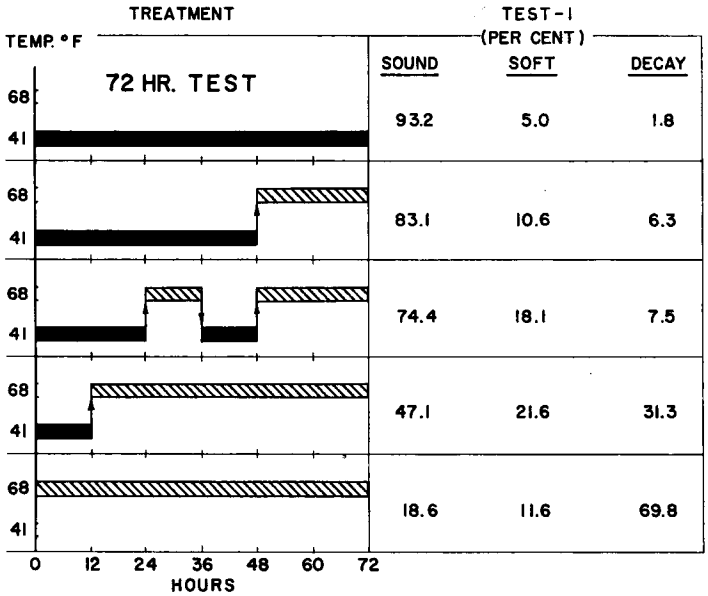
Air transit is greatly reducing the marketing period for much of California's strawberry crop. However, low holding temperatures were still found important for strawberries—even when they are consumed within two or three days of harvest. Constant low holding temperatures provided the greatest protection, and any warming was detrimental to fruit quality. Total deterioration was related to the total length of time fruit was exposed to warm temperatures, regardless of the pattern of exposure. Rewarming of fruit after cooling did not accelerate the rate of deterioration, as compared with fruit held at a constant warm temperature.

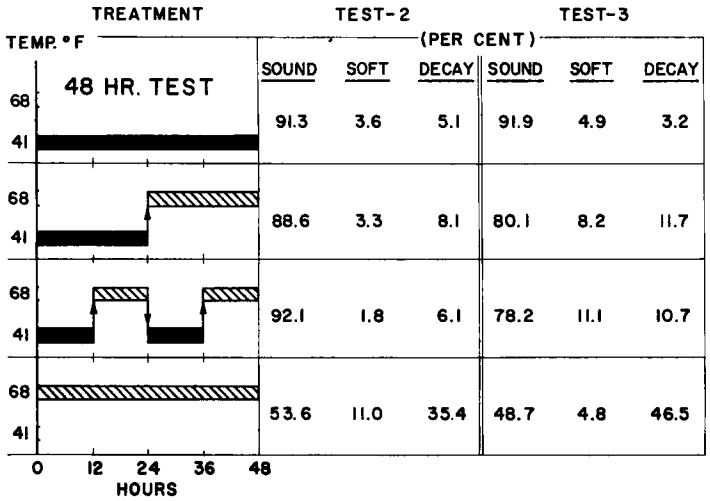
LOW HOLDING TEMPERATURES

still vital with rapid marketing of strawberries

F. G. MITCHELL · E. C. MAXIE
GENE MAYER

STRAWBERRY COOLING TESTS — EFFECT OF DIFFERENT WARMING AND COOLING TREATMENTS ON FRUIT CONDITION





STRAWBERRY HANDLERS realize that California berries must be thoroughly cooled before the normal ground-transit period of five or six days from California to an eastern market. However, the value of refrigeration has been questioned when either local sales or air transit limits the total marketing period to two or three days. In such cases facilities to maintain constant low temperatures are often lacking, and many handlers believe that strawberries will deteriorate more rapidly if cooled, and subsequently rewarmed, than if not cooled at all.

In this study, strawberries were subjected to various combinations of warm and cold temperatures over a two- or three-day period prior to grading. To simulate nonrefrigerated marketing conditions, a 68°F (20°C) temperature was used (considerably lower than the field temperatures often encountered). Refrigerated fruits were held at 41°F (5°C). While earlier studies have shown 32°F

(0°C) to be ideal for maximum holding of strawberries, 41°F (5°C) is considered typical of many cooling and transit conditions. Alternate cooling and warming patterns were compared with constant temperatures. Treatments and results are shown in the accompanying graph.

First test

In the first test, fruit was held for 72 hours before grading. During grading the fruit was separated into three major classifications: sound fruit, soft fruit, and fruit showing visible rot. Sound fruit was firm with no evidence of breakdown whereas soft fruit showed evidence of deterioration and softening but no rot. The deterioration of the fruit appeared to be related to the length of exposure to the 68° F temperature (test 1). In this test the fruit at the higher temperature showed a rapid rate of deterioration and high incidence of rot primarily from gray mold (*Botrytis cinerea* Pers. ex Fr.). These results are consistent with earlier studies showing rapid deterioration from short delays at field temperatures before the start of cooling. In this test the deterioration of berries did not appear to be related to the pattern of cooling and warming, but apparently was influenced only by the length of exposure to the higher temperature.

To verify the relationship between length of exposure to warm temperature and fruit deterioration, two additional tests were conducted. In these tests constant cold temperatures and constant warm temperatures were compared to two combinations of alternate warming and cooling, both of which provided the same length of exposure to the higher temperature (tests 2 and 3). In addition, a holding period of 48 hours was used to explore the magnitude of the deterioration during very rapid marketing. The results of the two tests were essentially similar and compared closely with those of test 1. In the latter tests there was no difference in fruit deterioration between 12-hour and 24-hour cooling and warming cycles. These results indicate that quality is mainly influenced by the total time at warm or cold temperatures rather than by temperature fluctuations. These results also indicate that strawberries are subject to severe deterioration during marketing periods as short as 48 hours.

The tests reported here show that cooling of strawberries is vital to their successful marketing, even when the fruit is consumed within 48 hours of harvest. High quality strawberries can be marketed only when the fruit is held at a constant low temperature, but the rate of deterioration is a time-temperature function and is independent of the pattern of cooling and warming. Thus, if a constant low temperature cannot be maintained, cool temperatures should still be provided whenever possible during the handling of the fruit.

These comparisons are based on separation into sound, soft, and decayed fruit classifications. Such an evaluation does not take into account differences in the overall brightness and consumer appeal of the fruit. Sound fruit which was held at the lower temperature had greater eye appeal and showed promise of giving the consumer more satisfaction than sound fruit held at the higher temperature. Thus, holding at a low temperature would result in a higher percentage of marketable berries, greater sales appeal, and a more satisfied customer.

Air transit has made possible the rapid marketing of a large volume of California strawberries. However, if the true potential of rapid marketing is to be realized, a sound program of temperature management must be incorporated into the handling procedures.

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CONTROL OF DODDER IN ALFALFA WITH DCPA

G. H. MCNEELY • E. C. HOFFMAN • D. E. BAYER • C. L. FOY

DODDER causes sufficient agricultural losses to be considered a noxious weed in many states. Seed certification regulations help to restrict the spread of this prolific seed producer, but it is very difficult to clean out of many small-seeded crops. Once dodder has infested a seed production area, susceptible crops may be limited for several years since many species of dodder may infest more than one host.

In California, dodder continues to spread and cause problems for producers and consumers. In 1951, 86% of the alfalfa seed lots submitted for certification from the south San Joaquin region was rejected because of dodder.

In seed-producing areas where dodder infestations are limited, spot treating with oil, contact herbicides, or burning is often used. When the infestations are more extensive, CIPC (isopropyl N-(3-chlorophenyl) carbamate) has been used with good success. Unfortunately, this material has a relatively short-lived soil residue; and therefore provides only short-term dodder control. Recently, it has been reported that DCPA (dimethyl 2,3,5,6-tetrachloroterephthalate), an herbicide with a relatively long soil residual life, will control dodder in alfalfa without injuring the crop.

During April 1961, several herbicides