GRAPE SAMPLE PREPARATION METHODS REPRESENTATIVE OF MUST AND WINE ANALYSES

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ABSTRACT

Four methods of preparing grape berry samples for testing soluble solids, total acid, and pH were evaluated on European, American, American hybrid and French hybrid varieties. Grapes prepared in the Waring blender gave values of acid and pH corresponding to those of must and wine of red varieties when the grapes, with skins and seeds, were fermented at 70°F for 2 to 7 days.

When grapes for making white wines were pressed immediately after crushing and stemming, the "Squeezo" strainer appeared best for obtaining results on berry samples similar to must and wine analyses. The "potato ricer" and the "laboratory press" were not adequate for extracting total acid from red American varieties. Samples prepared in the Waring blender were 0.2 to 0.3 higher in pH than samples obtained by the other methods. All four methods compared satisfactorily for determining soluble solids.

Reliable measurements of sugar and acid in grapes and must are very useful to the enologist. These permit an evaluation of maturity, approximate calculation of obtainable alcohol, utilization as to wine type, blending for balance of alcohol, sugar, and acid in the wine, and for amelioration if necessary.

This study was made to determine which methods of sample preparation give sugar and, particularly, acid analyses that are more representative of the must and wine. Previous attempts showed that white wines made by prolonged contact with the skin (16-18 hours) tended to be lower in total acid and higher in pH than those pressed immediately following stemming and crushing. This phenomenon has been reported and confirmed by Ough (5). It was also noted that red wines fermented on skins and seeds for 2-7 days tended to have high pH.

Soluble solids represent 90 to 94% of the sugars present in grapes. These solids are commonly used as an indirect measure of sugars because they can be determined rapidly and simply with hydrometer or refractometer (1). Cooke (4) showed that hydrometer and refractometer gave comparable measurements of soluble solids when must was filtered.

Of most importance is the procuring of a reliable sample. Amerine and Roessler (3) demonstrated that berry samples can be used with reliability for field-testing grape maturity. The present investigation reports the results of four different methods of sample preparation of grape berries. (Reference to a company or product name does not imply approval or recommendation of the product by the U.S. Department of Agriculture to the exclusion of others that may be suitable.)

MATERIALS AND METHODS

The grapes were grown at the Irrigated Agriculture Research and Extension Center in the lower Yakima Valley. The fruit was turgid and in excellent condition, with a minimum of rots or raisins. In 1970, 4 lugs totaling about 100-120 lb., were harvested from each of 45 varieties. These included

29 European and 16 American, American hybrid, and French hybrids used for making experimental table wines. The grapes had previously been field-tested for proper maturity. Before crushing and stemming, 4 berries were sampled at random from each cluster. One of the 4 berries was put into each of 4 separate cartons until 200 to 500 berries were collected. These samples were prepared in 4 different ways (Figure 1): 1) ground 60 sec in a Waring blender; 2) ground in a "Squeezo" strainer (resembling a hand-type screw press); 3) placed

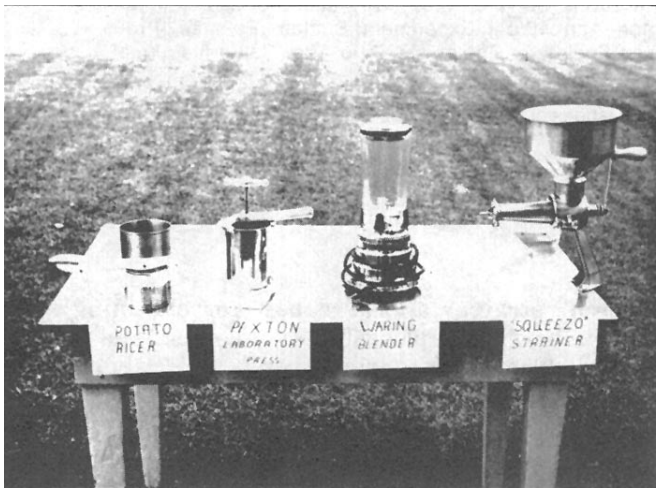

Figure 1. Equipment used in grape sample preparation study.

in a small cotton bag (5.5 x 8 inches), tied and squeezed in a "Pexton" laboratory press; and 4) pressed in a potato ricer. To test the variability of each method an additional harvest of 4 lugs was made. In this case 20 berries were taken from each cluster and one berry placed in each of 20 containers. After each sample of 200-500 berries was obtained, 5 samples were prepared by each method. Only 'Concord', 'Buffalo', 'Helena', and 'Cabernet Sauvignon' were tested in this manner. The juice from each procedure was filtered through 18 ½-cm S and S No. 588 folded analytical filter papers. Only the American varieties required much time for filtering. Soluble solids corrected to 20°C was determined by an Abbé type of refractometer, pH on a Photovolt pH meter, and total acid by titrating 10 g of juice in 100 ml distilled water with 0.1N NaOH to pH 8.4. Total acid was calculated as grams tartaric acid per 100 g. The total acid in wine was determined by pipetting 5 ml of wine into 80 ml of boiled distilled water and titrating to pH 8.4 with 0.1N NaOH.

After the four samples of berries described were removed and tested, the remaining berries and clusters were put through a stemmer-crusher. To each gallon of must was added 100 ppm SO_2 in the form of potassium-metabisulfite. The white varieties were pressed immediately in rack and cloths by using a hydraulic press capable of 4.1 lbs/in^2 pressure on a 17 x 17 inch face. Must samples were taken from the hydraulic press for analysis to compare with berry samples. With red varieties this sample was taken from the total must, placed in a 30-gallon plastic container, and blended for 30 seconds in a Waring blender and filtered. The must of the white varieties was divided between two 5-gallon glass carboys. One-half of the varieties were ameliorated with sucrose, sucrose syrup, or water because of either high soluble solids, high acid, or low soluble solids. Acid was adjusted to 0.9% by adding water or 21-22% sucrose syrup. Sugar was added when soluble solids content was less than 20%, which was usually the case with American types or when European varieties were overcropped. After 4 hours, 2.5 g of a dried preparation of yeast (Montrachet strain) were added to each bottle of white must, and 5.0 g to each container of red must. At the time of addition of yeast, a liquid pectinolytic enzyme preparation was also added at the rate of 0.3 lb per 1000 gallons to the red American varieties.

This procedure facilitated pressing. The white must was fermented at 50-55°F for 60-90 days, racked, adjusted to 100 ppm of SO_2 with potassium metabisulfite, tartrate-stabilized at 22-24°F for 10 days, and filtered through asbestos pads. The resulting wine was stored at 55°F. The red musts were retained with the skin and seeds for 2-7 days at 70°F. The maximum cap temperature was less than 85°F. These musts were punched twice daily until pressed. Three days to 2 weeks later the new wines were racked. A second racking was made about 40 days later, when the SO_2 was adjusted to 75 ppm with potassium meta-bisulfite. The red wines were tartrate-stabilized in the same manner as the white wines. Analyses were made on wines after tartrate stabilization, storage at 55°F, and filtration through asbestos pads using Hyflo Super Cel.

RESULTS AND DISCUSSION

Table 1 indicates comparable reliability of the four preparation methods with regard to soluble solids, total acid, and pH for 'Helena', 'Cabernet Sauvignon', 'Buffalo', and 'Concord' varieties. Only the Waring blender was efficient in extracting total acid from such American varieties as 'Concord' and 'Buffalo'. The "Pexton" laboratory press gave the poorest extraction of acid, followed by the potato ricer and the "Squeezo" strainer. The consistency of all the tests was good, indicating uniformity of berry sampling. Any of the 4 methods was adequate for soluble solids extraction, because the values were within the range of error of the sampling methods used.

Table 2 shows the American and French hybrid white varieties and American and American hybrid red varieties to have no significant difference in

TABLE 1

Variability in Analysis of Grape Samples by 4 Methods of Preparation

	Soluble solids %				Total acid (g H_2T/100g)				pH			
	Waring blender	"Squeezo" strainer	Laboratory press	Potato ricer	Waring blender	"Squeezo" strainer	Laboratory press	Potato ricer	Waring blender	"Squeezo" strainer	Laboratory press	Potato ricer
'Helena'												
Mean[a]	23.44	23.32	23.28	23.12	1.37	1.42	1.45	1.55	3.32	3.07	3.06	3.02
SD[b]	0.10	0.13	0.25	0.026	0.021	0.016	0.023	0.0026	0.0055	0.0055	0.0055	0.0055
'Cabernet Sauvignon'												
Mean	23.64	23.36	23.38	23.28	0.769	0.772	1.04	0.961	3.72	3.39	3.24	3.23
SD	0.055	0.11	0.083	0.044	0.0078	0.014	0.024	0.033	0.0055	0.0071	0.013	0.0084
'Concord'												
Mean	18.82	18.80	19.10	18.82	0.869	0.639	0.271	0.480	3.46	3.36	3.53	3.33
SD	0.026	0.16	0.022	0.22	0.025	0.031	0.032	0.040	0.0084	0.0084	0.049	0.021
'Buffalo'												
Mean	21.14	21.46	22.10	21.68	0.811	0.773	0.424	0.657	3.64	3.34	3.49	3.32
SD	0.17	0.11	0.31	0.014	0.0044	0.022	0.014	0.011	0	0.0055	0.023	0.0028

[a] Mean of 5 samples by each method.
[b] SD = standard deviation.

TABLE 2

Mean[a] Soluble Solids for Grape Must and Berry Samples Prepared by 4 Methods

No.	Variety	Grape Berry Sample				
		Must	Waring blender	"Squeezo" strainer	Lab press	Potato ricer
18	European varieties, white	21.02bc	21.30d	21.17cd	20.79a	20.96ab
8	American & French hybrids, white	20.68a	20.41a	20.49a	20.44a	20.51a
11	European varieties, red	21.92a	21.63b	21.56b	21.15c	21.31d
4	American & American hybrids, red	18.80a	18.50a	18.68a	18.58a	18.50a
4	French hybrids, red	23.93ab	23.95a	23.65c	23.75bc	23.60c

[a] All means followed with the same letter are not significantly different at the 5% level.

soluble solids by the four methods used. With the European varieties and red French hybrids, however, there were significant differences. With the European varieties the potato ricer and laboratory press tended to give the lowest values of soluble solids. With the European white varieties the soluble solids obtained with the potato ricer and "Squeezo" strainer methods of preparation were not significantly different from those of the must. Therefore, all 4 methods of preparation were adequate for extracting soluble solids.

Must analyses shown in table 3 were made before amelioration but the wine analyses included ameliorated samples.

The most important differences between the preparation methods are shown in the total acids and pH data presented in table 3. With the white European varieties, total acid by the Waring blender procedure is significantly lower than that of the must, although some varieties show little or no decrease in acid. The "Squeezo" strainer value is not significantly different from that of the must, but the potato

TABLE 3

Mean[a] Total Acidity (TA) and pH for Wine, Grape Must, and Berry Samples by 4 Methods

No.	Variety	Wine TAg/ 100 ml	Total acidity %					pH					
			Must	Grape berry samples					Grape berry samples				
			hyd. press	Waring blender	"Squeezo" strainer	Lab press	Potato ricer	Wine[b]	hyd. press	Waring blender	"Squeezo" strainer	Lab press	Potato ricer
18	European varieties, white	0.857	1.023b	0.971c	0.994bc	1.097a	1.086a	3.230b	3.253b	3.518a	3.235b	3.204b	3.180b
8	American & French hybrids, white	0.772	0.855a	0.906a	0.894a	0.647b	0.857a	3.264bc	3.276b	3.456a	3.225cd	3.294b	3.024d
11	European varieties, red	0.859	0.978c	0.991c	1.050b	1.181a	1.178a	3.552a	3.560a	3.557a	3.265b	3.215b	3.204b
4	American & American hybrid, red	0.815	0.785a	0.798a	0.683b	0.350c	0.601b	3.390ab	3.488a	3.485a	3.265bc	3.430a	3.253c
4	French hybrids, red	0.920	0.953c	1.001bc	1.165ab	1.265a	1.215a	3.718a	3.610b	3.613b	3.308c	3.258c	3.240c

[a] All means followed with the same letter are not significantly different at the 5% level.
[b] Ameliorated wines were included in analysis of variance for pH because of minor effects of dilution. However, TA of wines were not analyzed for variance.

ricer and laboratory press values are significantly higher than that of the must. The pH values by the Waring blender method are significantly higher than those of the must. Thus the "Squeezo" strainer appears to be the most representative method for white European varieties. With white American and French hybrids the laboratory press did not give a satisfactory extraction of total acid. pH was significantly higher with the Waring blender method than with the other methods. The pH of the "Squeezo" strainer sample was not significantly different from that of the wine. Thus the "Squeezo" strainer would appear most useful for testing all white varieties for soluble solids, acid, and pH, whether European or American or French hybrids. This instrument more nearly resembles the screw-type crusher recommended by Amerine et al. (2) except that it was hand operated.

A very different situation exists with the red varieties. The Waring blender values of total acid and pH more nearly represented the must and wines than the other methods, as shown in table 3. The Waring blender is the only method giving a complete extraction of acid from the American and American hybrid varieties. It is interesting that red European varieties and red French hybrids are probably of very similar composition, whereas red American and American hybrids are different. The acids in the last are located largely in the skin areas and are extracted by the blender, whereas the acids in the European varieties are in the juice nearer the seed and are easily removed by the laboratory press and potato ricer.

This increased pH by the Waring blender procedure may be due mainly to release of cations in maceration. Extraction of a salt of a weak acid and strong base could explain the increase of pH. In 16 of the 18 European white varieties shown in table 3, total acid by the Waring blender was lower than that of the must. Two possible explanations could be: a) that the formation of an insoluble salt such as potassium acid tartrate is removed from the must and wine by detartration and filtration; and that b) there is an unequal distribution of acid in grape berry species. With the European varieties, free-run juice and light pressing could remove liquids that would be higher in acid.

The "Squeezo" strainer appears to be best for obtaining representative samples for acids and pH determinations, and best reflects the quality of must and wine of the white varieties, whether European, American, American hybrid, or French hybrid. With red varieties, the acid and pH of the wine and must are better represented by sample preparation in the Waring blender.

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