Quality Study on Strawberries

experiments with Shasta berries show harvested fruit should be protected against the effects of high field temperatures

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The following article is the first of two reports on Quality Studies with Strawberries. The second article will appear in the near future.

Strawberries—among the most perishable of fruits—have thin skin, soft flesh, a high rate of metabolism, and susceptibility to decay which all contribute to high losses in transit and marketing channels.

California strawberry growers often leave harvested fruit in the field for several hours after picking. The berries may be hauled—before or after cooling—for considerable distances on open, nonrefrigerated trucks. As a consequence, the berries often are subjected to relatively high temperatures for prolonged periods.

In 1957 a study of the effect of high temperatures on Shasta berries was initiated by measuring berry temperatures under simulated field conditions. Thermocouples were placed in the centers of eight Shasta berries of uniform size, shape, and color. Two berries were placed at the top of a pint basket in open sunlight; two berries were put at the bottom of a pint basket in the open sun; two more berries were placed at the top of a pint basket covered by two layers of canvas; and the fourth pair of berries were put at the bottom of a pint basket also under two layers of canvas. A thermocouple was used to measure the air temperature in the open sun. Both berry and air temperatures were recorded by a thermograph.

The temperature of berries exposed to direct sun quickly surpassed that of the surrounding air, and remained higher for the rest of the day. The maximum berry temperature was 107°F at 3:00 p.m. At 5:00 p.m. the exposed berries still were 14°F warmer than the air around them. The temperature of berries in the bottom of exposed baskets was somewhat lower than the surrounding air until about 2:30 p.m. and reached a maximum of 100°F at 3:30 p.m.

Berries at the top of covered baskets were cooler than the air for most of the day and reached a high of 93°F. Berries in the bottom of the covered basket were considerably cooler than the air.

The temperature pattern which developed in this test indicates the problems encountered in a commercial field. The temperature of the berries at the start of the experiment was already in the range where growth of decay organisms is a serious problem. Loss by decay alone would be expected to be severe if the fruit were held for any period of time in the field at these temperatures. Even under more moderate temperature conditions, fruit held in the field would be expected to be affected by decay losses which may not show until after the fruit leaves the shipping area. Any delay in cooling is bad but some temporary delays may be unavoidable in the orderly handling of the fruit. In such cases the fruit should always be covered to minimize the losses which will occur.

Warming-rates of Shasta berries were next considered in the fruit quality studies. Duplicate, full crates were used. The berries were cooled to 41°F. A basket in the center of the crate was emptied, and four berries of uniform size and maturity selected. The selected berries were held in the cold room while all other preparations were made. The crates were placed at either 85°F or 100°F. The thermograph was started, and the experimental berries were brought from the cold room. The thermocouples were quickly inserted into the four berries. Two of the selected berries were placed in the bottom of an empty basket, and the basket was refilled. The two remaining experimental berries were placed on the surface of the filled basket. This procedure was required to avoid temperature rises in the berries during the manipulations involved in setting up an experiment. One experiment was run in still air at each temperature, and a second with air blowing across the crate at a velocity of 10 miles per hour.

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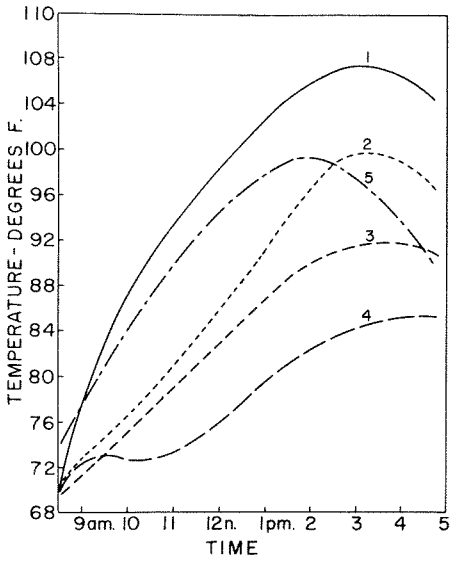
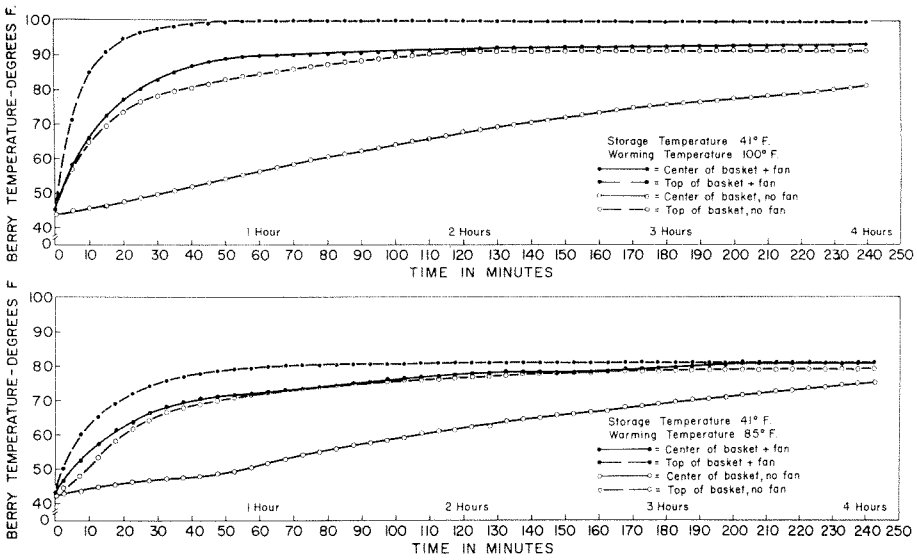
Temperatures of Shasta strawberries under simulated commercial handling conditions. 1, Fruit, top of basket in sun. 2, Fruit, bottom of basket in sun. 3, Fruit, top of covered basket. 4, Fruit, bottom of covered basket. 5, Air, in sun.



Warming-rates of Shasta strawberries when transferred from 41°F to 85°F and 100°F.



STRAWBERRIES

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The temperature of berries on top of the filled basket placed in 100°F moving air reached a temperature near 100°F in about 45 minutes. Similar berries in still air required two hours to reach 90°F and remained at about this value thereafter. Berries in moving air showed evidence of injury to the skin, a condition not evident in the lots in still air. Berries in the bottom of the center basket in moving air at 100°F reached a temperature of 90°F in about two hours and remained at about this temperature thereafter. Berries in the bottom of the center basket in still air, warmed at a uniform rate and reached a temperature of about 82°F after four hours. Evidently, the temperature reached by the berries was substantially the dry bulb temperature of the surrounding air when the surface of the berries was dried by high temperature and air velocity. When the berry surfaces remained moist, the temperature approached the wet bulb temperature of the surrounding air. As expected, the berries exposed to moving air changed temperature much faster than those in still air or in protected positions.

The berries placed in 85°F reached maximum temperatures in about the same time as those at 100°F. However, surface berries did not reach the air temperature.

The evidence on the temperatures developed under field and handling conditions obtained in these studies indicates the desirability of carefully scheduling strawberry harvest operations. To avoid high temperatures and their detrimental effect on the fruit, exposure to normal field temperatures after harvest should be minimized by rapid handling of the fruit in the field, by careful protection against exposure to the sun or moving air, and by rapid and thorough cooling. Protection should be provided against exposure to high temperatures after the fruit has been cooled. A good cooling job may be undone in as little as 20 minutes, if the berries are exposed to moving, warm air.

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Research Reported

Staff members of the California Agricultural Experiment Station published 1,322 separate articles during the fiscal year 1957–58, to disseminate information on their research findings to farmers, fellow scientists, and to the public.

Of the 1,322 articles—totaling 11,876 printed pages—1,163 or 87.8% appeared in farm journals, commodity publications, magazines, scientific journals, and other outlets which printed and distributed the material to their readers. The remainder—159 articles or 12.2%—was published and disseminated by the University in its Agricultural Experiment Station publications, in the form of leaflets, circulars, bulletins, and manuals, and in *Hilgardia* and *California Agriculture.*

Of the 11,876 printed pages, 9,872 pages or 83.1% appeared in popular magazines and scientific journals, the rest in Experiment Station publications.

The Agricultural Experiment Station compiled the publication figures of its staff on occasion of its annual report to the United States Department of Agriculture.

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