Use of Oleic Acid Derivatives to Accelerate Drying of Thompson Seedless Grapes

VINCENT PETRUCCI and NICK CANATA, Department of Viticulture, California State University, Fresno, California 93740, and H.R. BOLIN, G. FULLER, and A.E. STAFFORD, Western Regional Research Laboratory, 2 Albany, California 94710

ABSTRACT

Pilot scale procedures were developed for the use of fatty acid ester emulsions to decrease the time to dry the Thompson seedless grapes to raisins. Both sun and mechanical drying were used in these experiments. Mechanically harvested grapes were dipped in a 1% or 2% fatty acid ester emulsion and dehydrated at drying times less than those required for the soda-dipped raisins. Spraying grapes on the vine with a commercial ethyl ester mixture, which contained an emulsifier and added potassium carbonate, allowed the grapes to dry faster than the conventional sun drying procedures. These procedures produced light colored raisins of acceptable quality. In addition, these methods show savings by decreasing labor costs.

INTRODUCTION

Raisins made from Thompson seedless grapes are an important product of the central valley of California. Of the 246,349 acres of raisin variety grapes, 230,928 acres are of the Thompson seedless variety (1). However, ca. 110,000 acres are used for making raisins, which are mostly naturally sun dried. In a normal year, ca. 200,000 tons of raisins are processed this way, and ca. 20,000 tons are reduced salable tonnage. Any inclement weather during this period can cause serious losses to the grower in terms of a lower quality product and also involves considerable risk to the producer, since a minimum of 3 weeks drying time in the field is required. Any inclement weather during this period can cause serious losses to the grower in terms of a lower quality product and reduced salable tonnage.

A smaller percentage of raisins are dried by dehydration in a counter flow tunnel heated by gas and requires 22-24 hr to dry. There is considerable economic incentive to dry the raisins more quickly and to decrease the hand labor required in drying and processing. Since there is continual demand for a cleaner product at point of production, dehydration offers this added benefit.

The standard procedure is to dip Thompson seedless grapes into a 0.25% hot caustic soda solution before dehydration. This causes fine cracks to form on the skin of the grapes which greatly facilitate the rapid escape of water during dehydration. The finished raisin, while acceptable, is rather sticky due to the cracking of the skin as mentioned above.

The use of other dipping solutions to hasten drying time on grapes has been demonstrated by M. Grncarevic (2) in a process that affects the waxy surface of the grapes, thereby increasing their permeability to water.

J.V. Possingham (3) suggests that these cold dipping solutions have the effect of reorienting the individual wax platelets in an upright position, i.e. vertical to the grape surface and the spaces between the individual platelets appear larger, suggesting that this change may facilitate the movement of water from the grape to the atmosphere.

Ponit and McBean (4) have studied on a laboratory scale the effects of fatty acid derivative emulsions on drying time of grapes and other waxy fruits.

These experiments demonstrate feasibility of accelerating the drying time of Thompson seedless grapes by drying them on the vine or in a dehydrator using spraying and dipping solutions containing fatty acid derivatives, particularly ester mixtures high in oleates. (The treatment of grapes with fatty acid esters in the U.S. is still in the experimental stage and the ester mixtures applied in these experiments have not yet been approved for this use.) Another benefit of using these chemicals is production of a less sticky and light amber colored raisin similar to the Golden Bleach raisin of California which gets its light color from the sulfur dioxide treatment. Also included in this study is a comparison of the economics of drying raisins on the vine to that of making the traditional natural sun-dried raisins.

MATERIALS AND METHODS

Three procedures were used in this study: natural sun drying, on-the-vine drying, and dehydration following a dip in cold methyl oleate emulsion. The first two were done in the field, whereas the last was done using a forced air dehydrator. The Thompson seedless grape variety was used for all three of these raisin processes.

In making natural sun-dried raisins, the grapes are picked at between 20-23% sugar content (°B) by workers who place the grapes in metal pans. From these pans, the bunches are scattered onto 2 x 3 ft paper trays that are placed on the ground between the rows of grape vines. The soil is prepared in such a manner that a terrace is formed to facilitate drying by the sun further.

In 10-14 days the paper trays are turned so that the bunches will dry uniformly. Sixteen days later, the fruit, dehydrated mechanically. This represents one-third of the world production of raisins.

Three procedures were used in this study: natural sun drying, on-the-vine drying, and dehydration following a dip in cold methyl oleate emulsion. The first two were done in the field, whereas the last was done using a forced air dehydrator. The Thompson seedless grape variety was used for all three of these raisin processes.

In making natural sun-dried raisins, the grapes are picked at between 20-23% sugar content (°B) by workers who place the grapes in metal pans. From these pans, the bunches are scattered onto 2 x 3 ft paper trays that are placed on the ground between the rows of grape vines. The soil is prepared in such a manner that a terrace is formed to facilitate drying by the sun further.

In 10-14 days the paper trays are turned so that the bunches will dry uniformly. Sixteen days later, the fruit, dehydrated mechanically. This represents one-third of the world production of raisins.

FIG. 1. Front view of a prototype over-the-vine canopy sprayer pointing out (A) row centering device, (B) cane lifter, (C) spray collecting frame, (D) trough which returns excess spray run-off to the spray rig, (1) which is emitted from spray nozzles located on each side at E.
To ensure complete and rapid drying, every berry must be covered by the spray. In A the berries escaped the spray, while berries, B, were covered completely and dried uniformly.

which ranges between 16-18% moisture, then is rolled up in biscuit fashion and allowed to dry further to 14-16% moisture. The rolled trays of raisins are picked up and emptied into sweat boxes which, when full, contain 180-200 lb of raisins. They are fumigated and, in due course, delivered to the processing plant.

The experimental process involved in making the on-

FIG. 2. To ensure complete and rapid drying, every berry must be covered by the spray. In A the berries escaped the spray, while berries, B, were covered completely and dried uniformly.

FIG. 3. On the cut canes the main clusters rachis (A) dries at the same rate as the capstem (B) which assists the raisins in remaining on the cluster until shaken off by the mechanical harvester.

FIG. 4. On the uncut canes the main cluster stem (rachis) remains green (A). Further out on the rachis branches, the berries and capstems (B) dry at the same rate. However, an abscission layer (C) forms at the upper most part of the branch which, if shaken, may fall off prematurely.

the-vine dried raisins is described below. When the fruit is between 20-23°B, a crew of workers come into the field and with the use of hand shears or pneumatic shears cut last year’s fruit cane to facilitate even drying and efficient removal of the finished product.

The next step uses an over-the-row canopy sprayer developed at California State University, Fresno, (Fig. 1) to spray the fruit with a 2% emulsion of Eemulsoyle and potassium carbonate. The spraying is done at the rate of 1364 gal/acre, 44% of which is recovered and reused by the sprayer for a net usage of 764 gal/acre. The Eemulsoyle was found to contain a mixture of ethyl esters with an emulsifier; it is a proprietary product of the Victorian Chemical Company, Richmond, Australia.

Ca. 5 days later, a second application of one-half the concentration (1% Eemulsoyle and potassium carbonate) is applied at the rate of 909 gal/acre, which gives a net usage