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EFFECTS OF CULTIVAR, HARVEST DATE, AND SEASON ON QUALITY AND YIELD OF ARKANSAS WINE GRAPES

Keith Striegler and J.R. Morris

Arkansas could be considered as the viticultural "melting pot" of the United States. In no other area are there as many grape species and interspecific hybrids successfully grown for wine production. Wines are produced from *Vitis vinifera, Vitis rotundifolia, Vitis labrusca, Vitis aestivalis,* American hybrid, an French-American hybrid grape cultivars. Among these various species and interspecific hybrids, the culture of *Vitis vinifera* and French-American hybrids is the most demanding.

However, little information is available on the performance of *V. vinifera* and French-American hybrid cultivars in Arkansas. Preliminary evaluations have indicated that fruit maturity may be a problem in these cultivars under Arkansas conditions. Percent soluble solids or °Brix, acidity, and pH measurements are often used to assess fruit maturation. Amerine et al. established ranges for these parameters in California musts (Table 1). Using this information, previous investigators have found that low soluble solids (5,6), low acidity (6), and high pH (6) can he encountered in fruit at harvest under Arkansas conditions. Information on fruit maturation would be beneficial in determining optimum harvest dates for wine grapes in Arkansas. Furthermore, additional evaluation of V. vinifera and French-American hybrid wine crape cultivars would be advantageous since future plantings of wine grapes in Arkansas will be primarily of these cultivars.

Table 1. Recommended ranges of °Brix, titratable acidity, and pH in musts.[z]

Type or Wine	°Brix	Titratable acidity	pH
White table	19.5-23.0	0.70	3.3
Red table	20.5-23.5	0.65	3.4
Sweet table	22.0-25.0	0.65	3.4
Dessert	23.0-26.0	0.50	3.6

[z] After Amerine et al. (2).

To address these needs, a study was conducted during the 1979 and 1980 seasons to determine the fruit quality and yield of wine grapes grown in Arkansas.

MATERIALS AND METHODS

Fifteen cultivars were included in this study. Only results from the *Vitis vinifera* cultivars 'White Riesling', 'Gewürztraminer','Cabernet Sauvignon and 'Pinot Noir'; and the French-American hybrid cultivars 'Seyval', 'Villard Blanc', 'DeChaunac', and 'Baco Noir' are presented in this report. The two seasons in which this study was conducted were distinctly different. The 1979 season was cool and wet, while the 1980 season was hot and dry. Generally, the combined effects of drought and high temperatures in 1980 produced the most unfavorable climatic conditions for viticulture in Arkansas since 1936.

A factorial design was used with cultivar and harvest date comprising the factors. Plots consisted of three mature, uniformly growing, healthy vines and were replicated twice. All cultivars were own rooted and did not receive supplemental irrigation except during 1980 when water was applied late in the season to avoid crop and vine loss.

Fruit samples were collected at various times during ripening to demonstrate the effect of harvest date on quality. Sampling began after veraison. Each sample consisted of at least 200 randomly selected berries which were sealed in polyethylene bags, stored on ice, and transported to the Food Science Laboratory at Fayetteville where they were immediately frozen for later analysis.

At the time of analysis, thawed samples were blended for 30 seconds in a laboratory blender and then placed in a 250 ml beaker which was covered with a watch glass. The samples were heated for 1 hour at 85°C in a water bath to bring tartrates into solution. After cooling, the samples were squeezed through two layers of cheesecloth. The resulting juice was centrifuged for 10 minutes at 4000 rpm.

Percent soluble solids was determined using a Bausch and Lomb Abbe refractometer. A 5 ml aliquot of .juice was diluted to 125 ml with deionized H_2O and then titrated to pH 8.4 with 0.1 N NaOH to determine acidity. The pH was determined using a Corning (Model 130) pH meter. Following the final fruit sampling, the vines were harvested and individual vine yields were recorded.

RESULTS AND DISCUSSION

All white cultivars except 'White Riesling' produced acceptable soluble solids in 1979 (Figure 1). During 1980 'Villard Blanc' had the highest soluble solids among the white cultivars (Figure 2). As in 1979, soluble solids levels were low in 'White Riesling'. "Baco Noir' was highest in soluble solids among the red cultivars in 1979; however, none of the red cultivars exceeded 20% soluble solids (Figure 3). During the hot, dry year of 1980, soluble solids accumulation was greatest in 'Baco Noir' and 'Cabernet Sauvignon' (Figure 4). The lowest soluble solids content was found in fruit of DeChaunac.

The loss of acidity during 1979 was greatest in 'Gewürztraminer' and 'Villard Blanc' within the white cultivars (Figure 5). A similar trend was evident in 1980 (Figure 6). Acidity levels in general were reduced in 1980 due to the high temperatures which occurred during ripening. High acidity rather than low acidity was a problem in the red cultivars during 1979 with 'Baco Noir' having the highest acidity (Figure 7). The *V. vinifera* cultivars 'Cabernet Sauvignon' and 'Pinot Noir' had the lowest acidity in 1980 (Figure 8). The reduction in acidity of 'Pinot Noir' during ripening was quite dramatic. However, in 'Cabernet Sauvignon' berries, acidity was low initially and changed little during the sampling period.

All white cultivars showed increases in pH as ripening progressed in 1979 (Figure 9). The pH found in 'Villard Blanc' and 'Gewürztraminer' was quite high by the final harvest date. It is important to note that due to the preparation technique employed in this study, pH values for the white cultivars may be from 0.2 to 0.3 units too high (3). A similar pattern was observed in 1980 (Figure 10). However, the pH measurements obtained at the final harvest date for 'Seyval' and 'White Riesling' were not appreciably higher than in 1979, while 'Villard Blanc' and 'Gewürztraminer' displayed final harvest date pH values which were much higher than in 1979.

Among the red cultivars, 'Cabernet Sauvignon' and 'Pinot Noir' exhibited the greatest increases in pH during 1979 (Figure 11). All red cultivars had a higher pH by the final harvest date in 1980 than in 1979 except 'Cabernet Sauvignon' (Figure 12). This cultivar did not increase significantly in pH during the sampling period.

Yield was highest in 'Cabernet Sauvignon' and 'Villard Blanc' in 1979 (Table 2). A reduction in yield during 1980 was observed in all cultivars except 'Pinot Noir' and 'White Riesling'. During this season the highest yield was recorded in 'Pinot Noir'.

Table 2. Harvest date and yield of wine grapes grown in Arkansas.

	1979		1980	
Cultivar	Harvest Date	Yield (tons/A)	Harvest Date	Yield_ (tons/A)
Red				
Cabernet Sauvignon	Sept. 4	8.0	Sept. 3	6.8
Pinot Noir	Aug. 15	6.5	Aug. 20	12.6
DeChaunac	Aug. 8	6.2	Aug. 6	4.9
Baco Noir	Aug. 8	4.7	Aug. 7	4.1
White				
White Riesling	Aug. 15	4.3	Aug. 27	6.5
Gewürztraminer	Aug. 15	5.9	Aug, 11	5.3
Seyval	Aug. 15	5.8	Aug. 5	4.9
Villard Blanc	Sept. 4	9.0	Aug. 27	4.1

Under the conditions of this study, Arkansas wine grapes seldom met Amerine's recommendations for % soluble solids, % acidity and pH in California musts (Table 1). Soluble solids and pH appear to he the quality parameters which deviate the most from these recommendations. Harvesting based on soluble solids content would have resulted in excessive pH. On the other hand, harvesting based on pH would have resulted in low soluble solids content.

Traditionally, wine grapes have been harvested using soluble solids content as the primary criterion of maturity. This is due to the fact that greater than 90% of the soluble solids in grapes are composed of fermentable sugars (1,2). Thus, soluble solids content is related to the yield of ethanol during fermentation.

The importance of off in determining wine quality and stability is becoming increasingly recognized. Amerine and Ough have suggested that wines with a pH greater than 3.60 are potentially unstable (l.). As a result, high pH grapes present special problems for the winemaker. To avoid this problem, harvesting based on pH has been advocated for the Central Valley districts of California (4).

The decision of when the harvest wine grapes in Arkansas should be based on the style of wine which is to he produced. Early harvesting should be used when low soluble solids and low pH are desired. Grapes harvested at this time are well suited to the production of low alcohol wines. If higher alcohol, table wines are to be produced, pH and

soluble solids should he carefully monitored during maturation to insure that optimum grape quality is achieved. The yields obtained from wine grapes in Arkansas during the study were quite good, especially for the *V. vinifera* cultivars. Further study is needed to determine if these consistent high yields can be maintained.

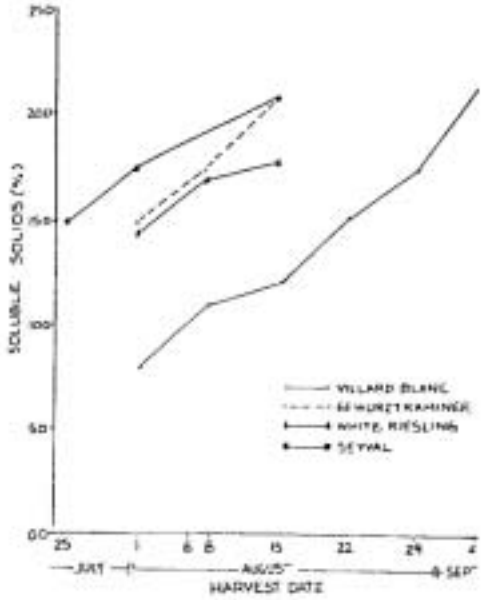
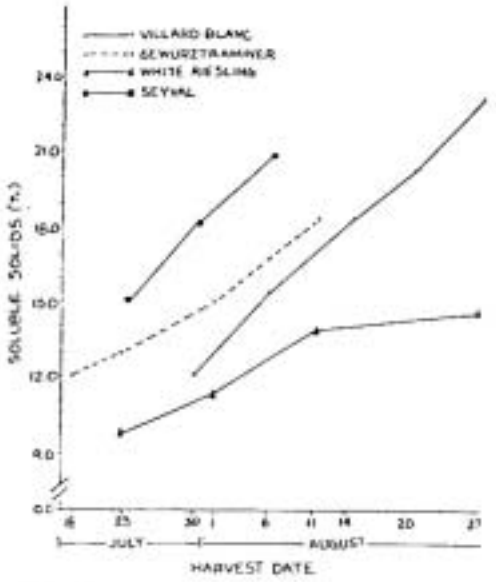


FIGURE 1. CHANGES IN SOLUBLE SOLIDS OF WHITE WINE GRAPE CULTIVARS DURING 1979.



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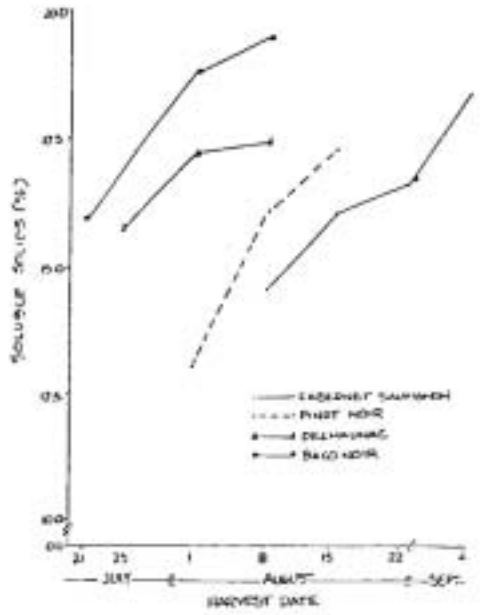

FIGURE 3. CHANGES IN SOLUBLE SOLIDS OF RED WINE GRAPE CULTIVARS DURING 1979.

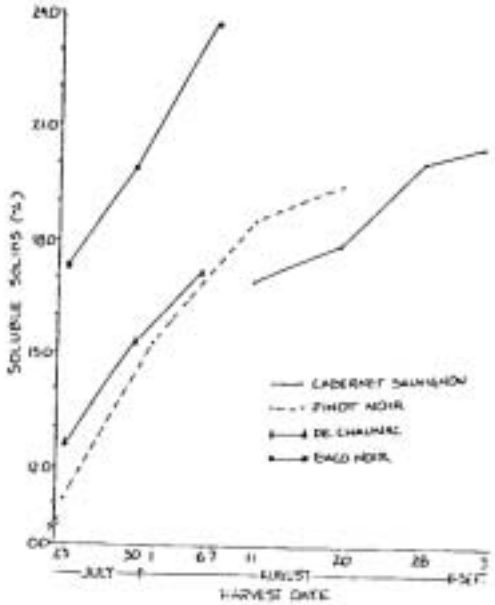

FIGURE 4. CHANGES IN SOLUBLE SOLIDS OF RED WINE GRAPE CULTIVARS DURING 1980.

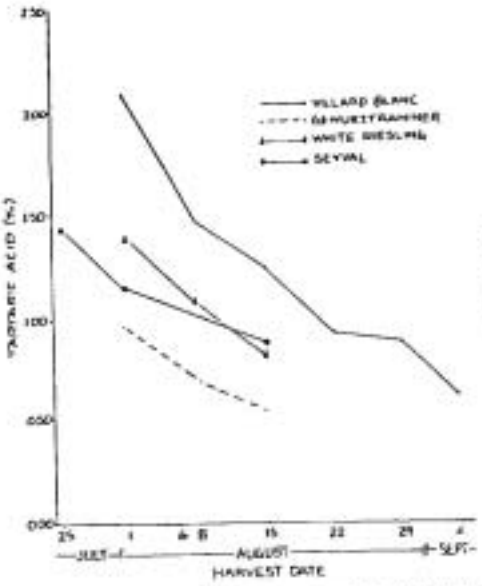

FIGURE 5. CHANGES IN ACIDITY OF WHITE WINE GRAPE CULTIVARS DURING 1979.

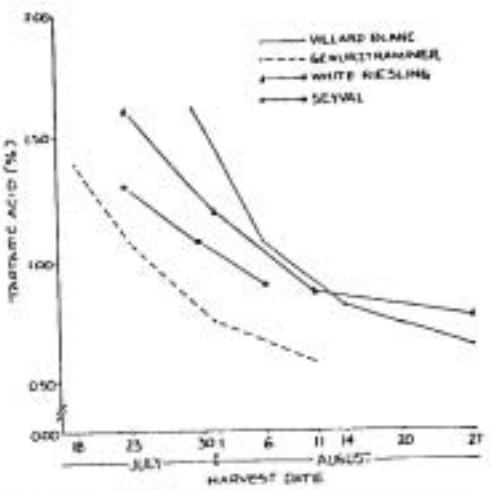

FIGURE 6. CHANGES IN ACIDITY OF WHITE WINE GRAPE CULTIVARS DURING 1980.

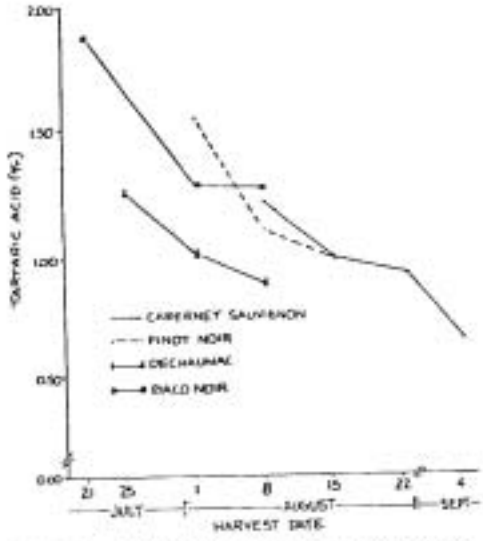

FIGURE 7. CHANGES IN ACIDITY OF RED WINE GRAPE CULTIVARS DURING 1979.

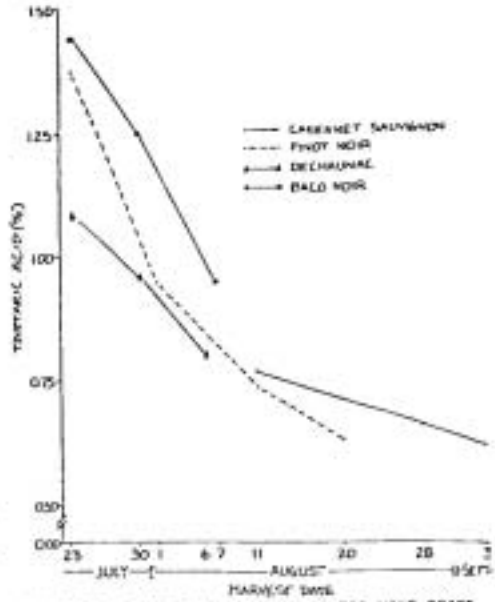

FIGURE 8. CHANGES IN ACIDITY OF RED WINE GRAPE CULTIVARS DURING 1980.

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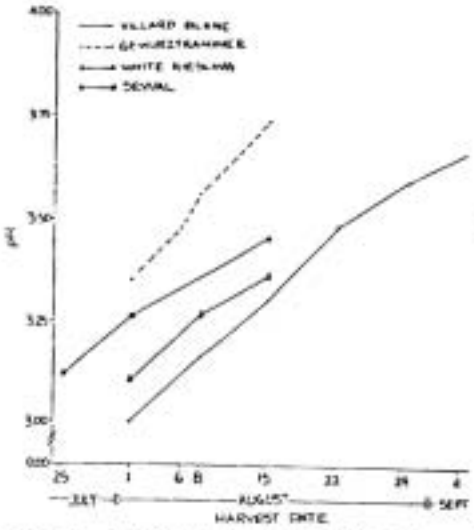
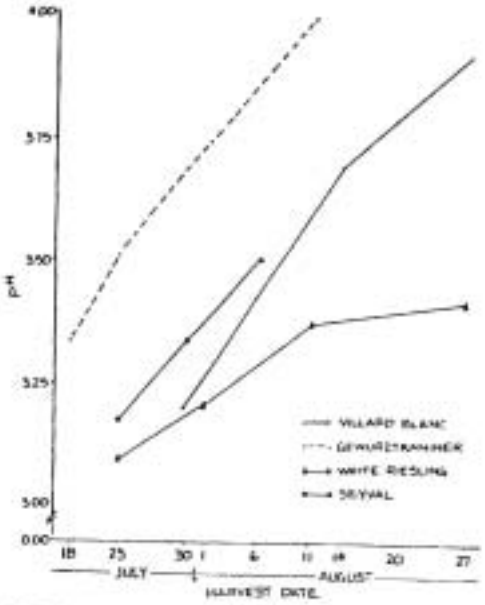


FIGURE 9. CHANGES IN pH OF WHITE WINE GRAPE CULTIVARS DURING 1979.



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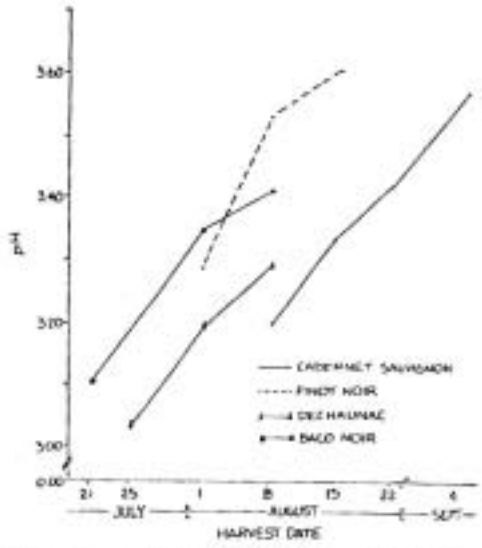

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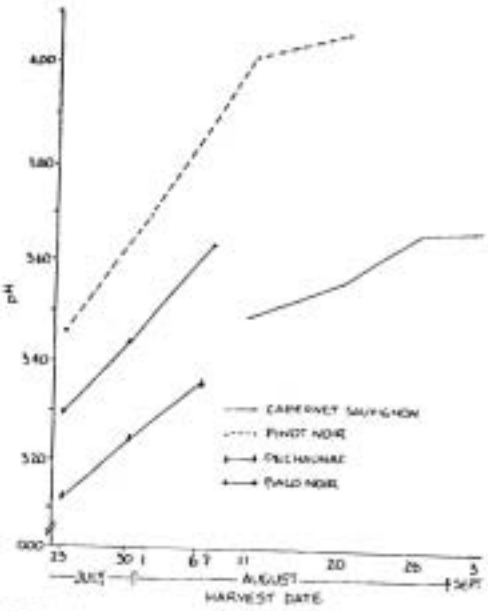

FIGURE 12. CHANGES IN pH OF RED WINE GRAPE CULTIVARS DURING 1980.

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