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SUN-DRYING FRUITS

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This Circular

IS FOR THE FARMER WHO HAS A DRYING YARD

It is intended to give information on good sun-drying practices to the grower who already has sun-drying facilities. The circular is *not* published to instruct the farmer in how to install a sun-drying plant. It is expected that sun-drying of fruits will be employed less and less, and that dehydration will eventually become the accepted method of drying.

▶ *This swing away from sun-drying and to dehydrating has come about because of the greater possibility of producing a cleaner, higher quality dried fruit by the latter method. In some cases, and in periods of high labor costs, dehydration may actually be cheaper than sun-drying; when labor costs are low, however, the reverse may be true. The use of dehydration cuts the drying time, it minimizes losses due to bad weather conditions, and it is more suitable for mechanization, hence reducing labor requirements.*

SUN-DRYING WILL CONTINUE, of course, among established orchardists who have the facilities, although it may be necessary to mechanize some of the operations. To maintain a satisfactory market for his product, it behooves the grower to produce high quality dried fruit. To accomplish this the fresh fruit must be sound and of *eating quality* when prepared for drying. The rules of sanitation must be applied from picking to storing the dried product. Workers must be instructed in clean working habits and encouraged to be alert to all sources of contamination, both inside and outside the drying yard.

▶ *Requirements of the Food and Drug Administration*, with respect to sanitation and cleanliness of the product, are such that unless the grower enforces high standards of cleanliness, he may find it impossible to market his product. But cleanliness, combined with the use of sound fruit and proper drying methods, will assure the orchardist of a good quality product, highly acceptable to the market.

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SUN-DRYING FRUITS

E. M. Mrak and H. J. Phaff

THE PROCESS of preparing fruits for sun-drying differs somewhat for each of the fruits. The proper treatment for each is given separately in this circular.

Whatever the steps in the process, the end result is the same: preservation of fruit by reducing moisture content so that bacteria, yeasts and molds cannot develop; and at the same time, production of a dried fruit with a desirable flavor and attractive appearance.

There are certain general rules which apply to all the fruits. These principally pertain to cleanliness, and to the selection of fruits for drying.

You Can't Make GOOD Fruit from BAD by Drying

No fruit or part of a fruit should be dried which would not be considered edible in fresh form. In considering a single fruit and its fitness to be dried, the test should be, "Would I eat this fruit myself, as is?"

When a dried fruit is cooked it is no better than the fresh product from which it is made. Cull or waste fruit gains nothing in the drying. Rotten or worm-infested fruit must be removed and discarded at the beginning of the preparation process.

The time and procedure of harvesting are important factors in determining the condition of the fresh product. The ideal harvesting periods and procedures vary with each fruit. These are covered in more detail in the later discussions of specific fruits.

Cleanliness should be the watchword. Cleanliness in all phases of dried-fruit production is absolutely necessary to a good product.

Washing Trays and Boxes

Trays and fruit boxes must be kept clean. Some fruit juice adheres to the wooden surfaces with each handling. This results in an accumulation of dirt and mold that may contaminate and injure the appearance of the dried product.

Soak the boxes and trays in a vat containing a solution of trisodium phosphate or other alkaline cleansing agent. Scrub them with a stiff bristle or wire brush. Finally, rinse with clear water.

The strength of cleaning solution needed will vary with the condition of the trays and whether or not brushes are used. A sufficient concentration should be maintained to clean the trays thoroughly.

In large drying yards continuous tray- and box-washing machines are economical. One type of tray washer has a rotary fiber brush under which the trays are moved continuously. Another type has reciprocating-motion fiber brushes with interrupted movement of the trays to permit brush operation from the side. The second type works closer into the corners than the first, and rubs with the grain of the wood. If heated water is used, two operators can clean three to five a minute.

The oiling of new or clean trays with light mineral oil will prolong their life and make for easier cleaning.

To reduce mold growth on the trays during off-season storage, wash and dry them thoroughly, then store so as to permit good ventilation through the pile.

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Washing Fruit

It is desirable to wash all fruits to be dried. This is, of course, not possible in the case of grapes dried in the vineyard (natural raisins and currants).

Apricots, peaches, and nectarines may be washed by immersion, or by passing under sprays of clean water. Pears should be washed after traying the cut fruit to remove insect fragments and debris. Prunes will be washed satisfactorily during pretreatment providing clean dipping solutions and washing water are used.

Although it is desirable to wash figs to be dehydrated, it is not wise to wash those to be dried in the sun since washing might result in increased yeast and mold growth.

Removing Spray Residues

Lead arsenate is still used to some extent on apples and pears. Where it is used it is necessary to remove all spray residue before the fruit is cut.

Where the spray program includes the use of DDT or related compounds, special precautions must be taken to remove the residue. Since information about these insecticides is changing so rapidly, the grower should write to the Department of Entomology of the University of California, Berkeley, outlining his spray program and requesting information about the removal of residues.

No Animals

Keep animals and especially chickens away from the dry-yard premises.

Disposing of Waste

Daily removal from the cutting shed of rotten and waste fruit is of first importance. Waste fruits and fruit pits are ideal breeding places for insects. Such waste should not be dumped in a nearby arroyo—as has been done in many cases—but should be put into holes or piles and covered with lye, quicklime, or chlorinated lime to prevent fermentation.

Pits, with the exception of those of apricots, have no commercial value. Collect pits in containers, separate from trimmings and waste. *Do not put pits back in boxes with uncut fruit.* Dry pits by spreading them about 4 inches deep on trays or concrete in the hot sun. Rake them periodically.

Settling Dust

Roads, earth, floors, and paths should be treated to settle dust which otherwise would settle on the fruit.

Asphaltic oil may be used with good results if it is heavy enough with asphalt to cement the soil surface. Light oils are not satisfactory.

A good material for settling dust is calcium chloride. When spread on the earth it absorbs moisture from the air and keeps the soil surface moist. Use calcium chloride at the rate of one-half pound per square yard. Spread it on, or rake it into the surface, or dissolve it in water and apply with a sprinkling can. The chloride will need replacing every year.

Drying-Yard Condition

Cleanliness in the drying yard is as essential as in the cutting shed. The most desirable yard surface is asphalt or concrete. If plain dirt is used it should be smooth and free of bits of straw, embers or burnt grass, or other materials that may blow onto the fruit.

The yard should be located away from dusty paths or roads. It should be protected from farm animals.

Cutting-Shed Sanitation

Sanitary arrangements of the cutting shed and its surroundings should include wash bowls well supplied with soap and towels, and drinking fountains or paper cups and a place for their disposal.

Sanitary toilets and lavatories should be located a distance from the cutting shed, and should drain properly into sewer or septic tank.

Cutters should be encouraged to wash their hands and cutting knives several times a day.

Instructing Workers

It is surprising but true that many drying-yard operators fail to give adequate instructions to their workers. They seem to take for granted that if cutters have worked before they will know the correct procedures and rules. They think that a new worker, put with an experi-

enced worker, will automatically learn the right methods.

Instruction and demonstration are necessary, for the old worker as well as the new. This should be done by the forelady in a small operation, or by crew-leaders in a large operation. In the latter case the foreman must instruct crew-leaders, then make sure they are passing on to their crews the correct information.

Table 1: SCHEDULES FOR PRETREATMENT AND SUN-DRYING

Fruit	Pretreatment	Drying in the sun*
Apricots.....	Sulfuring Cut: 4 to 5 hours Whole: 10 hours	Interior: 1 to 2 days Coastal: 2 to 7 days
Freestone Peaches.....	Lovells: 5½ to 6½ hours Others: 5 to 6 hours	Interior: 3 to 4 days Coastal: 4 to 9 days
Nectarines.....	4 to 5 hours	3 to 4 days
Pears.....	24 to 48 hours	1 to 2 days
Prunes.....	Dipping 5 to 15 seconds	7 days or more
Grapes (soda-dipped).....	10 to 20 seconds	1 to 2 weeks
Grapes (sulfur-bleached).....	Dipping/Sulfuring 5 seconds/1 to 3 hours	3 to 5 hours in sun; then 2 to 3 weeks stacked
Grapes (natural).....	(No pretreatment).....	3 to 4 weeks

* To be followed by a variable period of stack-drying.

Table 2: DRIED-FRUIT LOCALITIES, VARIETIES, SEASONS, AND YIELDS IN CALIFORNIA *

Fruit	Principal localities	Principal varieties	Drying season	Yield per acre in dried tons			Range of drying ratios†
				Low	Medium	High	
Apricots	Santa Clara, Sacramento, and San Joaquin valleys	Blenheim, Royal, Tilton	June 15 to Aug. 1	0.5	1.0	2.5	4:1 to 7.5:1
Figs	San Joaquin Valley	Adriatic	July 20 to Nov. 1	0.5	1.5	2.5	
		Black Mission	July 20 to Nov. 1	1.5	2.0	3.0	
		Calimyrna	July 20 to Nov. 1	0.5	1.0	2.0	
		Kadota	July 20 to Nov. 1	0.5	1.5	2.5	
Nectarines	Sacramento and San Joaquin valleys	Gower, Quetta, Stanwick, Rivers	July 15 to Aug. 30	0.5	1.5	3.0	5.5:1 to 8.5:1
Peaches (clingstone)	Sacramento and San Joaquin valleys	Midsummer varieties and Phillips	Aug. 1 to Sept. 15	0.5	1.0	2.0	6.5:1 to 10:1
Peaches (freestone)	Sacramento and San Joaquin valleys	Elberta, Lovell, Muir	July 15 to Sept. 15	1.0	2.0	4.5	4:1 to 8:1
Pears	Lake and Mendocino counties; Napa, Sacramento, Santa Clara, and Sonoma valleys	Bartlett	July 15 to Oct. 1	0.5	1.5	3.0	4:1 to 7:1
Prunes	Napa, Santa Clara, Sonoma, Sacramento, and San Joaquin valleys	French, Imperial, Sugar, Robe de Sergeant	Aug. 15 to Oct. 1	1.0	2.0	5.0	2:1 to 3.5:1
Raisins (natural)	San Joaquin Valley	Muscat	Aug. 15 to Nov. 1	0.5	1.0	2.0	3:1 to 5:1
		Sultana	Aug. 15 to Nov. 1	0.5	1.0	2.0	4:1 to 6:1
Raisins (sulfur-bleached)	San Joaquin Valley	Thompson Seedless	Aug. 20 to Oct. 1	1.0	1.5	3.0	3:1 to 5:1
		Thompson Seedless	Aug. 20 to Oct. 1	1.0	1.5	3.0	3:1 to 5:1
Raisins (soda-dipped)	San Joaquin Valley	Thompson Seedless	Aug. 20 to Oct. 1	1.0	1.5	3.0	3:1 to 5:1
Currants (Zante)	San Joaquin Valley	Black Corinth	Aug. 5 to Aug. 20	0.5	1.5	2.5	4:1 to 6:1

* The drying season, yield per acre, and drying ratio vary with the year and locality of production.

† Most of the fig drying usually occurs before the fruit is harvested. For the conversion of dried weights into green weights a drying ratio of 3:1 is commonly used and for converting dried weights into fruit weights as harvested, 1.5:1 is sometimes used.

HANDLING THE *Specific Fruits* FOR SUN-DRYING

The fruits commonly sun-dried in California are apricots, peaches, pears, figs, grapes, and prunes. Cherries, nectarines, and persimmons also are sun-dried, but on a very limited scale.

Apricots

Two varieties of apricots, Moorpark and Hemskirke, are grown almost exclusively for drying. The more important Royal, Blenheim, and Tilton varieties may be dried, canned, frozen, or shipped fresh.

Most apricots are halved for drying, although there is a very limited market for whole cured fruit and slip pits (whole fruit with pits squeezed out).

Harvesting

Apricots for drying should be at least as ripe as desired for eating fresh. Im-

mature fruit makes a dried product which is poor in color and flavor, and always shows more shrinkage.

Don't Shake. Apricots are to be hand-picked from the trees. Shaking of this fruit is sometimes done, but it is poor practice and should not be resorted to unless in a case of real necessity. A crop which is shaken must be culled in the cutting shed for imbedded dirt and for damaged or immature fruit. This may be done either before or after cutting.

Because cutters are paid by the box, the wooden lugs of fruit should be filled uniformly.

Plain talk about apricots—

The dried-apricot situation in California during the 1948 season reached a discouraging level. Many growers did not receive the cost of production. As the 1949 season approaches, growers are questioning the advisability of operating their plants. Many are looking for other outlets. Some have pulled out their trees, and others doubtless will follow.

This situation points to two things in the small sun-drying operation:

1. *Costs of production are too high for the small operators in the business*, many of whom are still using all hand labor in the cutting shed. With labor costs what they are, the alternative is a mechanized operation. A cutting machine will handle 4 to 5 tons of fruit an hour. One dry-yard operator has figured that a two-machine plant, staffed by 62 persons, will do the work of 300 women and 50 men in a hand operation.

The answer for the small operator seems to be either to have his fruit custom-dried by someone with mechanical equipment, or to join other small operators in his neighborhood and put in a mechanized cutting shed as a coöperative venture. This matter of mechanization should receive careful consideration for future seasons.

2. *The product of many operators is below standard in quality and cleanliness.* Consumer demands are swinging away from dried fruit with the result that the product of each operator enters a highly competitive market. Only the superior dried product will sell. Every sun-drier in the industry must look at his operation critically. He *has* to enforce high standards of sanitation if he expects to stay in business.

Preparation

It is common practice to dry apricots with the skin attached and without washing them, unless they have become soiled by contact with the ground. Washing of all apricots is recommended, however, and should be done before cutting. Boxes of fruit may be placed on a rack and doused in a vat of cold water; or the fruit may be emptied onto a belt conveyor which passes under a spray of water.

Apricots are cut by hand or machine completely around the seam. The fruit should not be torn when halves are separated, since tearing may result in slabs. Cut fruit is placed on trays closely and uniformly with the cut side up.

Pits Have Value. Kernels from apricot pits are used to manufacture various products, one of which is a cooky filler. Charcoal and chemicals are obtained from the shells. Pits are sold on a tonnage basis.

The commercial value is reduced by sulfuring. If apricots are sulfured whole and pits removed later, these pits should be kept separate.

Spread pits on trays or on concrete slabs for drying. Stir daily with a coarse rake. Dry them completely before sacking for transportation.

Sulfuring. Stacked trays of halved apricots are run into a sulfur house and exposed to fumes of burning sulfur for 4 to 5 hours. This process aids in preserving natural color, and in preventing mold and fermentation.

Complete instructions on the operation of a sulfur house are given in Circular 382 of the Agricultural Experiment Station, titled "Sulfur-House Operation."

If apricots are being dried whole the fruit is trayed and sulfured for about 10 hours. The fruit is then spread in the sun for a few days, then resulfured and the drying continued. Slip pits have the pits squeezed out before the resulfuring takes place.

Drying

Spread the fruit in the sun soon after sulfuring. If fruit stands on the car, juice collects in the cups. The surplus of juice will spill, making the trays sticky and decreasing the yield and quality of fruit.

Some growers leave the fruit spread on the drying field until it is sufficiently dry to remove from the trays and store. Somewhat better color and size can be obtained by stagger-stacking the trays with ends to the prevailing winds, before the fruit is fully dried.

Drying Time. Exposure to the sun for 1 to 2 days in the interior valleys, and for 2 to 7 days in the coastal areas (or longer depending on the weather), is needed for drying apricots.

The exact drying time is impossible to prescribe since so much depends upon the climate, district, and fruit. In any event, the fruit should have a flexible "kid-glove" texture in the stack before it is scraped from the trays and boxed. The drying time should not be so short that free syrup remains in the fruit. Test it by tearing a half fruit apart.

As fruit is transferred from trays to boxes it should be hand culled for discolored, dirty or slabbed pieces.

Freestone Peaches

Principal varieties of freestone peaches grown for drying are the Muir and the Lovell. The Elberta, J. H. Hale, Rio Oso Gem, and certain other varieties, grown primarily for fresh shipment, canning, or freezing, are also dried at times.¹

The peaches are halved, pitted, sulfured, and usually dried with the skin on. The processes are identical as for apricots, but the times required differ a little for this fruit. A vastly superior product would result if the skins were removed by steam blanching after sulfuring. Unfortunately the returns for peeled freestone

¹ A practical circular titled "Dehydrating Freestone Peaches" has been published as Cir. 381 of the Experiment Station.

peaches have not warranted their production.

Sulfuring. Freestones require about an hour longer in the sulfur house than do apricots, that is, from 5 to 6 hours. Lovells, since they are inclined to darken rapidly, can stand about $\frac{1}{2}$ hour longer than the other varieties. (See table 1 for time schedule.)

Drying Time. The time required for sun-drying varies with climate and district. In general, peaches require 2 days more than apricots in the sun before the trays are stacked. (Table 1, page 5.)

Nectarines

Procedure for drying nectarines is about like that for peaches except that the drying times may be somewhat less. (See table 1 for comparative drying schedules.)

It is advisable to wash nectarines in cold water before cutting and pitting.

Both freestone and clingstone nectarines may be dried. When clings are used it is necessary to pit them like cling peaches, using a pitting spoon.

Clingstone Peaches

In 1946 less than 1 per cent of the total clingstone peach production was dried. However, the history of cling peach production in California shows a period in the 1930's when economic factors caused an increase in clingstones going into dried fruit channels. Canners were reluctant to take any but the best fruit; canned clings brought low prices; consumers were going through a general depression. Almost 11 per cent of the harvested crop was dried in the period 1935-1939.

Returns to growers for drying peaches have consistently been about one half the returns from canning or fresh utilization. So it is probable that the drying of clings will continue to be a practice only in times of surplus, when the canning outlets are filled.

Even on such occasions *the sun-drying of clings is not recommended* since the resulting product is of such poor quality. If this fruit is to be dried it should be peeled, blanched, and dehydrated.

Nevertheless, because there will still be some inquiry about methods of sun-drying this fruit, brief instructions are included in this circular.

Preparation

Clingstones to be dried in the sun are tree-ripened and hand-picked. A washing in cold water before cutting will remove dirt particles and some of the skin fuzz.

The fruit is cut in a line extending around the seam. In small operations, pitting is done by the use of a hand-pitting spoon. Larger commercial drying yards use an automatic cutting and pitting machine.

Fruit may be dried with the skins on, in the manner described for freestones, but this is not advisable. It is preferable to peel this fruit by dipping in a boiling solution containing $1\frac{1}{2}$ to 2 per cent lye, followed by a rinse under heavy sprays of water to remove the loose skin.

Peeled peaches are spread on clean trays, sulfured and dried in the same way as unpeeled peaches.

Clingstone peaches are sulfured for about 6 hours—somewhat longer than is necessary for freestones.

Drying Time. The drying time for cling peaches will vary considerably with size, maturity, variety, and whether or not they have been peeled. It may range from one to three weeks. It is difficult to tell when clings have dried to the proper degree. It requires experience or the use of a dried fruit moisture tester.

Pits. Disposal of clingstone pits is something of a problem, since considerable flesh adheres to them, and they ferment and harbor insects. They should be spread out in thin layers to dry as quickly as possible. These pits have no commercial value. When dried they may be used as a fuel.

rules for management

- 1** leave bad fruit in the orchard; do not bring it into the drying yard
- 2** teach your workers habits of cleanliness
- 3** keep down dirt and dust in the drying yard and shed
- 4** allow only clean boxes and trays to be used. Dirty trays make culls out of sound fruit
- 5** dispose of refuse frequently. Do not let spoiled fruit and pits collect in shed
- 6** sort out culls before boxing dried fruit
- 7** fumigate stored fruit at first sign of insects

REMEMBER

rules for workers

1 wash your hands often

2 use only clean trays

3 keep knives sharp

4 make a complete cut. Do not break or tear fruit

5 keep pits separate. Do not let them fall onto uncut fruit

6 throw away . . .

... fruit that falls on floor

... fruit showing rot or mold

... fruit showing insect infestation

... fruit with imbedded dirt

**ONLY FRUIT THAT IS FIT
TO EAT FRESH . . .
IS FIT TO DRY**

Pears

Most of the pears grown in California are either canned or sold as fresh fruit. Sun-drying, however, dates back many years and is the usual method of handling surpluses. The only variety commercially important to the dried fruit industry is the Bartlett, although the Anjou makes an excellent dried product.

The drying of pears entails processes not necessary for other fruits. These are: ripening at room temperature, special care to remove spray residues from calyx end, special handling in cutting.

Pick Green, Then Ripen

Pears for all uses are picked when they have reached full size but still are hard and green. The part of the crop which is to be dried may be left on the tree a little longer than the fruit which is to be canned or shipped fresh. Fruit that drops to the ground may be salvaged for drying, but for the most part the drying fruit is hand-picked from trees. A large part of the pears used for drying are sort-outs from fruit to be used for canning or shipping fresh.

Ripening. Green pears, in lug boxes, are kept at room temperature (70° to 80° F) and the ripe fruit sorted out periodically by hand.

Since ripe or nearly-ripe pears give off ethylene gas, they can be used to hasten the ripening of the green fruit. Several boxes of fairly ripe pears are stacked with about twice the number of green pears in a closed room or under a tarpaulin. Such fruit should be watched closely to prevent over-ripening.

If more rapid ripening is desired, ethylene gas can be applied. When gas is used, the operator should have detailed instructions from an experienced person.

Pears are ready for drying when they are eating-ripe.

Preparation

Spray Residues. A general discussion concerning the removal of spray residues has been given on page 4.

The presence of the calyx on pears makes them more difficult than other fruits to clean thoroughly from spray residues. For this reason it is desirable to cut out the calyx in a separate operation from the regular cutting.

Cutting and Trimming. Pears usually are cut by hand, although some plants have mechanical cutters. Stems are pulled out and the calyx end is taken out with a calyx remover. It is not customary to peel pears, nor to remove the cores unless damaged. The fruit is cut into halves, lengthwise, and trimmed to remove damaged areas.

If to be halved by machine, the whole pear is taken by hand from the moving belt, the stem pulled out by hand, and the calyx removed by pressing the pear against a continuously operating auger. The fruit is then placed in a cup mounted on a belt which takes it to a rotating knife for halving.

Washing Pears. From the cutting operation, pear halves are placed cut-side-up on trays. The trayed fruit is thoroughly washed in cold water to remove bits of trimmings and insect excreta from the halves. Washing is done *before* the trays are stacked on a car, not afterward when dirt falls through onto the lower trays. A hose may be used, or fixed sprays of water.

Sulfuring. Cars of trayed fruit are run into the sulfur house, to remain from 24 to 48 hours. Several new charges of sulfur are lit during this time.

There is no good evidence that wetting the fruit during sulfuring improves sulfur absorption.

Fruit should be mushy when it has been properly sulfured. This will result in translucency after the sun-drying process.

Drying

For best color in the dried product, leave fruit in the sun for 1 to 2 days. Tilting the trays toward the south will give full exposure.

After this time in the sun, stagger-stack the trays, covering up the top one. Place a block or stick between the trays to help air circulation.

Two to 4 weeks in stacks will be necessary to complete drying. During that period the trays should be restacked several times, and the culls sorted out.

When finished, dried pears will be flat and flexible, not mushy, with little curling or browning of the cut edges.

Storing. The pears again are culled by hand as the dried fruit is transferred to clean lug boxes. They are then stored in a dry, cool, fumigable place.

Prunes

Almost all the prunes grown in California are for drying purposes. The percentage of California prunes that is dehydrated has increased so greatly that less than 20 per cent are still sun-dried.

The French prune is the principal variety grown, and is the most consistent producer over a period of years. Other principal varieties are the Robe de Sergeant, a rounder variety but quite similar to the French variety; the Imperial, a large, juicy prune, but erratic in production from season to season; and the Sugar prune, an alternate bearer which produces large fruit of fair quality, but which requires orchard thinning to grow to satisfactory size.

Sun-Drying vs. Dehydrating

The prune grower will have to weigh the advantages of the two methods of drying, and adopt the one best suited to his circumstances.² The swing to dehydra-

² A practical handbook titled "Dehydrating Prunes" has been published as Cir. 383 of the Experiment Station.

tion has been, for the most part, because it produces a superior dried fruit, in less time and at a lower cost.

Unfavorable weather often occurs during the drying season, since the season ranges from the middle of August to October or later. Weather does not interfere with dehydration.

There is a general opinion that if the grower owns his own dehydrater, or if he belongs to a coöperative dehydrating organization, it is cheaper to dehydrate than to sun-dry prunes. This is because of the high labor cost of handling the fruit in a sun-drying plant.

On the other hand, if the producer pays a fixed amount per ton to a custom-operated dehydrater for the drying process, then his own sun-drying plant may prove the cheaper means of handling prunes.

Harvesting

The harvesting season differs from year to year with the location of the orchard, but in general extends from August 15 to October 1.

Maturity of Fruit. Fruit grown in the Sacramento Valley is customarily harvested over a period of three or four weeks. Experiments conducted on several farms for two years showed that most fruit in this area is harvested too late. Prunes picked during the first ten days of the harvesting season gave more favorable yields and were superior in quality. Those that could not be dried at the time of harvest were held in cold storage for one to three weeks. These, too, were superior to those picked during the last two weeks of the harvesting season.

The best quality of dried product was obtained when prunes were harvested in the ideal condition for eating fresh. In other words, they were firm (no shriveling at all), juicy, and the flesh was free of any discoloration and gas pockets.

In the coastal counties prunes fall from the trees naturally when mature. Because

of this, losses in quality are not so apt to occur in the coastal prune areas as in the interior valleys, provided the fruit is not left on the ground until it deteriorates.

Over-mature prunes tend to discolor and the flesh tends to break down with the formation of gas pockets. Immature fruits form "chocolates," "bloaters," "frogs," and "frog bellies."

It is common practice to harvest prunes by picking them up from the ground after they have fallen or been shaken from the trees. Handpicking is costly, so mechanical shakers and pickers have been and are being tried in the interior valleys where prunes do not fall from the trees naturally. The labor-saving devices have not proved very successful in areas where prunes fall to the ground naturally. Sometimes the grower uses a mechanical shaker, but as a rule poles are used to shake the branches.

When the ground is smooth, the daily harvest per picker will be greater than when the ground is rough. Good pickers can gather 25 boxes weighing 50 pounds each in a day. Harvesters usually are paid by the box.

Number of Pickings. The number of pickings during a season varies with the location of the orchard. In coastal areas, where the fruit falls more naturally and only light shaking is needed, 3 or 4 pickings are customary. In the interior, where heavier shaking of the trees is needed, growers rarely make more than two pickings. A single picking at the proper stage of maturity may prove to be more feasible in the interior valleys.

Handle Quickly. The fresh fruit should be picked up soon after dropping from trees, carried to the drying yard without standing in boxes, dipped, trayed, and placed in the drying yard just as quickly as possible.

If prunes are held in boxes they discolor, develop gas cavities, lose sugar, and many even ferment or undergo molding, such as that caused by the brown rot fungus and other molds. Bloaters and frogs (swelled fruits) and chocolates

(browned fruits) are the culls which may develop from these causes.

If it should be impossible to handle fruit immediately, it is much better to place it in cold storage, or even allow it to stay on the ground, than to be stored in boxes at the drier. Fully mature prunes start to dry on the ground and ordinarily stay in a reasonably good condition for a day or so.

Clean the Fruit. Sticks, stones, leaves, and dirt are bound to be present in the fruit harvested from the ground. It is a good practice to pass prunes through a trash remover employing a strong draft of air, and then under strong sprays of clean water before they enter the dipping tank. Wash water should be kept clean, and never be recirculated.

Unless the prunes are cleaned of the trash which comes with them from the orchard, the lye-dipping solution soon becomes dirty and ineffective. Power-operated dippers usually have a trash screener attachment, but as a rule hand-operated dippers do not.

Dipping

A lye bath, applied either by dipping or spraying the prunes, causes the skin of the fruit to check, or be criss-crossed with tiny cracks, which aids drying. It is necessary to use a lye dip for all prunes to be sun-dried except the Imperial prunes, which may be dipped in either a weak lye solution or plain hot water.

Dip French prunes in a solution of about 1 pound of lye (caustic soda) to 20 gallons of water, at about 200° F, or close to the boiling point. If skins do not check readily, increase strength to 2 or 3 pounds of lye to 20 gallons of water. Immersion for 5 to 15 seconds is sufficient. Try to adjust temperature and strength of solution to do the necessary checking in the shorter exposure time. The skin should be definitely checked, but large cracks or peeling of the fruits should be avoided. Rinse the fruit well by immersing in running water, or by spraying.

Tough-skinned varieties such as the Robe de Sergeant require a more severe dip.

Imperial prunes to be sun-dried may be treated in a very mild lye solution for about 5 seconds, or in hot water for 5 to 10 seconds. This fruit must be given the pretreatment with care since it tends to form slabs easily.

If the freshly dipped prunes are not fairly uniform in size, or if some of the fruit is slightly or partially dried, it is desirable to use a "green fruit" size grader. The small and large prunes are then spread on separate trays for drying, and the possibility of overdrying some fruit is reduced.

Spread prunes one layer deep on the trays. A tray (3' x 8') will hold 45 to 55 pounds of French prunes or 60 to 75 pounds of Imperial or Sugar prunes.

Drying

Prunes are slow-drying. The time required for drying will depend upon the size and condition of the fruit, and upon weather conditions.

Time in Sun. Leave prunes in the sun until they are at least three-quarters dried. This will require a week or more. Then stack the trays and allow prunes to continue drying slowly. In the case of large varieties such as Imperials, two men may shake the trays back and forth to turn the fruit.

In case of rain, stack and cover the trays, then spread them again when weather permits. In long-continued bad weather, prunes may have to be finished in a dehydrater in order to save them from mold spoilage. *Dehydration, however, cannot save spoiled fruit.*

Testing for Dryness. When the prunes are dry enough, the flesh will be firm and the pit will not slip when the fruit is squeezed between thumb and forefinger. The fruit should not be so dry as to rattle and sound like pebbles when shaken on the trays. When a handful is squeezed the

fruit will feel pliable, but when released the prunes will fall apart.

Storing

Hand cull the prunes while transferring them from trays to lug boxes. Clean, wooden lugs are recommended for storage, rather than bins.

Storage space must be cool, dry, well lighted and ventilated. Screening is essential to keep out insects, rats, and other animals.

Prunes will "sugar" and even mold if not completely dried before storage and if stored in a poorly ventilated place.

Grapes (Raisins)

Most raisin grapes produced in California are dried by the natural method, in the vineyard. This includes nearly all the Muscats, and most of the Thompson Seedless (Sultanina) and Sultana varieties. From 5 to 15 per cent of the Thompson Seedless are brought into the drying shed and given some kind of pretreatment. Many of these are dipped, sulfured, and dehydrated to produce the so-called "golden-bleached" raisins. The rest are dipped and then dried in the sun by either of two processes to produce "soda-dipped" or "sulfur-bleached" raisins.

Oil-dipped raisins, such as the "Greek process" or the "mix dip" of Australia, are not produced commercially in California.

The processes for producing natural, soda-dipped, and sulfur-bleached raisins are explained here.

Natural Raisins

Picking.³ Before picking begins, smooth the soil between the rows of vines if paper trays are to be used. If wood trays are to be used, use a plow or drag to throw up a ridge of soil on the south side of each or every other east-and-west row.

³ How to increase labor output in picking raisins by the use of a new tray carrier is told in an article in California Agriculture for June, 1949, available from the College of Agriculture.

Cut large clusters. Spread the fruit one bunch deep on the trays as it is cut from the vines. Rest the north end of the tray on the ridge to tilt it to the south. Ends may be reversed after 4 days.

Drying. Turn the fruit upside down after the top layer of berries has browned and shriveled, usually a week or 10 days after spreading.

When wood trays are used the fruit is turned by covering the full tray with an empty one and flipping the trays over. When all traces of green have disappeared and the grapes are about two-thirds dry, the trays are stacked.

When paper trays are used the grapes are turned by rolling onto another tray, or they are not turned at all. When the fruit is dry enough for stacking, the edges are turned in and the trays are then formed into biscuit rolls. (The practice of rolling paper trays in the manner of a cigarette should be discontinued because of the much greater possibility of insect infestation.)

After trays are stacked or rolled the raisins remain in the vineyard for curing until they are ready for boxing. The time may range from 10 days to over 2 weeks. When the raisins are so dry that juice cannot be squeezed out between the fingers, they are ready to be placed in sweat boxes.

It is desirable to pass the raisins from the trays over a shaker, or over a hand screen at time of boxing. This treatment eliminates a high percentage of sand and debris which may be present.

Soda-Dipped Raisins

In this process the grapes are dipped much like prunes. The dip usually contains 1 pound of lye (caustic soda) to 20 gallons of water. Some growers prefer the weaker sal soda (sodium carbonate), or the still weaker baking soda (sodium bicarbonate) solutions in order to avoid the danger of overdipping. A very small quantity of olive oil may be added to the dip.

When the lye solution is used and kept at or near the boiling point, immersion for 5 seconds or less will check the skin. This facilitates drying. The degree of checking varies greatly with the maturity and general condition of the fruit. For uniform checking the grapes must be of uniform maturity. Underripe fruit checks much more readily than the fully ripe.

Rinse grapes in fresh water. Spread on trays in the sun, turn after 3 or 4 days, and stack in about a week.

The finished raisins are somewhat translucent and of a distinctly reddish-brown color.

Sulfur-Bleached Raisins

The first step in this process is to dip the grapes in the same manner as used for the soda-dipped raisins. Spread on wooden trays. Sulfur the fruit for 2 to 4 hours. Use mature fruit but not grapes that have started to become raisin colored, as the latter will make a dark product.

Spread the trays in the sun, turn them in 3 hours to a day, depending on the weather. Stack the trays. Overexposure in the sun will produce an undesirable pink-brown or amber color.

Continue the drying in stacks. The fruit near the ends of the trays should be pushed toward the center to protect it from the sun and avoid discoloration. After about 10 days turn the fruit by covering the full tray with an empty one and flipping them over. Several weeks in the stacks are required. The raisins are then transferred to sweat boxes.

The finished product should be of a yellowish-white waxy color.

Currants

Currants (Black Corinth raisins) are dried without any preliminary treatment in a manner similar to that used for natural raisins. When the weather is hot, currants are dried on stacked trays without any direct exposure to the sun.

Figs

Sun-drying of figs has been a common practice for centuries in the Old World. In California it is the method most commonly used for the production of the dried fruit.

The Adriatic is the principal drying fig in California; the Calimyrna produces a dried fruit of high quality; the Kadota is mainly grown for canning, but a large quantity is dried; the Mission is an excellent dried fruit, but its black color is not generally acceptable.

Harvesting. The best dried figs are allowed to become partially dried on the tree. They drop naturally or with only a light shaking. They should be gathered frequently (about once a week) from the ground to help forestall insect infestation.

Figs are taken to the fumigation chambers directly from the orchard. They are fumigated with methyl bromide or other effective fumigant overnight in the picking boxes to kill insects and insect eggs.

The common practice today is to produce naturally dried figs without the use of dipping or sulfuring. Adriatic figs are sometimes dipped in water and sulfured for a period of about 4 hours; Kadota figs may be sulfured to remove the green color if picked before the green color disappears. Calimyrna and Mission varieties are not sulfured.

Drying. The length of time required for drying in the sun depends on the weather and dryness of the fruit when harvested. If three-quarters dry when picked up it may be necessary only to place the fruit in shallow boxes and expose to the sun for a few days. Fruit that requires more drying is spread on trays and exposed to the sun until dry.

Sorting. *This is a most important and necessary step.* Federal laws and industry agreements impose a tolerance for bad fruit which may be delivered without

penalty by the grower to the packer. For this reason it is necessary for each grower to sort his fruit.

In small drying plants the sorting may be done direct from the dry-yard trays. In larger plants it is more economical to use continuous sorting belts. In both cases the sorting is done by hand by persons trained in this work.

Because of the peculiar structure of the fig, many of the spoilage organisms attack the inside and cannot be detected unless the fig is opened. A certain amount of such spoilage is bound to be present in each lot of figs; therefore, in order to keep within the tolerance, it behooves the grower to cull out all fruit which is obviously bad during the sorting operation.

When properly dried the interior of the fig should be of the consistency of stiff jelly, free from juice, and the skin should be flexible.

Cherries

All light-colored varieties, including the Napoleon (Royal Ann) should be sulfured for about 1 to 2 hours if a light color is desired. A light lye-dipping is also advisable before sulfuring.

Black varieties may also be lye-dipped and lightly sulfured, although a better product is made by drying these varieties without sulfuring and dipping.

Persimmons

In this country there has been little commercial demand for dried persimmons such as exists in China and Japan. There is considerable demand for information on the drying of this fruit for home use. The Fuyu, Suyakaki, and Kuro Kuma varieties give somewhat better products than the Hachiya when dried.

Dried persimmons have an unusual taste, and can hardly be classed with such dried fruits as prunes and apricots. Immature persimmons are normally very

astringent, and for this reason are allowed to become soft ripe before eating.

The oriental method of drying is to harvest the fruit with "T" stems attached, peel the fruit, then suspend each whole fruit on a string in the air for drying.

The fruit may be peeled, then halved or quartered with stainless steel knives. Trimming losses will amount to about 30 per cent of the weight of the fruit. The pieces are spread on wood trays one layer deep, and dried without sulfuring, since sulfuring causes astringency.

The dried product is light brown to

medium brown in color. The texture is fairly tender but unlike other dried fruits. The flavor is mild and pleasant, but rather flat when compared with dried apricots.

A sugar formation on the outside of the dried fruit is frequently desired, since it gives a glacé appearance and much sweeter taste. After 6 months in storage the product becomes naturally coated with dextrose sugar crystals. Slow drying of the whole fruit in a humid climate tends to favor sugaring. Or the fruit may be rolled in dextrose (corn sugar) crystals prior to drying.

CARE OF *Dried Fruit* IN STORAGE

It is not expected that dried fruit will be stored for a very long period on the farm. Ordinarily dried fruit is soon delivered to a packinghouse where it is packed in suitable containers for marketing.

If for any reason it is necessary to keep dried fruit in storage, utmost care must be taken to provide a clean and cool storage place, and facilities for fumigating when necessary.

Location. The storage space should be cool, dry, well lighted and ventilated.

Screening, or any other precautions which may be necessary, must be taken to keep out insects, rodents, poultry, and other animals.

Any remnants of dried fruit from last year's crop should be removed from the building and the sweepings burned. Such refuse is an ideal breeding place for insects.

Grain and other cereals should not be stored near the fruit, since they usually harbor insects.

Fumigation

Keep a close watch on the fruit in storage, and fumigate at the first sign of insect infestation.

The fumigation chamber may be an especially constructed airtight compartment, or it may be the sulfur house which has been tightened somewhat for this use, or it may be a rubberized or gas-tight tarpaulin thrown over a stack of filled trays or boxes. The size of the individual farm operation will largely determine what kind of fumigation plant is needed.

The one requisite in a fumigation chamber is that it be gastight, not merely lightproof.

If a fumigation chamber is to be built, plywood construction or sheet steel is good, but all joints must be filled and sealed with asphalt mastic. The most difficult place to seal is the door. The door jamb must be designed to permit the use of weatherstripping.

The sulfuring houses may be adaptable to this purpose when the cracks around the door and the ventilation openings are tightly closed. The tarpaulin of rubberized material will serve for an occasional use of fumigant. It should be made to fit closely to the floor or ground by the use of sandbags as weights.

Fumigants. There are available a number of fumigants, including chloropicrin and methyl bromide. The use of cyanide

gas is not advisable because of the possibility of toxic residues.

When using fumigants on the farm the grower should receive full instructions and warning signs from the dealer.

The recommended quantities of fumigants to use, per 1,000 cubic feet of space,

are: chloropicrin, 2 pounds; methyl bromide, 1 pound. These quantities apply whether the compartment be nearly empty or full of the products to be fumigated.

Periods of exposure vary with the different fumigants, and with the temperature. Carefully detailed instructions should be obtained from the distributors.

**ONLY FRUIT THAT IS
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