Evaluations of Wine Grape Varieties for Lodi
A long-term study was conducted to determine the suitability of certain grape varieties for table wine production in the Lodi area. To obtain this objective, an experimental test plot was established in the area in 1960, and wines from each of the 25 varieties grown there were made and evaluated. This bulletin describes:

- The experimental test plot
- Wine-making methods used for small lots of wine
- Climate and soil determinations
- Must and wine analyses
- Viticultural descriptions and observations
- Wine quality comments and evaluations

THE AUTHORS:
J. J. Kistler is Farm Advisor in San Joaquin County, C. S. Ough is Enologist in the Department of Viticulture and Enology, University of California, Davis; C. J. Alley is Viticulturist in the Department of Viticulture and Enology, University of California, Davis.

EVALUATIONS OF GRAPE VARIETIES FOR LODI

INTRODUCTION

In the past, most California wine grape variety evaluations were made with the idea of applying recommendations based on them to large areas of the state. This approach had disadvantages—for example, a variety recommended for Region IV might not be well suited to all parts of that region which includes delta areas of moderate climate as well as Sierra Nevada foothills having much greater climatic ranges. Avid, obviously, sandy soils of the Modesto area are not comparable to the rich, loamy soils around Lodi. Clearly, what was needed for a specific area was a body of recommendations based on a study of wine grape varieties grown in an area of similar climate and soils. Previous evaluations (Amerine and Winkler, 1944, 1945), although often corresponding to fieldings in this bulletin, did not have that advantage.

A further complication was present in the Lodi district, however. For many years, principal viticultural and winemaking operations there had been the production of table grapes and dessert wines. But in recent years, consumers' tastes have changed—there has been decreasing demand for table grapes and dessert wines, and an ever-increasing demand for table wines.

Any study of wine grape varieties suitable for the Lodi area should, therefore, concentrate on table wine varieties.

With these objectives in mind, a Lodi Variety Trial Plot was established in 1960. The varieties to be studied were grown there, and wines made from them were produced and tested under precisely controlled conditions. Data from these tests, plus data gathered from field observations in the area, form the basis for viticultural performance and wine quality evaluations presented here.

EXPERIMENTAL METHODS

The Lodi Variety Trial plot was located approximately 3 miles east of Lodi in the northernmost grape-producing district of the San Joaquin Valley. It is the coolest area in the San Joaquin Valley: late afternoon temperatures are influenced by oceas breezes giving through the Carquinez Straits, and maximum temperatures are normally of a relatively short duration. Maximum temperatures are usually reached between 4:00 and 5:00 p.m. and then begin to decline. Table 1 gives the average hours per day of temperatures above 90°, 80°, and 100°F by month for two typical years. Table 2 gives the degree-days by month for 1965 through 1971.

San Joaquin County soil map (Wolfs, 1962) classified the soil on which the grape varieties were grown as Sanborn Sandy Loam. However, mechanical analysis of the soil found the texture to be a loam. Table 3 gives soil analyses for the site. The varieties tested were on resistant rootstocks commercially used in this district. The plot was designed with 10 vines each on St. George, 1635, Dog Ridge, and Silo Creek (Ramsey). There were 40 vines for each variety, which was adequate for extensive wine evaluations. The vines, which were spaced 8 x 12 feet, were bilateral-cordon trained on a standard 2·wire trellis. The wire supporting the cordon was 38 inches above the vineyard floor. The foliage wine was 12 to 16 inches above the cordon wire, depending on the vigor of a variety.

Fruit quality determinations were made by collecting 100 berry samples and analyzing the expressed juices for degree Brix, total acids, and pH.

The field berry-sampling technique consisted of taking 10 berries from each vine at various positions on the clusters and throughout the vines as described by Amerine and Boessler (1968). All 10 vines from each variety-rootstock combination were sampled, then the berry samples were mixed and a sample of this mixture was analyzed. Sampling began when maturity approached 17 degrees Brix and was repeated weekly until harvest. Samples were taken to the laboratory and run within 3 hours of picking. The unripe berries of each cluster were crushed gently with a large mortar and pestle so as not to break the seeds, and the juice was then filtered and squeezed through 4 threads of cheesecloth. Degree Brix was determined with a calibrated and temperature-corrected hand refractometer. Total acids (expressed as grams tartaric per 100 ml) were determined by titrating with 0.1N Na OH to an end point of pH 8.2 with a glass electrode pH meter (Amerine, 1960). The pH of the expressed juice was measured by means of a Corning pH meter, Model 7.

The cluster grapes were hand harvested and picked in 50-pound picking boxes. A total of 3 boxes of each
variety was picked. The grapes were transported to the University of Cali-
ifornia, Davis, where they were crushed and stemmed the same day they were picked or the following day. Free-run juice samples were obtained from crushed grapes for the wine analysis. The samples were analyzed within a few hours for degree Brix, total acid-
ity, and pH. The samples were also fermented in a Kjeldahl flask and total ni-
trogen determined when the sample was dry. These analyses were made by
American Society of Viticulture and Enology (1962).

White wines were pressed imme-
diately, with essentially no skin-con-
tax time. The juice would be equiva-
 lent to commercial free-run with a very 
low solids content. Red varieties were
left in contact with the skins for about 
3 days. The degree Brix was usually 
between 5° and 12° at time of press.
Again, the press was relatively
White juices were fermented in 12-
gallon glass containers. The red musts
were fermented in 20-gallon earthen-
ware crocks or polyethylene barrel
liners of appropriate size. Sulfur di-
oxide (50 mg/liter E) was added and
then the yeast culture (1 part of the
total volume). The standard yeast
was Saccharomyces cerevisiae
Montrachet strain (Department
of Viticulture and Enology culture
No. 322). Degree Brix were determined
daily or every few days until fermenta-
tions were complete. White wines
were fermented at 70°F for the first
3 years and at 80°F for the last 2 years.
Red wines were all fermented at 70°F. Once the wines were dry, they were racked and held in full containers at 53°F. A rigorous sche-
dule of racking and treatment was
then maintained to reduce cellular oxid-
at and possible spoilage. The final
step was to filter and bottle the wines.

All samples were kept in glass con-
tainers.

The finished wines were tasted by
the expert panel at the University of Cali-
ifornia, Davis, in the spring of the
year following production, using the
methodology described by Ough and
Balke (1961). The tastings were
conducted during one week, with the cooperation of the oenology
program to appraise them of the wine quality and to maintain grower interest. The results were in agreement with the panel results at Davis. The wines were also analyzed for certain
chemical attributes using methods de-
scribed by American (1965).

A summary of viticultural descrip-
tions, some wine quality comments,
and a general evaluation of each vari-
ety are given in pages 7 to 8. Today, Car-
agine, Grenache, and Ruby Cabernet
were not included in the Lodi Variety
Trial report because these varieties are
planted extensively in this district.

Evaluations given for these varieties
are based on commercial wine ex-
perience, experimental data taken from
other Lodi vineyards, and observa-
tional data.

In general, the white varieties eval-
uated as "good" or "excellent" made
standard-to-excellent table wines, with
the exception of Tokay which is best suited for sherry ma-
tures, brandy, or perhaps bulk cham-
pagne blending material. Of the white varieties, only Sauvignon blanc has a
recognizable varietal character. French
Cabernet has a distinct, odd flavor
if left overly long in the wines. Muscat
blanc and Orange Muscat can be made into dry or nearly-dry table wines and do not have the history
associated with some muscat varieties. Gray Rie-
ing can be an excellent or a poor wine,
we have not had the history associated
with the viticulturist; its time of harvest is im-
portant, and crop-level maintenance
requires expert attention. Emerald
Riesling is a good blending wine for
acidity, but it is a difficult variety to
handle in the wine at full maturity because of poor vines. Barbera, Petite Sirah, and Ruby
Cabernet make distinctive wines. Bar-
bera is fruity, and Petite Sirah makes a
rich highly-colored wine of good-
to-excellent quality. Ruby Cabernet
makes a wine of distinctive varietal
character but must be properly aged
for best results. In experimental sam-

cles, Cabernet Sauvignon had a dis-

Table 1
SOIL ANALYSIS OF LODI VARIETY TRAIL, 1968

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Texture</th>
<th>pH</th>
<th>ECe</th>
<th>Ca+Mg+</th>
<th>Alkalinity</th>
<th>Organic Carbon</th>
<th>Available P</th>
<th>Cation Exchange Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>silty clay loam</td>
<td>8.1</td>
<td>2.3</td>
<td>1.6</td>
<td>1.2</td>
<td>0.2</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td>clay loam</td>
<td>8.2</td>
<td>2.4</td>
<td>1.7</td>
<td>1.3</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>clay loam</td>
<td>8.2</td>
<td>2.4</td>
<td>1.7</td>
<td>1.3</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 2
VARIETY EVALUATION

<table>
<thead>
<tr>
<th>Variety</th>
<th>Origin</th>
<th>Vigor</th>
<th>Fruiting</th>
<th>Bud set</th>
<th>Pruning freedom</th>
<th>Cluster size</th>
<th>Cluster density</th>
<th>Bot rot potential</th>
<th>Production, tons per acre*</th>
<th>Remarks</th>
<th>Wine quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aligoté</td>
<td>France</td>
<td>Medium</td>
<td>Spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>4-8</td>
<td>No problem</td>
<td>Good, fruity</td>
<td>Good</td>
<td>Good varietal character</td>
</tr>
<tr>
<td>Berger</td>
<td>France</td>
<td>Medium</td>
<td>Spur</td>
<td>Large</td>
<td>Compact Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Poor quality</td>
</tr>
<tr>
<td>Chardonnay</td>
<td>France</td>
<td>High</td>
<td>Spur</td>
<td>Medium</td>
<td>Compact High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Poor quality</td>
</tr>
<tr>
<td>Riesling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average quality</td>
</tr>
<tr>
<td>All together</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colombard</td>
<td>France</td>
<td>High</td>
<td>long spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>6-10</td>
<td>Quick delivery</td>
<td>Good, fruity</td>
<td>Qualified</td>
<td></td>
</tr>
<tr>
<td>Grownewitz</td>
<td>Germany</td>
<td>Low to medium</td>
<td>Spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>6-10</td>
<td>Susceptible to ahead breaking</td>
<td>Good, fruit</td>
<td>Qualified</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aligoté</td>
<td>France</td>
<td>Medium</td>
<td>Spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>4-8</td>
<td>No problem</td>
<td>Good, fruity</td>
<td>Good</td>
<td>Good varietal character</td>
</tr>
<tr>
<td>Berger</td>
<td>France</td>
<td>Medium</td>
<td>Spur</td>
<td>Large</td>
<td>Compact Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Poor quality</td>
</tr>
<tr>
<td>Chardonnay</td>
<td>France</td>
<td>High</td>
<td>Spur</td>
<td>Medium</td>
<td>Compact High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Poor quality</td>
</tr>
<tr>
<td>Riesling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average quality</td>
</tr>
<tr>
<td>All together</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colombard</td>
<td>France</td>
<td>High</td>
<td>long spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>6-10</td>
<td>Quick delivery</td>
<td>Good, fruity</td>
<td>Qualified</td>
<td></td>
</tr>
<tr>
<td>Grownewitz</td>
<td>Germany</td>
<td>Low to medium</td>
<td>Spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>6-10</td>
<td>Susceptible to ahead breaking</td>
<td>Good, fruit</td>
<td>Qualified</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aligoté</td>
<td>France</td>
<td>Medium</td>
<td>Spur</td>
<td>Medium to large</td>
<td>Well-filled</td>
<td>Low</td>
<td>4-8</td>
<td>No problem</td>
<td>Good, fruity</td>
<td>Good</td>
<td>Good varietal character</td>
</tr>
<tr>
<td>Berger</td>
<td>France</td>
<td>Medium</td>
<td>Spur</td>
<td>Large</td>
<td>Compact Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Poor quality</td>
</tr>
<tr>
<td>Chardonnay</td>
<td>France</td>
<td>High</td>
<td>Spur</td>
<td>Medium</td>
<td>Compact High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Poor quality</td>
</tr>
<tr>
<td>Riesling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average quality</td>
</tr>
<tr>
<td>All together</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Degree Brix per month is calculated by the following formula:

Degree Brix per month = (Month 1 + Month 2 + Month 3 + ... + Month n) / (n - 1)

*Temperature data was taken at the site of the variety trial by Hydrographic Recorder.
ENOTHERAL PROBLEMS

Red table wines should be fermented at warmer temperatures not exceeding 50°F, and maintaining good skin-juice contact during this period expedites color extraction. Skin-juice contact should not be continued after about 6 degrees Brix. For the most desirable color development for red varietal wines, they should be aged in oak cooperage. For standard wines, the oak aging may not be desirable. Certain high tannin varietals should be gelatin finned.

In general, the same rules apply for making quality wines in all locations. Gapes from warmer areas are generally harvested at a lower degree Brix. Wines made from these lower-degree Brix grapes usually mature fast and are generally fruity. A major problem is the prevention of oxidation, which can be accomplished by removing residual mustard sulfur—centrifugation of the juice also accomplishes this. These treatments also lower the non-soluble solids and tend to increase wine quality.

RROTSTOCK EVALUATION

Selection of the proper rootstocks for soil type, root pest, and variety is highly important. In the Lodi trial plot, the rootstock Dog Ridge caused an excess vigor problem with most of the high-vigor varieties. Varieties with excessive growth, poor set, and reduced yields on Dog Ridge were French Colombard, Tocai, Helena, Sauvignon Blanc, and Cabernet Sauvignon.

Silt Creek is a vigorous rootstock, but varieties grafted onto this stock were not as vigorous as were the same...
varieties on Dog Ridge. Varieties that were difficult to manage because of excess vigor were French Colombard, Tokay, and Grenache.

St. George rootstock was a poor stock for the variety Pinot St. George. Yields were drastically reduced because both stock and scion had high levels of nitrate-nitrogen, growth was excessive, and fruit set was poor. The rootstock 1613 produced weak vines when grafted to low- or medium-vigor varieties. These weak vines resulted in fruit sunburn damage, berry shrivel, excess browning, and low yields. Vigorous varieties on 1613 produced a normal crop of good-quality fruit.

ACKNOWLEDGMENTS

Thanks are due to George Cooke and A. N. Kasimatis for their help in maintaining grower interest by the industry tasting they conducted, and to the panel of tasters from Davis who so freely gave their time. Special thanks go to Carl Mettler, without whose unselfish contribution of land and equipment these experiments could not have been done. Thanks also go to the East-Side Winery, Lodi, for invaluable participation.

BIBLIOGRAPHY

M. A. Amerine
1965. Laboratory procedures for enologists. Department of Viticulture and Enology, Davis.

M. A. Amerine, H. W. Berg, and W. V. Chriss

M. A. Amerine and E. B. Roessler

M. A. Amerine and A. J. Winkler


A. N. Kasimatis, L. P. Christensen, D. A. Lovinsi, and J. J. Klesler

C. S. Ough and M. A. Amerine

C. S. Ough and G. A. Baker

W. W. Wen

To simplify the information, it is sometimes necessary to use trade names of products or equipment. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.