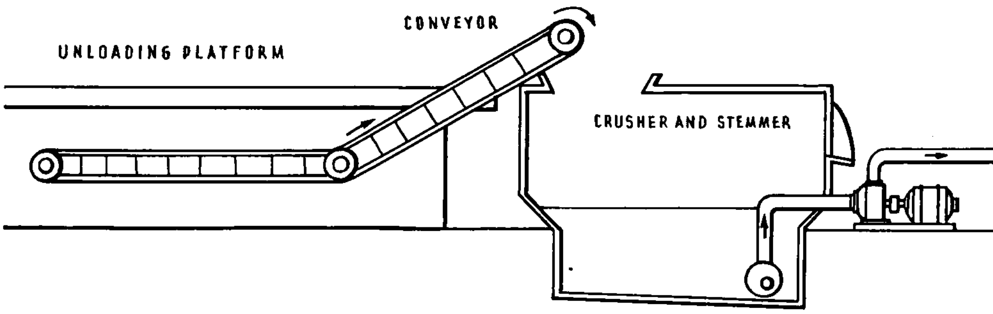
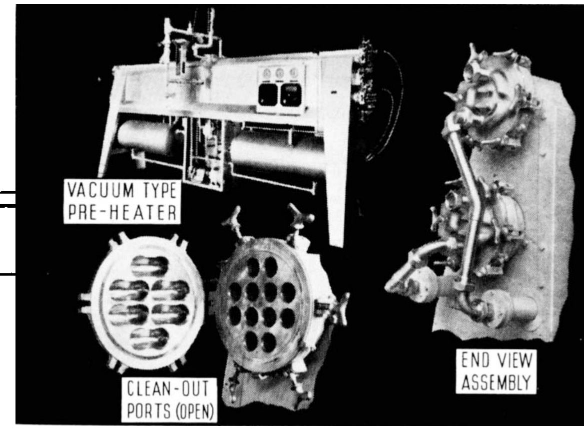
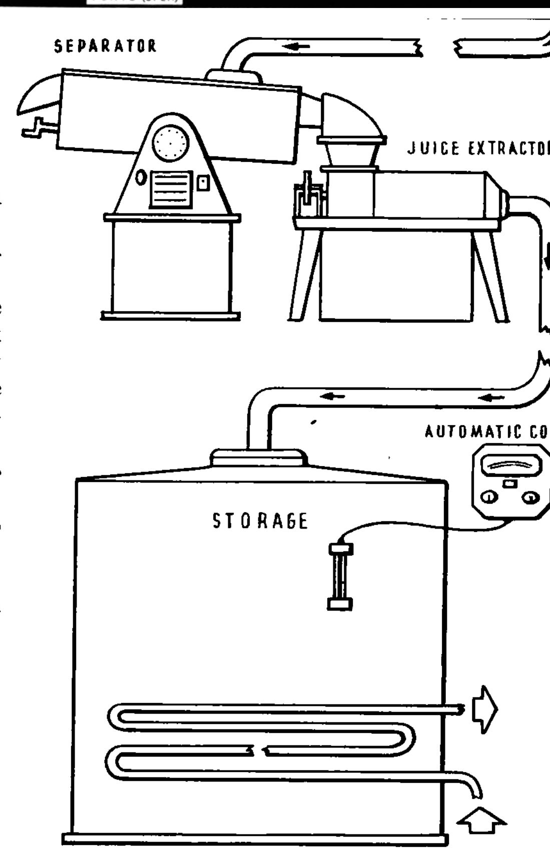




Automatic Temperature

control recommended for improved wine-growing

George L. Marsh



Flow chart of juice from grape to fermenting tank.

Quality of product in wine-growing could be improved markedly by a closer application of technological knowledge concerning refrigeration requirements of fermentation.

Control of temperature is a basic wine-growing problem. Heat generated during fermentation, if uncontrolled or of prolonged effect, can result in complete loss of the wine.

This danger is fully recognized, but the damage to quality that occurs when wines are allowed to stand for short intervals at the maximum permissible temperatures, often is completely ignored by wine-growers.

Not only do deleterious changes in quality occur at maximum temperatures but they also occur when the fermentation temperature is allowed to exceed 70° F for any time interval.

With due regard to the use of sulfur dioxide and pure yeast as control measures for fermentation, temperature control is of major importance for the production of sound wines under California conditions. Without it, wine growing, except for the coastal areas, would be virtually impossible.

It is recommended that 70° F should be considered the maximum temperature of fermentation for both white and red grapes. The practical minimum temperature of fermentation still remains to be determined.

All fermentations, irrespective of the variety, should be carried out on the liquid portion of the grapes only.

The fermenting units, irrespective of size, should be designed to permit the use of a controlled temperature program during fermentation—a program that is automatically controlled through adequate instrumentation.

In white wine-growing the recommended system differs from the one now used principally in the matter of temperature and its control.

The theoretical maximum temperature for white wine fermentations is 85° F but by present practice 85° F more closely represents the weighted average than the maximum. Under the pressures and tension of the vintage season, tanks frequently exceed 85° F before cooling is commenced.

This wide fluctuation of temperature is directly responsible for a very considerable loss of quality which can be avoided by constant control of the fermentation temperature.

In setting up the proposed system greatest consideration should be given to making the temperature control fully automatic in operation.

Red Wine

At the present time, red wine is fermented in contact with the crushed grape-tissues—pulp, skins, and seeds.

The primary purpose of this practice is to cause extraction of the anthocyamin pigments located in the cells of the skins.

The secondary purpose is to extract the tannin, volatile oils, acids and the like. Both the alcohol and the heat produced during fermentation are the principal agents in effecting the results.

The end results of fermentation in contact with skins can be accomplished mechanically much more simply, with better control and less cost over a period of time.

A few comparatively simple changes in handling red grapes prior to fermentation will permit this accomplishment.

Heat produces two beneficial and useful physical changes in the crushed grape tissues.

It causes the color to flow and it modifies the structure or composition of the crushed mass in such a manner that juice extraction becomes a comparatively simple operation.

Changes Recommended

The time and temperature relationships required to cause color flow are well known.

Heat exchanger units—such as those used for handling a continuous flow of crushed tomatoes in canneries—are available and can be adapted for handling red grape must.

It is recommended that such a unit be made an integral part of the flow-line for handling red grapes for wine-growing.

It would be necessary to add a unit for separating the juice from the grape

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TEMPERATURE

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tissues, such as a continuous expeeler press, vibrating screens or the like.

The must from the present crusher and stemmer would be pumped through the heat interchanger which contains both a heater section and a cooler section, in series.

In order to insure a constant or controllable flow, a surge tank might be required ahead of the heat exchanger.

The heated and cooled must would pass immediately through an appropriate juice extractor and from this unit, the juice would be pumped into closed fermenters designed for operation at constant temperature of 70° F or less—automatically controlled.

It is known from studies by many investigators that heat does not cause any injury to the juice.

The momentary application of heat under the modernized system would have little effect on flavor.

The exact temperature and time relationships for obtaining the most desirable results with all varieties would require considerable work. The variations in composition—color, tannin, acid, flavoring constituents—would permit a variety of products to be made from the same grape variety.

Heat accomplishes other and perhaps far-reaching effects. A very considerable reduction, if not complete destruction, of the microbial load would occur. Both the beneficial and the harmful organism are reduced in numbers. A pure yeast strain, or mixture of strains, would be required as a starter. This can only be considered as a desirable accomplishment.

It might be found that the reduction in bacterial load would eliminate the present necessity for using sulfur dioxide, or at least, markedly lessen the amount required. This, too, must be considered as a desirable accomplishment.

Advantages

Other advantages warrant mentioning. There is a higher yield of juice per ton of fresh grapes crushed. The greater fermentation efficiency would give the recommended system a greater over-all winery efficiency than the system now used.

Residual sugar in the pomace would be removed more easily by leaching and pressing operations. These could be established as an integral part of the juice extraction units and the pomace need never accumulate in or around the winery.

The extracted juice can be balanced or adjusted more easily to a uniform composition prior to fermentation.

The production of wines of better quality with greater efficiency would more than offset the capital expenditure for the additional equipment and greater refrigeration requirements.

Finally, the possibility of producing distinctive wine types is almost unlimited.

The recommended system modernizes wine-growing and permits much close control of the principal step in the conversion of grapes to wine.

George L. Marsh is Assistant Professor of Food Technology, and Assistant Chemist in the Experiment Station, Berkeley.

SPRAYS

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emulsion even though the actual amount of oil applied per tree was approximately the same.

In the partial concentrate spray applications, the oil deposits were slightly better than the bulk sprays throughout, and the emulsive oil and the tank-mix oil deposits were 1.4 times the deposits of the oil emulsion.

Per tree, the deposits of the partial concentrate sprays were higher than the deposits of the bulk sprays, even when less than half the amount of actual oil was applied.

Table 2 shows that a saving of 55% in the cost of material per acre is possible with the partial concentrate sprays.

Though the equipment used in this experiment was of a type producing over 50,000 cubic feet of air per minute and had further been perfected as to directional control of the discharge, other equipment of less volume undoubtedly could be used in orchards where the trees are not as large. A large volume of air is essential, especially in foliage sprays and many types of equipment lack this essential.

Arthur D. Borden is Associate Entomologist in the Experiment Station, Berkeley.

Harold Madson, Research Assistant, Division of Entomology assisted in the investigation reported here.

NEW PUBLICATIONS

TURKEYS

CALIFORNIA TURKEYS, SITUATION AND OUTLOOK—1948, by Edwin C. Voorhies. Cir. 380, March, 1948. (20 pages.)

PANSIES AND VIOLAS

COLOR BREAKING IN PANSIES AND VIOLAS, by Henry H. P. Severin. Cir. 377, February, 1948. (4 pages.)

FARM REAL ESTATE

CALIFORNIA'S FARM REAL ESTATE SITUATION, by David Weeks and Charles H. West. Cir. 379, February, 1948. (20 pages.)

DONATIONS FOR AGRICULTURAL RESEARCH

Gifts to the University of California for research by the College of Agriculture, accepted in February, 1948

BERKELEY	
American Potash Institute, Inc.	$1,200.00
Division of Plant Nutrition	
Dr. William H. Boynton	$190.91
Department of Veterinary Science	
Chipman Chemical Co.	1 gallon of Berako
Division of Entomology and Parasitology	
Lederle Laboratories Division, American Cyanamid Co.	10 grams Folvite Powder
Division of Poultry Husbandry	
Merck & Co., Inc.	$1,000.00
Division of Poultry Husbandry	
DAVIS	
Armour and Co.	$5,000.00
(Second installment of $10,000 grant) Investigations on plasma fractions from domestic livestock. School of Veterinary Medicine	
Mr. W. S. Burnett	$500.00
School of Veterinary Medicine	
California Committee on the Relation of Electricity to Agriculture	$3,625.00
Division of Agricultural Engineering	
Chas. Bach Co.	$600.00
Bauer-Schweitzer Hop & Malt Co.	$1,200.00
The Grange Co.	$50.00
Miller Malting Co.	$1,200.00
Pacific Brewing and Malting Co.	$250.00
San Francisco Grain Trade	$100.00
Sonoma Malt and Grain Co.	$100.00
Stephens and Lowe	$50.00
J. Steventon	$100.00
R. Volmer and Sons	$200.00
Barley Research Division of Agronomy	
Messrs. Hart, Cole and Goss	$1,603.78
Research Fellowship Division of Animal Husbandry	
State of California, Department of Finance	One Palomino Stallion, Harvest Breeze
LOS ANGELES	
Best Fertilizers Co.	200 lbs. "Earthfoam" (Basaltic Pumice)
Division of Subtropical Horticulture	