The Wine and Juice Industry in Arkansas
by Justin Morris, Ph.D.

ARKANSAS IS THE OLDEST AND largest producer of grape juice and wine of all the states in the southern United States. It all started late in the last century, and in more recent times has been closely connected to the University of Arkansas at Fayetteville.

History Grapes were first grown commercially in Arkansas sometime in the 1870s at Altus, Franklin County, by a colony of German-Swiss who settled in the foothills of the Ozark Mountains. With both the soil and climate suited to grape production, these early viticulturists soon recognized the potential of the region. The Boston Mountains to the north provided a barrier to the winter cold, and the elevation of the small, flat-top mountains provided the necessary protection from spring frost.

These early winemakers found a ready market for their product among the immigrant railroad workers and coal miners who were accustomed to enjoying wine with their meals. Some of the early winemakers in the area were Herman Wiederkehr, Jacob Post and Henry Sax. Several wineries operating in the Altus area today are run by fourth and fifth generation descendants of these original wine families.

Professor Joseph Bachman was a Swiss immigrant and grape breeder in the Altus area in the late 1880s. The cultivars he developed drew nationwide attention and made contributions to Eastern viticulture. One of his most famous cultivars won a silver medal in the 1904 exposition in St. Louis. The grape was later bought by Stark Brother's nursery and renamed Stark's Star.

During Prohibition, many wine grape vines were grafted over to table-grape cultivars. Private grape breeders such as Joseph Bachman developed Sunrise, Stark's Star and Banner cultivars. Herman Wiederkehr discovered a bud mutation of Campbell's Early during this period and sold the propagation rights to Stark Brothers Nurseries. This became Stark's Patent No. 1. At repeal of Prohibition, the wineries in the Altus area expanded significantly. Most of the plantings now are devoted to the best of the French American hybrids and hardy Vitis vinifera. Al Wiederkehr of Wiederkehr Wine Cellars is given credit for pioneering the first commercial vinifera plantings in Arkansas.

Another early grape production center was established in Northwest Arkansas in Washington County by Italian immigrants. These Italian immigrants first went to Sunnyside, in the southeastern corner of the state, to settle on a large plantation owned by Austin Corbin.

The first ship arrived in New Orleans in 1895 carrying 100 families, and the second ship arrived in New York in 1896. Three years after their arrival, a double tragedy struck. Their benefactor, Corbin, died, and a malaria epidemic spread throughout the new colony. Over 100 people died in one year. These Italians from the mountainous climate of the Alps and Apennines could not acclimate to the conditions of the eastern Arkansas swamps.

A Catholic priest by the name of Father Bandini of New York heard of the plight of the Italian immigrants and came to their rescue. He gathered the 20 remaining families and took them to the area that is now Tontitown, where he purchased 700 acres of land and founded the town. These people soon found that Concord juice grapes, as well as hardy wine grapes, thrived in this area and provided excellent quality juice. Early wineries were established in the Tontitown area, but not one operates today. However, wine grapes are still produced in Northwest Arkansas. They are then shipped to the Altus wineries for processing. Tontitown still celebrates its annual Concord Grape Festival inaugurated in 1898.

Welch Foods learned of this group of grape growers and in 1922 built a Concord juice plant in Springdale. When sold in 1992 to Ozark Valley Products, it had a juice storage capacity of 1.9 million gallons. Today Ozark Valley Products continues to process grape juice as well as other fruit-juice products.

There are now four wineries in Arkansas with a storage capacity of 1,230,000 gallons. Two of these wineries in the Altus area are in the top 100 wineries in the United States in terms of wine gallons produced annually. Wiederkehr Wine Cellars, Ins., is 49th and Post Winery, Ins., is 67th.

The University of Arkansas For the past 33 years, the University of Arkansas has devoted major research effort to developing methods that will allow the Arkansas grape and wine industry to remain competitive on a national basis. The thrust of the research has been to evaluate the effect of each part of the production-growing, harvesting, handling and processing-on final juice yields and quality. This is one of the few programs in the United States to examine the total system and its effect on final juice quality. As a result of the research, recommendations have been developed for training systems, production systems, mechanical harvesting and handling systems, mechanical pruning systems, mechanical shoot positioning systems, and also for new processing methods. We have developed production techniques that have doubled production without any loss in juice quality.

Studies have shown that wine quality can be maintained through the use of mechanized vineyard canopy management to provide fruit exposure. This must be combined with optimizes: viticultural practices, especially fruit thinning and management for optimal soil moisture. Vineyard mechanization such as mechanical pruning, has minimal adverse effects on grape juice quality and should benefit the Concord grape juice industry.
For many years I have worked with the breeding program of Distinguished Professor J.N. Moore and Dr. John Clark of the Horticulture Department at the University. This research group gathered detailed evaluations of all of Dr. Moore's new breeding lines and released new table-grape and juice-grape cultivars. This team research effort has allowed for a complete knowledge of the fresh and processed quality of all new table grape and juice-grape releases. In 1993 a new juice grape was released by the Moore, Morris and Clark team out of the Arkansas Agricultural Experiment Station. Sunbelt, the new cultivar, fulfills the need for a processing grape that can be grown in southern areas. Sunbelt ripens evenly under the climatic conditions of extreme southern areas where Concord grapes display the uneven fruit ripening associated with high temperatures. Sunbelt is similar to Concord in most plant and fruit characteristics, differing primarily in its ability to ripen more evenly under high temperatures.

The need for knowledge about the quality of the final juice or wine product as well as consumer acceptability resulted in an inter-department research effort with Dr. Carter Price and Dr. Carl Dillon of the Department of Agricultural Economics. It has explored alternative markets for grapes and developed budgets for production and processing for both juice and wine.

The University of Arkansas program is now recognized for having one of the best programs east of the Rockies for training graduate students in etiology. The Eastern Section of the American Society of Etiology and Viticulture regularly presents University of Arkansas students with research awards, and former students are currently serving as the next generation of winemakers and researchers for the grape and wine industry.

**A SAMPLING OF RESEARCH PROJECTS**

*Editor's note:* From many pages describing grape, wine and juice research at the University of Arkansas, the following seem to have the most universal appeal to AWS JOURNAL readers. They also seem to reflect results that would likely be valid for other climates or be projects that could be investigated elsewhere. However, keep in mind that the research was specific to Arkansas and may or may not be applicable to other areas of the country.

**Controlling resveratrol levels**

Resveratrol has recently come to public attention as a possible link between the moderate consumption of wine and the reduction of cholesterol levels. Resveratrol is a key component of the vine's ability to ward off infection. Research has been conducted to determine: 1) Factors that affect resveratrol levels in wine, 2) How variables should be changed to increase resveratrol levels, 3) Optimal resveratrol level, 4) What actions must be taken to achieve this optimal level.

By controlling these factors, production of wine with higher resveratrol levels is conceivable.

**Fining agents and color of Seyval Blanc**

Experiments examined the effects of fining agents applied prior to and/or during fermentation on the color of Seyval Blanc wine. In the experiment, kieselsol, polyvinylpolypyrrolidone, bentonite, sulfur dioxide (SO₂) and combinations of these were applied to the juice. The juice was analyzed and then fermented. Wine was analyzed initially and after two months of storage. All bentonite applications improved juice and wine color as compared to the control. Bentonite added both to juice and during fermentation reduced browning to the salve extent as did SO₂. However, storage for two months at 37°C increased browning of all treatments except the SO₂ treatment in both studies, showing a need for an antioxidant at bottling.

**Canopy management and aromatic qualities of Golden Muscat grapes**

Studies on the influence of cluster exposure to the sun in the vineyard as well as winemaking processes on monoterpenes and the resulting olfactory effects on wine were conducted on Golden Muscat. Canopies of Golden Muscat grape vines were manipulated by shoot positioning and basal leaf removal at fruit-set to create shaded and exposed cluster conditions. Exposed fruit contained more phenols and sugars and less acid than shaded fruit, and these
differences remained in the wines. An olfactory evaluation detected differences between wine from shaded fruit and wine from exposed fruit and among wines from different winemaking treatments.

Lampblack for frost protection of Concord grapes

The test began on April 4 when there was still a 50 percent probability of the temperature falling to 28°F. Lampblack was applied at the rate of 25 pounds per acre. Temperatures were measured at 12-minute intervals at heights of 4.5, 38 and 55 inches at two locations in the treated and check plots from April 4 through April 19. Five episodes of freezing temperatures occurred during this time.

Onset of 32°F averaged an hour later in the lampblack plot than in the check plot, and average duration of freezing temperatures was shorter in the lampblack plots than in the check plot, averaging about 45 minutes less at the 38 inch height.

On April 9, temperatures at the 55-inch height fell to nearly 26°F in check plots and to slightly less than 28°F in lampblack plots. Bud counts on April 23 showed no evidence that lampblack had reduced bud damage. This preliminary test suggests that some frost protection can be achieved by applying lampblack but temperature differences are not great. Significant protection may be noted only if freezes occur when buds are at their most susceptible stage and temperatures do not fall much below 28°F.

Study of training and pruning systems on Niagara grapes.

The study involved the response of Niagara grapes to various training and pruning systems. Training systems included the Geneva Double Curtain and single wire cordon. Pruning variations included the severities of 30, 50 and 70+10. (For those unfamiliar with pruning methods, 30 plus 10 means the pruner retains 30 buds or nodes for the first pound of cane prunings and 10 buds for each additional pound removed; 50 plus 10 means 50 nodes are left for the first pound and 10 nodes for each additional pound.)

Spur or cane lengths of 3, 6 and 9 nodes and shoot positioning were included. All are being evaluated. Preliminary results (average of two years’ data) indicate that the Geneva Double Curtain training system is more productive than single wire cordon, while maintaining juice quality at a level comparable to the lower yielding single cordon training system.

Less severe pruning will increase yields with a corresponding reduction in soluble solids. Little response has been obtained from the different spur or cane lengths. Shoot positioning increases yield without a sacrifice of fruit quality.

Acids, which are of concern in Niagara grapes, drop rapidly and pH increases rapidly as the fruits mature. Excessively high pH's are obtained by the time Niagara grapes develop 15 percent soluble solids.

Changes in training systems, pruning and spur lengths on French hybrids

A study was conducted for four years on three white and three red commercially important French hybrid cultivars to determine their response to training systems, pruning severities and spur lengths. Chelois and Chancellor (both red) were the highest-yielding and most vigorous cultivars. Verdelet and Aurore (both white) were the lowest yielding cultivars.

The lower-yielding white cultivars had a higher percentage of soluble solids, higher pH and lower acidity at harvest than the higher-yielding red cultivars. Regression analysis showed that the Verdelet and Aurore cultivars had a higher pH at a given percentage of soluble solids than did Seyval (white), Villard Noir (red), Chelois, and Chancellor cultivars. All cultivars except Aurore had higher yields and lower percentage of soluble solids on the Geneva Double Curtain training system than on the single-wire, bilateral cordon system. Training system had no effect on pH or acidity. There were no differences between the 10+10 and 20+10 pruning severities on yield, pruning weight or quality parameters. There was probably due to the productive nodes in noncount positions. There were no differences between the 2-node spurs and the 4-node spurs on yield, pruning weight or quality parameters.

Aging abilities of red wine pigment

The fractionation of wine anthocyanins was accomplished by direct injection onto a low pressure chromatographic column. The procedure was used to analyze five different wine styles made with Vitis vinifera and Vitis rotundifolia grapes. The gradient profile consistently resolved the pigments in both types of wines into four distinct fractions. Resultant profiles showed that mono- and di-glucoside anthocyanins in wines aged differently. This research emphasized the inability of red wines with a high portion of di-glucosides to improve with age and remain stable.
The experimental Press at the University of Arkansas. Graduate student Cinda Siler (right) and past AWS scholarship recipient Dr. Renee Threlfall (left).

View of a mechanical shoot thinner that can be used to open area manage vine canopies to increase sunlight and air flow within the canopy. It is part of a complete mechanized vineyard system that is currently being patented by Morris and Oldridge, Arkansas grape growers.
Professor Justin Morris, has been with the University of Arkansas since earning his doctorate from Rutgers University in 1964. He coordinates both the enology and viticulture programs and is known for his work with graduate programs. He has been major advisor for 9 Ph.D. candidates and 33 M.S. students and has served on the committees of many other graduate students. His students are now filling positions of authority and prominence throughout the food and wine industry.

Dr. Morris is now the director of the new University of Arkansas Institute of Food Science and Engineering. The Institute sponsors projects in which faculty members and food processing companies collaborate on research and technology transfer. He is also executive vice president of the Ozark Food Processors Association and recently served as president of the national Council for Agricultural Science and Technology.

Results of his research efforts have been implemented with producers and processors in the major grape production regions in the United States and Europe. Among many other awards, he has received the University of Arkansas College of Agriculture Outstanding Research Award, the Arkansas State Horticulture Society Research Appreciation Award, the Southern Region of the American Society for Horticultural Science (ASHS/SR) Outstanding Research Award, the Gamma Sigma Delta Outstanding Research Award, the national Norman F. Childers Outstanding Graduate Teaching Award presented by the ASHS. He is a fellow of ASHS and has served as Associate Editor for both the ASHS and the ASEV journals.

In 1985 he was promoted to the rank of University Professor, which was a new academic rank for professors who had provided exceptional service. In 1997 he was promoted to Distinguished Professor and became an IFT Fellow and received the Spitze Land Grant University Faculty Award for Excellence.

In 1993 the University of Arkansas Alumni Association bestowed him with the Faculty Distinguished Achievement Award for Research and Public Service. In 1995 the American Society for Enology and Viticulture Eastern Section (ASEV/ES) presented him with the Distinguished Achievement Award and in 1996 he received the ASEV Merit Award. He has published over 300 research and extension articles along with judging 34 wine competitions on local, national and international levels. Morris is also co-author of a new textbook entitled Modern Fruit Science.

In addition to all this, he is a lifetime member, loyal supporter and friend of the American Wine Society.