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Response of Vidal 256 Grapevines to the Geneva Double Curtain and Six Cane Kniffin Training Systems as Grown in South Central Pennsylvania

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Abstract

Plants of Vidal 256 (commonly known as 'Vidal Blanc'), a white wine cultivar, were planted in 1972 at the Fruit Research Laboratory of The Pennsylvania State University, Biglerville, Pa. Initial commercial production was realized in the 1974 season. Growth and production were excellent and vines survived temperatures of -22C with no apparent adverse effect. An inverse relationship between pruning weights and production was evident, as Geneva Double Curtain (GDC)-trained vines produced significantly more fruit and less wood than vines trained to the Six Cane Kniffin (SCK) system. Must quality differences—percent soluble solids, must pH and total acidity—were not evident between vines trained to those two systems. Must pH values were higher than expected, which may have been a reflection of the technique used in sample preparation. Several vineyard factors—yield, foliar levels of P, Fe and B—were associated with wine pH levels. Mean values for 10 essential mineral nutrients did not reveal differences due to training system.

Methods and Materials

One-year rooted cuttings of V256 grapevines were planted at The Pennsylvania State University Fruit Research Laboratory, Biglerville, Adams County, Pennsylvania in the spring of 1972. Plants were set 2.5 m apart in rows spaced 3.1 m apart. Soil was an Arendtsville gravelly loam which is moderately eroded with a reddish-brown gravelly topsoil that grades into a reddish-brown gravelly silt loam. At a depth of 40 inches and below, the underlying material consists of a reddish-brown gravelly loam that permits deep penetration of roots. This soil type is excellent for grapes (11).

Elevation of the site was 229 m above sea level and had a rolling terrain. Initial fertilizer requirements were determined from soil tests taken prior to establishment. After vines were fruiting, annual soil and plant analyses were utilized to determine fertilizer requirements. A permanent cover crop of perennial rye grass was established in the row middles in the year of planting. Weed competition was controlled in a band 1.2 m wide underneath the trellis by use of herbicides and row middles were mowed as needed. Vines were trained to two training systems—The Geneva Double Curtain (GDC) and Six Cane Kniffin (SCK). Vines trained to the GDC were shoot positioned, by hand, once during the growing season approximately three weeks after peak bloom.

After vines commenced bearing fruit, a maximum of 36 to 40 buds were retrained per vine with a maximum of 72 to 80 clusters per vine. Three vines were used per plot with two replications per training system. Data collected included weight of one-year wood per vine, yield per vine, must percent soluble solids (SS), must pH (pH), titratable acidity (TA), and potassium (K) concentration of the must. Berry samples were taken in accordance with the technique described by Shaulis (16). Samples were macerated for 30 seconds in a Waring blender and subsequently pressed in a Carter hydraulic press until a pressure of 35,000 kPa was attained. The expressed juice was stored frozen for analysis at a later time. Upon removal from storage, juice was thawed and heated to 70 C in a constant temperature water bath, held at that temperature for 20 minutes and allowed to cool to room temperature before analysis. Leaf samples were taken in late July for each season. Concentrations of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), iron (Fe), copper (Cu), boron (B), and zinc (Zn) in the leaves (blades and petioles) were determined annually on a plot basis.

Growth, production and quality data were subjected to a split plot analysis of variance and means of significant variables were separated by the Bayesian Multiple Range test (21). Since quality factors did not differ between systems of training (Table 2), data were combined for the purpose of conducting multiple regression analyses with parsimony in order to determine the association of 23 variables with must pH values (20).

Results and Discussion

Data presented in Table 1 revealed that low winter temperature extremes of -21.2 C and -22.2 C were experienced. Those extremes were not detrimental to production by V256 vines (Table 2). Also, mean growing degree day values were excellent for those five years, particularly in August (708). As a result, fruit matured well in most of the test years. Precipitation during the growing season over that same period was lower than average, particularly during the month of August (7.2 cm). However, growing degree day and rainfall data for September agreed quite well with the average (9).

Data for fruit yield, cane pruning weight, and must quality presented in Table 2 revealed that yield was excel-

Table 1. Climatic data for a five-year duration at the Fruit Research Laboratory of The Pennsylvania State University, Biglerville, PA.

Growing season	Preceding winter minimum (deg. C)	Growing degree days Apr 1-Oct 31 (>10 deg. C)	August rainfall (cm)
1975	-16.6	2750	4.9
1976	-17.2	2613	6.4
1977	-22.2	3027	6.4
1978	-16.6	2681	5.9
1979	-21.1	2554	12.1
Mean	——	2725	7.1

lent over the five-year duration, surpassing that reported for Erie County, PA. (10). During the experiment, GDC-trained vines produced significantly more fruit than those trained to the SCK. Differences between training systems, also, were statistically significant in four of the five years (Table 3). Mean pruning weight was significantly lower in GDC-trained vines than those trained to the SCK system during the experimental period. This response was normal, since fruit production was higher in vines trained to the GDC system. Research with 'Concord' grapevines support those data (16). In two out of five years, vine growth was significantly less in GDC-trained vines than in vines trained to the SCK system. In the 1979 growing season the reverse was noted (Table 3).

Must quality was not affected by the system of training (Table 2). However, must pH was higher than desired and higher than reported by Haeseler and Beelman (11). Values for pH may have been affected by the technique of sample preparation in which the berries were macerated in a Waring blender for 30 seconds. Carter *et al.* reported that samples of white wine cv prepared with a Waring blender reflected pH values from 0.2 to 0.3 units higher than when other accepted preparation techniques were used (6). Downward adjustment of the pH values reported in Table 2 would place them in a pH range of 3.3 to 3.4 which is similar to that reported by Haeseler and Beelman for that cultivar (11).

The system of training did not significantly affect the concentrations of 10 chemical elements essential to plant growth. Levels were within ranges stipulated in earlier reports concerning the cv Vidal 256 in Pennsylvania (11). Nutritional demands appear to be the same regardless of which training system is utilized. Consequently, vines growing in the Arendtsville soil series and fertilized according to soil and leaf analyses should not exhibit mineral nutrient stress in most years.

When potassium was added to mature 'Concord' vineyards with high levels of soil K, the pH values of the musts increased significantly (14). Those data supported the hypothesis that pH of musts and wine might be controlled through vineyard management practices (2). Multiple regression analyses of 23 variables with must pH revealed that all variables accounted for 86.1% of the variation in must pH values. Leaf potassium was one of the first variables eliminated by parsimony in the order of removal from first to last until four variables—yield, leaf phosphorus, leaf iron and leaf boron—accounted for 80.2% of the var-

Table 2. Average growth, production and must quality characteristics if Vidal 256 grapevines as grown in Adams County, PA., for a five-year duration.*

			Must quality			
Training system	Yield (t/ha)	Pruning weight (Kg/v)	Soluble solids (%)			
GDC	27.0 a	1.5 b	19.4 a	3.6 a	0.88 a	2170 a
SCK	20.2 b	2.0 a	18.9 a	3.7 a	0.89 a	2170 a

*Mean values followed by the same letter do not differ at the 5% level of significance.

Table 3. Production and pruning weight patterns for Vidal 256 grapevines over a five-year duration in south central Pennsylvania.*

Training systems	1975	1976	1977	1978	1979
	Yield (t/ha)				
GDC	36.0 a	22.2 a	32.2 a	21.5 a	23.0 a
SCK	32.0 b	14.0 b	22.5 b	21.5 a	11.8 b
	Pruning weights (Kg/v)				
GDC	1.2 a	1.1 a	1.0 b	1.6 b	2.4 a
SCK	1.8 a	2.3 a	1.4 a	2.4 a	2.1 b

*Values followed by the same letter do not differ at the 5% level of significance.

iation in must pH. Although studies with Concord (14) showed an increase in juice pH when potassium fertilizer was applied, production was low and leaf potassium levels in those plants not fertilized with potassium had sufficient leaf potassium (19). Therefore, that response might be attributable to luxury consumption, particularly since attempts to correlate potassium with juice pH were not conducted. A similar relationship was reported for the cv Marechal Foch (10). Since several factors affect the behavior of pH in musts and wine, factors other than potassium fertilization may be as important in accounting for the variation of pH in musts and wine (3). Therefore, it appears that the solution to the problem of high pH values in musts and wine is more complex than originally anticipated.

It is apparent that Vidal 256 vines can be grown commercially and produce high quality fruit for wine purposes in south central Pennsylvania. Also, vines of V256 will withstand reasonably low winter temperature conditions, if proper site selection criteria and management practices are utilized. Serious problems with insects and diseases were not encountered and berries did not deteriorate prior to harvest.

Literature Cited

1. Beelman, R. B. 1971. Cultivar evaluation for table wine in Pennsylvania. Proc. PA Wine Conf. 4:52-55.
2. Beelman, R. B. 1983. The importance of must and wine pH to wine quality. Proc. PA Wine Conf. 15:8-22.
3. Boulton, R. 1980. The general relationship between potassium, sodium and pH in grape juice and wine. Amer. J. Enol. and Vitic. 31:182-186.
4. Bradt, O. A., A. Hutchinson, S. J. Leuty and C. L. Ricketson. 1978. *Fruit Varieties*. A guide for commercial growers. Ontario Ministry of Agric. and Food Publ. #430. pp. 112.
5. Byloff, R. C. 1983. Must pH and wine quality: commercial applications. Proc. PA Wine Conf. 15:23-29.
6. Carter, G. H., C. W. Nagel and W. J. Clore. 1972. Grape sample preparation methods representative of must and wine analyses. Amer. J. Enol. and Vitic. 23(1):10-13.
7. Einset, J., K. Kimball, W. B. Robinson and J. J. Bertino. 1971. 1969-70 Vineyard and cellar notes. NYS Agric. Expt. Sta. Special Report No. 4.
8. Galet, P. 1956. *Cepages et Vignobles de France*. 1:441-444.
9. Haeseler, C. W. 1970. Climatic factors and the potential for wine grape production in several areas of Pennsylvania. The Pennsylvania State University Agric. Expt. Sta. Prog. Rpt. 303. pp. 12.
10. Haeseler, C. W. and G. M. Greene II. 1987. Characteristics of the red wine cultivar Marechal Foch (Kuhlman 188-2), as grown in Adams County, Pennsylvania. Applied Agricultural Research 2(2):103-106.
11. Haeseler, C. W. and Robert B. Beelman. 1977. Vine performance and wine quality for seventeen white wine grape cultivars grown in Erie County, Pennsylvania for three growing seasons. Am. J. Enol. Vitic. 28(4):223-227.
12. Matelski, R. P. 1974. Vineyard soils for Pennsylvania. Proc. PA Wine Conf. 7:83-85.
13. Mattick, L. R. R. A. Plane and R. D. Weirs. 1980. Lowering wine acidity with carbonates. Am. J. Enol. and Vitic. 31(4):350-355.
14. Morris, J. R., D. W. Cawthon. 1982. Effect of irrigation, fruit load and potassium fertilization on yield, quality and petiole analysis of Concord (Vitis labrusca L.) grapes. A. J. Enol. and Vitic. 33(3):145-148.
15. Ruiz, Hernandez, M. 1969. Contribution of the study of acidity in wines from northern Spain; fertilization and the potassium nutrition of vines and wine quality. Semana Vitivini. 1196-7:10.
16. Shaulis, N. J. 1956. The sampling of small fruits for composition and nutritional studies. Proc. Am. Soc. Hort. Sci. 68:576-586.

17. Shaulis, N. J., H. Amberg, and D. Crowe. 1966. Response of Concord grape light, exposure and Geneva double curtain training. Proc. Am. Soc. Hort. Sci. 89:268-80.
18. Sims. V. A. and J. R. Morris. 1984. Effects of pH, sulfur dioxide, storage time and temperature on color and stability of red muscadine grape wine. Am. J. Enol. and Vitic. 35(1):35-39.
19. Smith, C. B., H. K. Fleming and J. H. Poorbaugh. 1957. The nutritional status of Concord grape vines in Erie County, Pennsylvania as indicated by petiole and soil analyses. Proc. Am. Soc. Hort. Sci. 70:189-196.
20. Snedecor, G. W. 1946. Statistical methods. 4th Ed. Iowa State Univ. Press. Ames, IA. pp. 123-93, 413-446.
21. Waller, R. A., and D. B. Duncan. 1969. A bayes rule for the symmetric multiple comparison problem. Am. J. Stat. Assoc. 64: 1484-503.

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Relationship Between Visual Rating and Chromaticity Values in 'Delicious' Apple Strains[1]

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Abstract

Fruit of 37 'Delicious' apple (*Malus domestica* Borkh.) strains were harvested 149 days after full bloom in 1988, and visually evaluated by panelists on a 1 to 10 scale, where 10 = excellent color. Fruit color was measured at the mid point between the stem and calyx end on the blushed surface of each fruit with a Minolta Chroma Meter CR-200b portable tristimulus colorimeter. A simple linear regression of color panel rating on L* value provided a $R^2 = 0.55$, indicating that this parameter influences visual color evaluation. However, the a*/b* ratio was the best single predictor of color rating ($R^2 = 0.63$). Although several models were tested, and many were statistically significant, none appeared to be better than the a*/b* ratio from a practical standpoint. Assessing fruit color with a colorimeter eliminates the problems of subjectivity associated with visual ratings and permits color to be reported in internationally accepted units.

Introduction

Fruit color is an important characteristic of 'Delicious' strains and influences both consumer acceptance (3) and sales (10). Consequently, a major criterion in the selection of new strains is their higher red coloration (5). Visual assessment of fruit red color is a primary basis for the U.S. grade standards (11), and low coloration is an important cause for reduction in grade (1). Cultural practices that improve red color include growth regulator sprays (8), orchard nutrition (12) and summer pruning (9). Evaluation of fruit color following field investigations generally utilize sensory (numerical rating) methods (2, 8). Whereas this approach is adequate from the standpoint of U.S. grade standards which have wide variations, it can be problematic from a research standpoint because treatment differences may be less dramatic and because the subjective nature of sensory ratings makes it difficult to quantify and compare results from different studies. The development of portable, easy-to-operate, tristimulus colorimeters permit quantification of fruit coloration in internationally acceptable units, thereby allowing more reliable and consistent comparisons of fruit color.

The objective of the present study was to determine the relationship between sensory color evaluation and Commission Internationale d'Eclairage (CIE) L* a* b* Color Space coordinates (7) measured with a Minolta Chroma Meter CR-200b portable tri-

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