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Storage, Shipping And Precooling Of Stone Fruits

F. W. Allen

The ability to hold stone fruits for even a week or ten days makes it possible for the canner or processor at the peak of the harvest season to receive fruit faster than it can be processed.

Most stone fruits will, even under best storage conditions, soon show some deterioration, with the amount and rapidity depending largely on the condition of the fruit when received.

Storage Temperature

The storage temperature and humidity generally recommended for peaches, apricots, plums and cherries is 31° to 32°F, with a humidity of 80-85%.

After a number of weeks in experimental storage at 32° the flesh of well matured peaches frequently becomes red, but at 31° or 30° it either remained normal or else reddening was materially retarded.

It has been reported that where freezing did not occur, peaches stored at 30° and ripened at 70° were often of distinctly better quality than those stored at 32°.

With all stone fruits, unless it be cherries, storage temperatures between 35° and 42° for any length of time have proven unsuitable.

One of the first signs of deterioration in peaches, nectarines and apricots is loss of flavor—followed perhaps by a discoloration of the flesh. This loss of flavor may be noticeable even after a period of ten days.

Peaches

In some of our experimental lots of peaches, fair quality still existed after a storage period of four weeks at 31° but browning of the flesh occurred very soon after the fruit became ripe. After holding for six weeks in storage all samples, even though of good external appearance, were worthless.

Apricots

Well matured apricots in a few instances have been held with fine appearance for eight weeks. Observations however, on approximately 200 samples showed that the flavor had generally deteriorated and that 12% developed some browning around the pit during four weeks in storage. Little difference was noted in this respect between samples held at 30°

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Comparative Tests On Plowed And Unplowed Soil For Sugar Beet Seed-bed Preparation

L. D. Doneen

Results of trials over a period of four years show that nothing is gained in the production of sugar beets by plowing the soil in seed-bed preparation provided shallow cultivation kills all the weed growth.

In this study, plowed and unplowed plots proved to be substantially the same in yield, sugar content, purity, and number of beets per acre; the volume weight and pore space of the soil; penetration rates of the irrigation water; and the shape of the beets.

If weeds infest the surface soil, plowing may be practical for burying their seed deeply and thus eliminating some of the weed growth the next year.

Under certain other conditions, such as where a plow pan exists, deep tillage or plowing may be necessary. Plow pans interfere with the penetration of irrigation water and sometimes cause rotting of the beet root. They should be broken by deep tillage or deeper plowing.

Even though these exceptions exist, plowing could be eliminated profitably on much of the sugar beet land in California.

Preparation of the Seed-Bed

The experiments consisted of two treatments; (1) The soil was not plowed, but was stirred to the depth of two to four inches with a springtooth harrow or disk to kill all growing weeds before the crop was planted. (2) The soil was plowed 12 inches deep in the late fall or winter.

The sugar beets were planted the latter part of January or in February, according to weather conditions. Except for keeping cultivations to a minimum for weed control, the cultural operations after planting were the same as those practiced in the area adjoining the experimental plots.

Yield of Beets and Sugar

The difference in mean yield for the treatments, 0.44 tons of sugar beets, was not statistically significant.

The difference in per cent sugar was slight between the plowed and unplowed plots. The average for the two treatments showed 0.33% higher sugar in the beets for the unplowed than for the plowed plots.

The purity of the beets was about the same for both treatments. The average gross sugar per acre was essentially the same.

Drying and Crusting

When there were conditions favorable for rapid drying of the soil, it was observed throughout these experiments that the surface soil dried earlier in the plowed plots. In the areas not plowed it showed higher moisture for several days.

In areas where crusting of the soil is a problem, the moist surface of the shallow-tilled soil provided a period several days longer for the emergence of the seeding before crusting occurred. On the unplowed soil, the crusting was usually less severe than on the finely pulverized plowed soils.

Germination of the Seed

In the unplowed areas, the seed ball was placed on a firm and compact soil, which may have given better germination. The time for seedling emergence on the unplowed land was two to four days less than on the plowed.

Even though the plowed land had been harrowed and rolled, there was a tendency to deeper planting because the soil was so loose.

Growth of Roots Above the Surface

A study was made to determine whether a firm soil, as in the unplowed plots, would cause more of the beet root to grow above ground than in plots plowed 12 inches deep.

The results indicated that the fleshy part of the beet root was not forced to grow above the unstirred portion of the soil.

Specific Gravity of the Soil

Investigations were made of apparent specific gravities of the soil of these two treatments.

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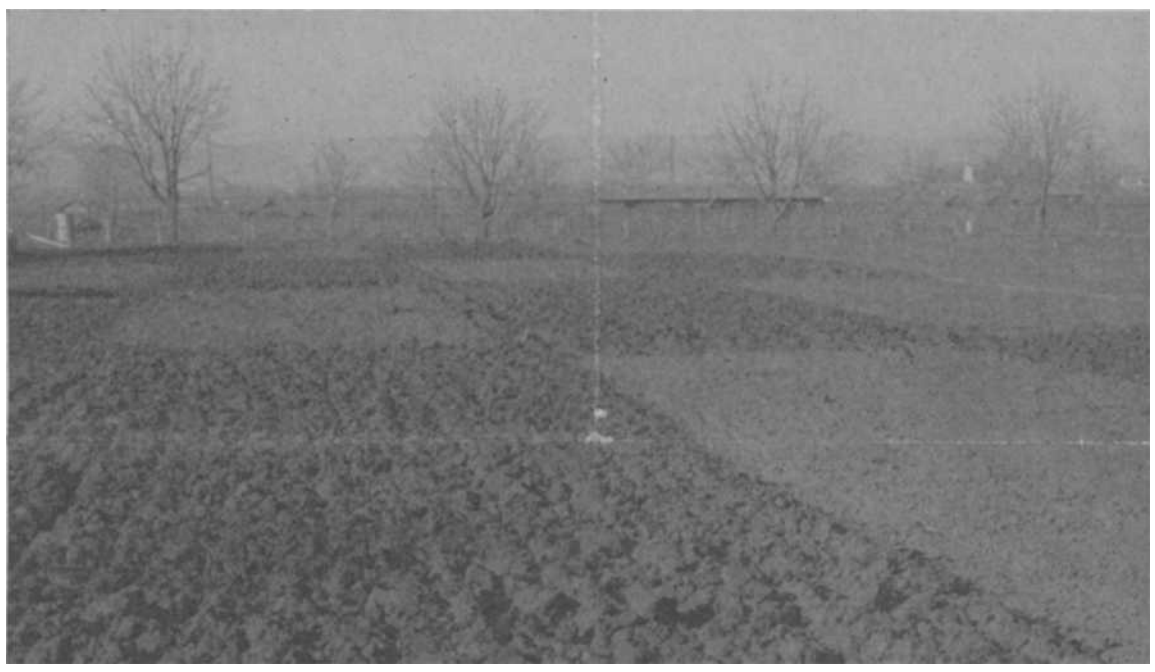

Partial view of the plowed and unplowed plots in the seed-bed preparation experiment. The rough land indicates the plowed plots, later cultivated to finely pulverized seed-bed. The light areas indicate the unplowed plots, which have been disked about two inches deep, floated, and made ready for seeding the crop.

Fertilized Legumes Aid Following Crop Of Non-legumes

John P. Conrad

Fertilizers containing no nitrogen may increase the growth of legumes such as bur clover, vetch, and peas, which contain relatively high amounts of nitrogen. This is possible because bacteria contained in nodules on the roots of legumes fix the free nitrogen of the air—a form unavailable to most other plants.

The increased amounts of fixed nitrogen supplied by the decay of the residues of these fertilized legumes may give greater yield to the following crops of non-legumes.

Until recently the possible magnitudes of the increases in yields of legumes and of the following season's non-legumes for many agricultural conditions in California had not been recognized. Nor had the particular fertilizer or combination of fertilizers nor the legumes best suited to give increased growth of the following non-legumes for each locality been determined.

Observations in one area of Ventura County a few years ago indicated that carriers of sulfur markedly increased the growth of bur clover, and that this increased legume growth more than doubled the yields of the following barely crop, gave some idea of the magnitudes of the increases possible.

Field Trials

As sulfur alone could not be expected to give maximum yields of legumes in every location throughout the state, about 150 exploratory trials to determine local deficiencies by the response obtained, were established in 20 representative counties.

In general at each location, treble superphosphate supplying phosphorus, muriate of potash— potassium chloride—supplying potassium and gypsum supplying sulfur were applied singly and in all combinations.

About 50 good—50%—to marked —200% to 1000%—increases in the growth of legumes, principally bur clover and vetch, on range, hay, grain, and pasture lands have already been secured. Of these increases about 40% have been from gypsum alone, about 40% from treble superphosphate alone, and about 20% from a combination of the two. The possibilities of additional responses from potash seem promising in some areas but further detailed

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Costs Of Methods Of Mechanized Harvesting Of Alfalfa Hay Are Subjects Of Comparative Study

Arthur Shultis

To compare methods and costs of harvesting alfalfa hay in California a survey was conducted by the Bureau of Agriculture Economics in 1945.

In California, over 100 records were collected on alfalfa hay harvesting in Madera County, where most methods used in the Central Valley were available for study.

Mowing and Raking

There were 30 horse-drawn and 79 tractor mowers in the study.

The total cost per acre for mowing with a 5-foot horse-drawn mower, averaged $1.39.

The average total cost of tractor-drawn 6-foot mowers was 72c per acre.

Where 7-foot tractor-drawn mowers were used, the total average cost per acre was 71c.

In cases of horse-drawn dump-rakes the total cost per acre averaged 71c also.

The cost of the 10-foot tractor-drawn side-delivery rake, averaged 70c per acre.

Loose Hay

Transportation of loose hay from windrow to storage was studied in cases of pitching on and off, pitching on and unloading mechanically, and the use of a hay loader in the field with mechanical unloading at storage.

In cases where horse-drawn wagons were used with the pitch on and off, the output averaged 0.7 tons per hour at a total cost of $4.44 per ton. Where the wagons were tractor-drawn the output was 0.9 tons per hour at a total cost of $4.35.

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Control Of Vapors In Storage Essential For Prolonging Life Of Avocados And Citrus Fruits

J. B. Biale

Improved keeping quality and longer storage life were the aims of extensive studies conducted during the past seven years on storage problems of avocado and citrus fruits.

It was found that respiration measurements afforded an objective criterion for determining the effects of various treatments. These measurements consisted of finding out by suitable chemical methods the amount of oxygen absorbed and carbon dioxide given off by the fruit.

Respiration and Ripening

The relationship between respiration and ripening is most striking in the case of the avocado.

When a sample of fruit is placed at a constant temperature and under a constant rate of ventilation, the rate of carbon dioxide evolution first drops to a minimum, then increases sharply to a maximum, followed by a marked decrease in respiratory activity.

Fruit softening was found to be closely associated with this trend in respiration. It never occurred prior to the peak but always following it. From the nature of the carbon dioxide curve, predictions could be made as to the date when avocados would be most suitable for consumption.

To prolong storage life, different treatments were employed which would delay the rise in respiratory activity. Reductions in the oxygen content of the atmosphere and increase in carbon dioxide concentration resulted in doubling and tripling the storage life of Fuerte avocados.

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Control Of Vapors In Storage Essential For Prolonging Life Of Avocados And Citrus Fruits

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One of the factors which plays an important role in avocado storage is the accumulation of an active emanation recently identified in this laboratory as ethylene gas.

The production of this gas is closely associated with the trend in respiration. By exposing several samples of avocados to temperatures varying from 41°F to 77°F, it was found that the rise in respiration started at different dates.

No evolution of active emanation was observed prior to these dates, as evidenced from the use of pea seedlings, which are very sensitive to ethylene gas. The maximum suppression in growth of these seedlings coincided with the peak in carbon dioxide production.

Citrus

The behavior of citrus fruits in storage was found to be markedly different from that of avocados.

With lemons, no measurable quantities of active vapors were noticed as long as the fruit was sound. The occurrence of a slight amount of mold altered the picture decidedly. The effects of the common green mold are most pronounced. The gaseous products of this rot increase the rate of respiration and accelerate color development of sound green lemons.

Carbon Dioxide Production

Air was passed over four samples of fifty lemons each, at a constant rate, with the exception of the treated fruit, which was exposed to the vapors of the infected fruit. The moldy lemons were kept in containers separated by means of tubes packed with cotton from the jars filled with sound lemons.

At the storage temperature of 59°F, the maximum carbon dioxide evolution is commonly 100% higher than in fruit subjected to air free of these active vapors.

Shedding of stem ends—buttons—and rind deterioration known as pitting and spotting often take place along with the above mentioned symptoms.

Emanations of a single moldy lemon can produce these effects in 500 sound fruit. This action is not limited to fruit immediately after picking. At any time during a seven months storage period of lemons the mold emanations bring about greatly increased respiration, which is doubtlessly responsible for the lowered vitality and very much decreased storage life of lemons subjected to mold emanations.

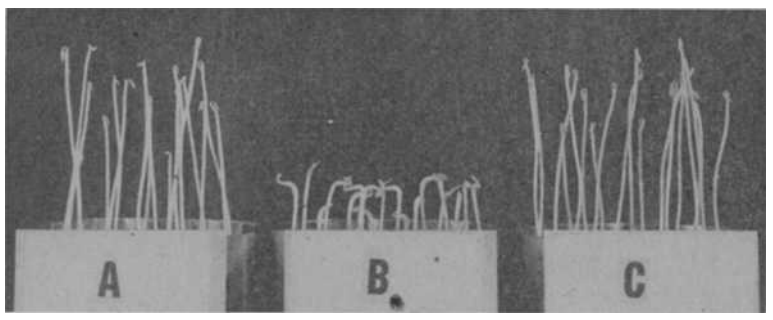
These active vapors can be readily absorbed from the atmosphere by passing the air through a solution of bromine. As a demonstration of this, pea seedlings were used as indicators for air purity.

If a stream of air, free of active volatiles, is passed through a container of peas grown by a standardized procedure, the growth of the seedlings is normal as shown in (C) of the accompanying illustration.

When the air is first passed through a container with green mold, the result is a depression in growth as shown in (B).

Finally, (A) refers to the effect on peas of an air stream which passed through a container with a moldy lemon, then through a bromine absorber, and finally over the peas. Clearly the bromine took out the active emanation.

In subsequent experiments it was found that activated charcoal treated with bromine was highly effective in purifying the air stream. These tests can be cited as strong suggestion that the vapor under consideration is an unsaturated hydrocarbon, presumably ethylene.



The absorption of active vapors by bromine illustrated by pea plants. (A) The effect of air first passed through a container of moldy fruit, then through a bromine absorber to continue on over the peas. (B) The effect of air passed through a container of moldy fruit directly to the peas. (C) Normal growth resulted when air, free of active volatiles, passed through a container of pea seedlings.

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Fertilized Legumes Aid Following Crop Of Non-legumes

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studies will be required in each area.

Non-legumes

The increases of non-legumes such as grasses, cereal hay, and threshed grain following the fertilized legumes have varied from 38% to 107%. In addition, many of the fertilized plots continue to give increased growth of legumes, as for example, bur clover mixed with the grasses on range lands.

Though a good start has been obtained much remains to be done to find the most efficient combination of legumes and of fertilizer practice to secure the maximum benefits for the various areas of the state.

John P. Conrad is Professor of Agronomy and Agronomist in the Experiment Station, Davis.

Poultry Nutrition Research Proves Helpful To Humans

A brief report concerning the search for a successful formula for a synthetic diet for chickens, and some of the unforeseen benefits to humans and animals disclosed by investigation of vitamins discovered in the search for the diet.

Nutritional research made possible the formula for a synthetic diet which would promote growth and reproduction in chickens. It discovered Vitamin K which has proved of value in human medicine, especially surgery. And it led to the process for making synthetic folic acid that gives relief to humans afflicted with certain types of anemia.

Universities, experiment stations, and industrial laboratories have contributed to the scientific advances made in the general field of fundamental nutrition.

Project 677-D-2

The progress made in nutritional research is reflected in the records of Project 677-D-2, a research program conducted by the Division of Poultry Husbandry.

Organized in 1935, the project had the expressed purpose of seeking to construct a diet of purified feedstuffs that would supply completely, the nutritional requirements of the chicken for growth and reproduction.

Vitamin K

The same year that Project 677-D-2 was started, and within a few weeks of each other, a scientist in Denmark and scientists working in the Division of Poultry Husbandry in California, announced the discovery of an unknown vitamin.

The new vitamin was named Vitamin K, and is known as the coagulation vitamin because of its ability to cause the clotting of blood.

Absence of Vitamin K in the diet of the chick leads to hemorrhages, but there is no problem in supplying an adequate amount of the vitamin in the normal poultry diet.

Studies of Vitamin K by research laboratories in other fields extended into investigation of its value in human medicine. There it proved of great value in certain cases of surgery.

Riboflavin

In the course of work on Project 677-D-2 studies were made of the vitamin factor, riboflavin. Investigations proved that a deficiency of this vitamin in the diet of chickens caused the production of eggs with low hatchability.

Dead embryos had characteristics defects, such as dwarf size, degeneration of the kidneys, deformed down, and evidences of edema and anemia.

In 1937 California poultrymen reported an epidemic-like prevalence of eggs with low hatchability. They were advised to increase the riboflavin content of the diet they gave their chickens. They did so and the egg hatchability jumped to normal.

Pyridoxine

Pyridoxine is another vitamin factor to be discovered in the progress of Project 677-D-2.

A scientist working on the project conducted parallel investigations with rats. He made certain findings which he applied to the experiments in progress with the poultry diet. His observations in his rat studies were confirmed. Thus pyridoxine was first isolated and the first description made of the neurological manifestations of its deficiency.

Lack of sufficient pyridoxine in the diet of the chick is indicated by such symptoms as weakness, nervousness, and convulsions.

Pantothenic Acid

Pantothenic acid was investigated to determine the possible place of this vitamin in the sought-for synthetic diet.

It was found that the presence, or a deficiency, of pantothenic acid in the diet of the parent hen affected the embryos in her eggs. A sufficiency of this vitamin is needed to prevent a certain type of dermatitis—an inflammation of the skin—in the chicks and is necessary for reproduction by the adults.

Choline

Tests of choline proved this vitamin factor to be necessary for good growth and normal bone formation in chickens and turkeys.

Biotin

Investigations of biotin established

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Vertical Cabinet Type Electric Sterilizer Tested For Lethal Effect On Bacteria In Milk Cans

J. R. Tavernetti

Tests were made on a vertical cabinet sterilizer heated by five strip heaters and using no moisture except that on the equipment after washing.

The cabinet has outside dimensions of 50" depth, 38" width and 66" height, is insulated with three inches of mineral wool all around and has a net storage space of 30 cubic feet.

The heaters which have a total connected load of 2500 watts are located under a false bottom and the heat is circulated through a flue located on the back wall. It is equipped with a thermostat which cuts off the heat at the temperature at which it is set and the heat does not go on again until the thermostat is reset.

For the tests seven standard 10 gallon milk cans—6 sterilized, 1 control—were used. Milk was allowed to stand in the cans at room temperature for 4 hours after which they were rinsed with cold water and placed in the sterilizer and heated. The cans were then removed and bacteria counts made and compared with the control.

Temperatures of the air and the cans were taken at various points in the cabinet by thermocouples and an ordinary thermometer with which the cabinet was equipped.

In tables 1 and 2 are shown the results of the tests.

TABLE I

Temperatures at Various Points in Sterilizer When Loaded with Six 10 Gallon Milk Cans (150 lbs. metal)

	Thermocouples						Thermometer	
Time Mins.	Air #1	Air #2	Air #3	Air #4	Can* #5	Can* #6	Air T	
0	79	80	80	80	86	82	—	
6	82	86	97	97	84	80	95	
15	106	115	135	135	99	90	118	
25	129	142	167	167	122	108	145	
35	154	169	194	192	153	129	172	
45	178	192	217	217	180	156	192	
50	187	201	226	225	190	167	200	Heat Off
55	192	205	223	221	199	178	200	
65	189	198	205	199	201	185	180	
75	180	189	192	189	198	187	165	
95	171	180	181	176	189	181	155	Cans removed

*Thermocouple soldered in junction of bottom and side on outside of can.

TABLE II

Results of Tests for Lethal Effect on Bacteria in Sterilizer

Can Number	Condition of can	Bacteria Colony Count
216—sterilized	old fair condition no rust	215
77—sterilized	old dented fair condition	68
617—sterilized	old sl. etched good condition	900
391—sterilized	old dented rust spots bottom	840
693—sterilized	good condition	225
336—sterilized	old dented sl. etched no rust	69
584—not sterilized	control can not washed old sl. rusty	228,000

J. R. Tavernetti is Associate Agricultural Engineer in the Experiment Station, Davis.

Proper Temperatures Important In The Storage, Precooling And The Shipping Of Stone Fruits

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and at 32°. It is questionable if apricots should be held longer than three weeks.

Plums

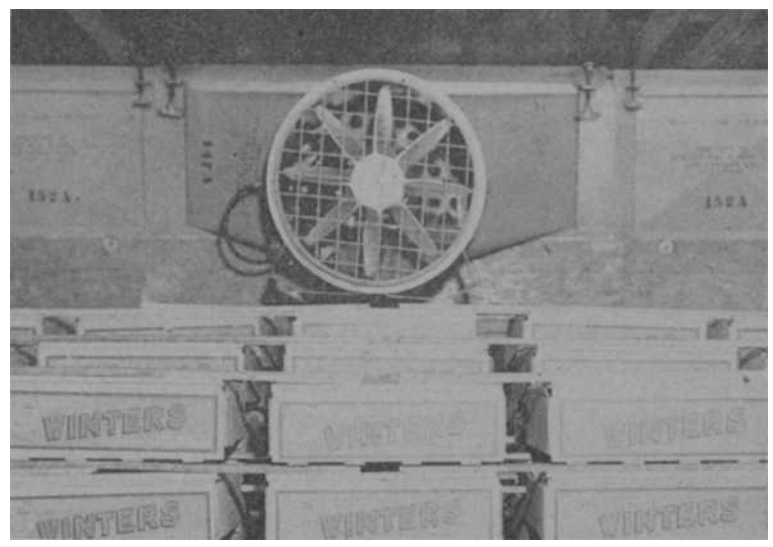
Plums, of which we have numerous varieties, hold their dessert quality in storage rather well, most of them being quite acceptable for a month to six weeks. Tragedy has, in some instances, kept well and has maintained its quality for two months. After four to six weeks, Santa Rosa sometimes failed to ripen. The flesh of the greener fruits was often woodlike in texture, and bitter. Browning also developed around the pit.

Cherries

Except during precooling and while in transit, cherries are usually not held under refrigeration. Limited storage trials with Tartarian, Black Republican, Bing and Lambert indicate that good fruit free from mold infection may be held four to five weeks, but not without loss of flavor, considerable pitting of the skin, darkening of the color and drying of the stems. In general it is doubtful if cherries should be stored longer than two, or at the most, three weeks.

Precooling

Except at the beginning of the shipping season when some ripening of plums and apricots in transit is more beneficial than detrimental, precooling of stone fruits in California is general.



Loading of apricots in a refrigerator car. Precooling fan in place at top of ice bunker opening. The fruit is precooled for 12 to 18 hours.

In the absence of definite precooling standards, the term "precooled" has sometimes been applied to fruit where only the top heat is removed and where at the time of shipping the temperature in the center of the packages was between 50° and 60° F. When fruit in the center of packages is cooled to 40° it can be transported for ten days in well iced cars with maximum temperatures of between 40° and 48°.

Fruit cooled to 32° to 34° will carry under a lower temperature during the first few days in transit and, in a well constructed car in good repair and kept well iced, may even arrive at destination slightly colder than if precooled only to 40°. Since, however, the temperature of refrigerator cars at the time of loading is not generally below 45° to 50°, and the ice in the car frequently does not maintain an average air temperature lower than between 40° to 50°, the advantages gained by precooling fruit to 32° to 34° are not always so great as anticipated. Cooling to these temperatures is most effective when the car itself is precooled to a temperature approximating that of the fruit loaded.

Hydrocooling

Hydrocooling is infinitely more rapid than cooling in air and this is now employed commercially with a number of vegetables.

In experimental tests conducted by Federal investigators in the state of Washington, the temperature of individual cherries was reduced from 65° to 34° in seven minutes, or about 145 times as fast as packed fruit held in still air at 32° No cracking or other injury was noted from water cooling for seven minutes.

Dry Ice

Since trials in using dry ice to retard mold growth on fruit in transit and since its retarding effects upon coloring and softening have been established, interest has been taken in using it as a supplement to refrigeration.

In a test shipment of Bing and Tartarian cherries conducted in 1941, five pairs of test cars, one of each pair containing dry ice, were shipped to the New York market. The fruit from each was sold in the auction and size for size the price paid for the fruit in the dry ice cars ranged from 10c to 49c per box more than the fruit from the untreated cars.

Possibly the commercial use of dry ice in conjunction with good precooling, may make possible the shipment of a better quality product.

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