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Cameron Jones

University of Arkansas at Little Rock

Dominic T.C. Yang

University of Arkansas at Little Rock

Thomas O. Whitley

University of Arkansas at Little Rock

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Composition of Arkansas Grapes During Maturation

CAMERON JONES, DOMINIC T.C. YANG*, and THOMAS O. WHITLEY

Department of Chemistry, University of Arkansas at Little Rock,
Little Rock, Arkansas 72204

ABSTRACT

Changes in organic acid and glucose content during maturation and ripening of grapes grown in Arkansas in 1973 are shown for four French hybrid varieties, S5279, S10878, SV23-657, and S13053, and for four rotundifolia varieties, Scuppernong, Tarheel, Fry, and Magoon. In all varieties the concentrations of malates and tartrates were highest in the early stages of berry growth after véraison. During ripening the titratable acidity decreased and Balling and pH measurements increased. Although varieties reached maturity on different dates, changes in parameters followed similar curves typical for grapes of the species but occurring over a short period (Johnson and Nagel 1976, Winkler 1970). Rotundifolia varieties showed unacceptable Balling-acid ratios as well as irregular maturation progress in the study period.

HISTORY AND BACKGROUND

Vitivinicultural industry, also called the winegrowing industry, may have an important future in Arkansas. Thousands of hillside acres, now semiproductive, could produce valuable crops of grapes. The most discouraging aspect for the investor is the almost complete lack of technical information on desirable locations and the best grape varieties to plant.

European nations have been selecting locations and varieties for hundreds of years (Continuescu 1971). In California, New York, Ohio, Michigan, and Washington sufficient data have been accumulated to define risks and prospects (Carter 1974). The UALR Department of Chemistry undertook preliminary investigations in 1971 using the procedures and techniques developed by the University of California at Davis (Amerine 1967).

Grapes were obtained from the University of Arkansas Experiment Station Fruit Substation in Clarksville to accumulate data on ripening patterns in Arkansas grapes. Wine was made each year from several of the varieties obtained to gain experience in winemaking with local grapes.

Ripening phenomena usually are recorded in terms of sugar and acid content, commonly expressed as ratios of Balling to acid (Joslyn and Amerine 1964). Balling is a hydrometer scale representing soluble solids in grape juice as percentage fructose and total acidity is expressed as percentage tartaric acid. Of total acid, 95% is tartaric and malic. Many other acids account for the remaining 5%. pH was recorded after the first year. A pH of less than 4 is desirable to inhibit the growth of spoilage organisms in the medium, whereas more than 1% total acids may produce wines too acid to drink (Amerine 1967).

Studies reported here were undertaken when it appeared from previous experience that grapes grown in Arkansas do not mature as they do in other states (Amerine and Joslyn 1970, Johnson and Nagel 1976).

The balance between glucose and titratable acid content of mature grapes, or Balling-acid ratio, depends greatly on the variety and climate in which it matures. Taste-panel evaluations of experimental and commercially produced wines in Arkansas indicate a potential for varietal wine production of excellent quality. However, several varieties considered adaptable to Arkansas may in fact show wide fluctuations in Balling-acid ratio from year to year and may not perform as well as in other locations. The varieties of grapes used in this study were selected from varieties known to be grown in commercial quantities within the state.

MATERIALS AND METHOD

Sample preparation. Grape berry samples were collected from varietal plantings of the University of Arkansas Agricultural Experiment Station Fruit Substation near Clarksville. Approximately 500 g of each variety were collected at one-week intervals during the 1973 season. Clusters were taken from several vines in different

*To whom all inquiries should be addressed.

locations in the case of French hybrid varieties. Rotundifolia vines were shaken according to commercial harvesting practice and all fruit which fell was collected. The berries were macerated in a blender for one minute to produce a homogeneous sample. The sample was centrifuged to remove particulate matter and 100 ml of clear juice was placed in a 125-ml flask, labeled, and stored at approximately 0°C until analyzed.

Measurement. The pH of the sample was determined by means of a Beckman pH meter calibrated to ambient temperature and range 3 to 4. Titratable acidity was measured on 5-ml samples of juice diluted with 50 ml of deionized water. The samples were titrated by use of phenolphthalein indicator to first permanent tinge with 0.1N NaOH. Titratable acidity was expressed as tartaric acid in g/100 g of grapes (Amerine 1967). Soluble solids were measured by Abbé refractometer. Balling at 20°C was read from tables.

RESULTS AND CONCLUSIONS

Total titratable acid diminished (Figs. 2, 5) and glucose increased in all samples analyzed (Figs. 1, 4). French hybrid varieties reached acceptable balance or Balling-acid ratios between 20 and 40 with Balling 19 or more (Winkler 1970). Rotundifolia varieties did not. The relatively small change in Balling-acid ratios of the latter during the sampling period may indicate that flowering and berry set were prolonged either because of environmental conditions, as characteristic of the varieties, or a combination of both (Avramov 1972, Calo 1972, Minarik 1971). In South Carolina where there are large acreages of Scuppernong, the berries are harvested by hand several times, each berry selected for maturity (Hiaring 1971). Shaking may produce a uniform mix of ripe and immature berries over an extended period. The pH remained at low levels for rotundifolia varieties (Fig. 6) but rose to unacceptable levels for S5279 and S13053 (Fig. 3).

These data are indicative of characteristics of grapes grown in Arkansas. The information may provide a basis for the selection of varieties best suited to this environment.

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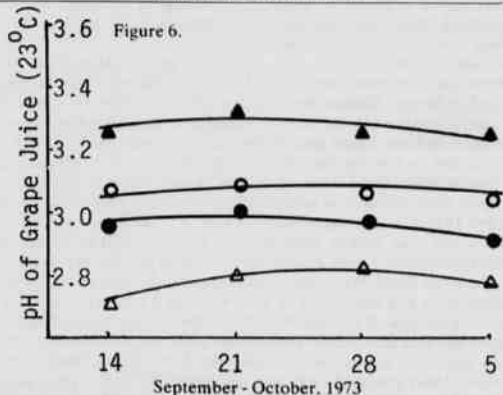
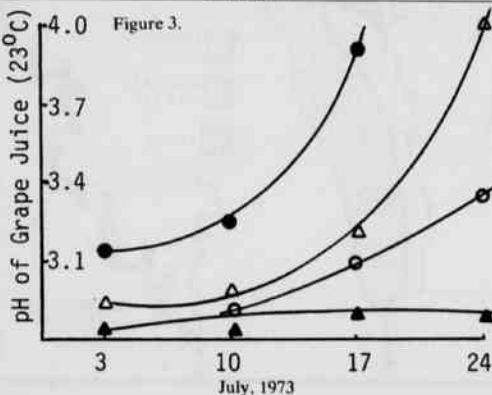
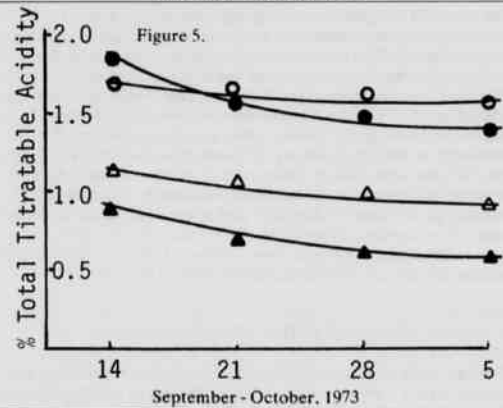
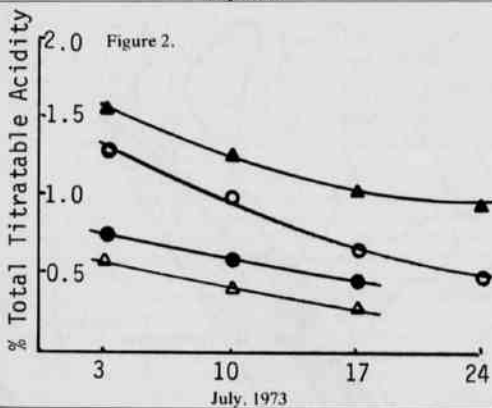
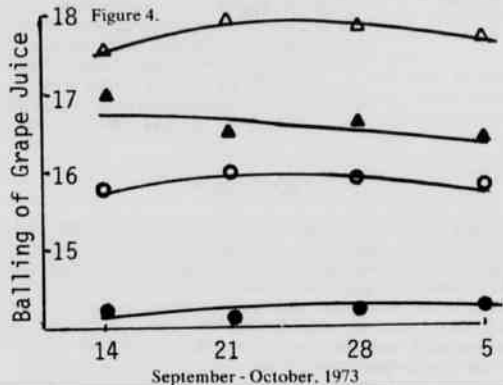
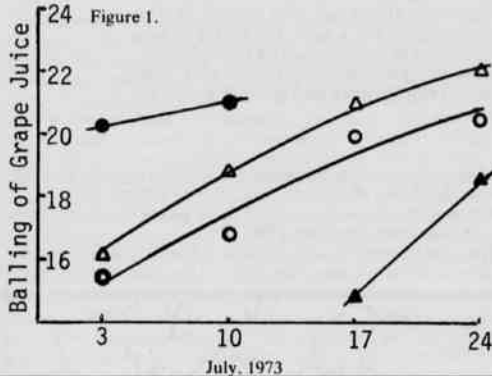
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Cameron Jones, Dominic T. C. Yang, and Thomas O. Whitley

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Figures 1-3. Changes in composition of four French hybrid grape varieties during July 1973. ● S5279, ▲ SV23-657, ○ S10878, △ S13053.

Figures 4-6. Changes in composition of four rotundifolia grape varieties during September - October 1973. ● Scuppernong, ▲ Fry, ○ Tarheel, △ Magoon.