0	2.0
f.	Uniformity in flowering (%)	1.0	0.5	2.0	1.5
3.	Bunch characters	(18.36)	(17.52)	(19.58)	(17.34)
a.	Mean bunch weight (g)	2.5	3.0	3.0	2.5
b.	Compactness Index	4.8	3.0	5.0	5.0
c.	Total length of rachis (cm)	2.41	2.56	3.00	2.82
d.	Berries/bunch	1.65	1.66	0.98	1.82
e.	Un-uniform berry size (%)	4.4	2.3	5.0	2.2
f.	Blemished berries (%)	2.6	5.0	2.6	3.0
4.	Berry characters	(8.9)	(12.65)	(8.5)	(6.75)
a.	Diameter (mm)	1.6	4.3	4.2	3.2
b.	Specific gravity	3.5	4.0	1.5	2.0
c.	TSS (°Brix)	2.0	2.95	1.4	1.35
d.	Acidity (g%)	1.8	1.4	1.4	0.2
	TOTAL SCORE	73.83	58.21	84.88	79.01

VY = Vineyard

Figures in parentheses indicate sub-total of the corresponding character

Table 5. Assessment of efficiency of Tas- A- Ganesh vineyards

S. No.	Parameter	Score			
		2013-14		2014-15	
		VY-1	VY-2	VY-1	VY-2
1.	Yield/acre	29.88	21.76	29.52	22.84
2.	Vine growth characters	(17.0)	(17.5)	(15.0)	(13.5)
a.	Cane diameter (mm)	2.0	2.0	1.5	1.5
b.	No. of canes/m^2	4.0	4.0	5.0	3.0
c.	Sub-cane/cane ratio	3.0	3.0	2.5	2.3
d.	Cluster/cane ratio	5.0	5.0	2.0	3.0
e.	Uniformity in bud break (%)	3.0	3.0	2.0	2.0
f.	Uniformity in flowering (%)	0.0	0.5	2.0	2.0
3.	Bunch characters	(19.41)	(17.09)	(15.45)	(15.88)
a.	Mean bunch-weight (g)	2.0	2.0	2.0	2.0
b.	Compactness Index	5.0	3.5	5.0	5.0
c.	Total length of rachis	2.49	2.19	2.27	2.37
d.	No. of berries/bunch	1.52	1.80	1.58	1.61
e.	Un-uniform berry size (%)	3.5	3.8	1.6	2.3
f.	Blemished berries (%)	4.9	3.8	3.0	2.6
4.	Berry characters	(8.95)	(8.55)	(7.45)	(9.0)
a.	Diameter (mm)	2.5	2.4	2.9	2.6
b.	Specific gravity	3.0	3.0	1.5	2.0
c.	TSS content (°Brix)	2.05	2.55	2.25	3.0
d.	Acidity (g%)	1.4	0.6	0.8	1.4
	TOTAL SCORE	75.24	64.9	67.42	61.22

VY = Vineyard

Figures in parentheses indicate sub-total of the corresponding character

a clone of 'Thompson Seedless') renders it relevant. Within a variety over the two seasons, Vineyard -1 scored better over Vineyard-2 in 'Thompson seedless' as also in 'Tas-A-Ganesh'. In an year-wise analysis, Vineyard-1 scored better over Vineyard-2 in both the years in the two varieties.

When the scale (Excellent: >90; Very Good = 81-90; Good = 71-80; Average = 61-70; Below Average = <61) was applied for grading the vineyards, 'Thompson Seedless' Vineyard-1 in 2014-15 was graded as 'Very Good'; 'Thompson Seedless' Vineyard-1 in 2013-14, 'Thompson Seedless' Vineyard-2 in 2014-15, and 'Tas-A-Ganesh' Vineyard-1 in 2013-14, were graded as 'Good'. Grading of the other vineyards in different cropping seasons is as follows:

Average: 'Tas-A-Ganesh' Vineyard-1 in 2014-15, and 'Tas-A-Ganesh' Vineyard-2 in both the seasons

Below Average: 'Thompson Seedless' Vineyard-2 in 2013-14

Efficiency analysis

Level of perfection/shortcoming in management, contributing to the differential rating of the vineyards, is analyzed below:

Very good: Performance of 'Thompson Seedless' Vineyard-1 in 2014-15 rated very well. The main contributory factors were yield, management of cane-diameter, uniformity in flowering, cluster compactness, and mean bunch-weight. Management of cane number/m^2, sub-cane development, cluster/cane ratio, berry diameter and uniformity in berries also contributed to this rating. Lacunae in management were mainly in berry-thinning and quality components, namely, a greater proportion of blemished berries, lower specific gravity, lower TSS, and high acid content of the berries. Analysis indicated that the bunches had a lower leaf to fruit ratio. Desired berry diameter was achieved with the help of growth regulators, and the grapes were harvested prematurely.

Good: 'Thompson Seedless' Vineyard-1 and 'Tas-A-Ganesh' Vineyard-1 fell under this category in 2013-14; 'Thompson Seedless' Vineyard-2 in 2014-15 also fell under this. The main reasons for this rating in 'Thompson Seedless' Vieyard-1 were yield and quality. Management of cane diameter and bud-break here was excellent. Mean bunch-weight being very good, the low yield can be attributed to a lower number of bunches harvested. Despite no. of canes/ m^2, sub-cane/ cane ratio and cluster/cane ratio being very good, fewer number of bunches indicates loss of clusters, due mainly to inadequate pest / disease management.

Lacunae in quality management were attributable to lack of adequate berry diameter, uniform berries, berry specific-gravity, TSS content of berries, and reduced berry scorching. A normal level of acid in the berries is indicating of harvest at the right stage. Thus, low specific gravity, coupled with low TSS content and smaller berry diameter, indicates a lower leaf to fruit ratio.

'Thompson Seedless' Vineyard-2 also rated 'Good' in 2014-25. In spite of ranking 'Excellent' in yield, and 'Very Good' in yield-attributes (namely, mean bunch-weight, number of berries/bunch, number of canes/m^2 and sub-cane/ cane ratio), it scored lower in cluster/cane ratio, uniformity in bud-break and flowering, and mainly, in bunch and berry quality parameters. Low acidity indicates delayed harvest. Hence, inadequate leaf to fruit ratio is the reason for simultaneous reduction in TSS content and berry specific-gravity. Lacunae here are: inadequate management of bud-fruitfulness, bud-break and optimum leaf to fruit ratio.

Among 'Tas-A-Ganesh' vineyards, Vineyard-1 alone rated 'Good' in 2013-14. The main contributing factor was yield/vine. Mean bunch weight was average, yet yield was good because of a very good rating in cluster/cane ratio, number of canes/m^2 and sub-cane/cane ratio. Despite excellent cane diameter, the average bunch-weight can be attributed to a higher cluster/cane ratio. Other virtues in management were: induction of uniform bud-break, berry-thinning and blemish-free berries. The shortcomings were: inadequate management of berry-quality including TSS, acidity, berry sizing, uniformity in berries and berry specific-gravity. Premature harvest and inadequate leaf to fruit ratio were the contributing factors.

Average: In 'Tas-A-Ganesh', Vineyard-1 in 2014-15 and Vineyard-2 in both the years rated as 'Average'. Vineyard-1 scored low on account of yield attributes and bunch / berry characters, in spite of having a good score in yield. Good yield was attributable to higher number of bunches/vine, and not from cluster/cane ratio or mean bunch weight. Clusters were loose to well-filled. Neither rachis elongation nor number of berries/bunch was managed well. Small berries would have contributed to less compactness of berries.

Vineyard-2 of 'Tas-A-Ganesh' rated 'Average' in both the years. All the parameters of evaluation were 'Average' in range, except the yield-attributes in 2013-14. Although cluster/cane ratio was excellent, yields suffered because of a lower number of canes and lower bunch-weight.

Below Average: Thompson Seedless Vineyard-2 in 2013-14 rated 'Below Average'. Although better in berry quality, this vineyard was rated so mainly because of very low yield, compact bunches and un-uniform berries. In spite of adequate cane density and excellent bunch-weight, yield was 'Below Average' because of a low cluster/cane ratio. Lack of management in bud-fruitfulness was poor in this vineyard.

ACKNOWLEGEMENT

The authors are grateful to Chairman and office bearers, Central Research Committee, Maharashtra State Grape Growers' Association, Pune, for supporting this research. They also thank Shri Ashok Gaikwad, Arun More, Jagannath Khapare and Suresh Kalamkar for facilitating the study in their vineyards. Support of Shri T.S. Mungare and T.S. Shelke, and guidance provided by Research Advisory Committee of the Association, are gratefully acknowledged.

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(MS Received 08 October 2015, Revised 10 June 2016, Accepted 13 June 2016)