



University of California
Cooperative Extension

Cottage Food Operator's Handbook

Dried Fruits, Vegetables, and Herbs

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Introduction

Drying is one of the oldest methods of food preservation. Drying foods can be an alternative to canning or freezing, or compliment these methods. Drying food is a simple, safe and an easy method of food preservation to learn. Dried foods cost little to store and use less storage space. According to the California Cottage Food Law, acceptable dried foods include dried pasta, dried fruits and vegetables which includes fruit and vegetable leathers, dried vegetarian-based soup mix, vegetable and potato chips, granola, trail mixes, herbs blends and dried mole paste.

Methods of Drying Foods

There are several methods of drying; each has advantages and disadvantages:

Dehydrator

Sun

Solar

Oven

NOTE: Sun and solar drying are not permissible for cottage foods; the food drying must be done in the cottage food operator's home kitchen.

1. Dehydrator drying

Electric food dehydrators are for drying foods indoors. Dehydrators are efficiently designed to dry foods quickly at 140°. There are two basic designs for dehydrators. One has horizontal air flow while the other has vertical air flow. The horizontal air flow units have their heating element and fan located on the side of the unit. The advantages of the horizontal flow unit are: it reduces the flavor mixture so that several different foods can be dried at the same time; the trays receive equal heat penetration; fewer trays can be used to accommodate thicker pieces of food like pears or tomatoes and juices; and liquids do not drip down into the heating element. The vertical unit has the heating element and fan located at the top or bottom of the unit. If different foods are dehydrated at the same time, the flavors can mix and the juice or liquids can drip into the heating element. However, the vertical dryer can have many trays added it thus allowing more food to be dried at one time. Tray liners can be used to prevent juice spillage onto the heating element.

Dehydrator Features to look for:

Double wall construction of metal or high grade plastic. Wood is not recommended because it is a fire hazard and is difficult to clean.

Enclosed heating element.

Counter top design

An enclosed thermostat with a range from 85°F to 160°F

Fan for moving air

Four to ten open mesh trays made of sturdy lightweight plastic for easy washing.

Underwriters Laboratory (UL) seal of approval.

A one-year guarantee.

Convenient service.

A dial for regulating temperature.

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A timer. Often the completed drying time may occur during the night and a timer could turn the dehydrator off and prevent scorching.

2. Solar drying

Solar drying uses the sun as the heat source. The foil surface inside the dehydrator helps to increase the temperature. Ventilation speeds up the drying time and reduces the risk of food spoilage or mold growth. Solar dryer must be in a home kitchen. **This method is not allowed for Cottage Food products at this time.**

3. Oven drying

First, check oven to see if it can register as low as 140°F. If your oven will not go this low, then your food will cook instead of drying. Use a thermometer to check the temperature at the “warm setting”.

The oven will need air circulation, leave the oven door propped open 2 to six inches. Circulation can be improved by placing a fan outside the oven near the door. **CAUTION:** This is not safe when small children are in the home! Because of the door being opened, the temperature will vary. Place the thermometer near the food for a more accurate reading. Adjust the temperature to achieve the required 140°F. Remember you are dehydrating the food; a higher temperature will cook the food.

Cooling racks placed on the top of cookie sheets work well for some foods. The oven racks, holding the trays will need to be two to three inches apart for circulation.

Drying Fruits

Choose ripened produce without any obvious bruising or spoilage. Wash thoroughly in running water, but **DO NOT SOAK** the produce. Fruits can be cut in half or sliced to uniform thickness; smaller fruits can be left whole. Fruit can be peeled and sliced into thin uniform pieces; this allows pieces to dry more quickly. The peel can be left on fruit; however, it will take longer to dry. Fruits dried whole take the longest amount of time to dehydrate.

Crazing or Checked: Nature provides some fruits with a natural protective wax coating, such as prunes, figs, plums, cranberries, blueberries, grapes, etc. It is necessary to pretreat these fruits by dipping them in boiling water for a period of time stated in Table 1. This process crazes or checks the wax coating on the skin and allows the moisture to escape, thus speeding the drying time of the fruits.

Pretreating the Fruit: Many light-colored fruits, such as apples, darken rapidly when cut and exposed to air. Pretreating helps to prevent the fruit from darkening and prevents nutrient loss. If these fruits are not pretreated in some manner they will continue to darken after they have been dried. Sulfuring or using sulfite dips are the best treatments for long-term storage of dried fruit.

CAUTION: Pretreatment with sulfur or sulfites to pretreat foods has been found to cause asthmatic reactions in a small portion of those suffering from asthma. Therefore, some people

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may use an alternative shorter-term pretreatment method. If dried foods are eaten within a short time, there may be little difference in the use of long and short term pretreatments. If you use sulfites to pretreat your fruit, you must include the following language on your product label: Contains added sulfites.

Sulfuring: Sublimed sulfur is ignited and burned in an enclosed box with the fruit. The sulfur fumes penetrate the fruit acting as a pretreatment by retarding spoilage and darkening of the fruit. There must be adequate air circulation; therefore, fruits being sulfured must be dried out-of-doors. Since Cottage Foods must be processed in a home kitchen, dried fruits cannot be treated with burning sulfur.

Sulfite Dip: Sulfite dips are a quicker and easier method of achieving the same long lasting effects of sulfuring. Either sodium bisulfite, sodium sulfite or sodium meta-bisulfite that are USP (food grade) or Reagent grade (pure) can be used. For suppliers check with your local drugstores or hobby shops, where wine-making supplies are sold. However, these chemicals should also be used with caution around those allergic to sulfur. Be sure to label the products as directed to prevent allergic reactions.

Directions for Use: Dissolve $\frac{3}{4}$ to 1 $\frac{1}{2}$ teaspoons sodium bisulfite per quart of water. (If using sodium sulfite, use $1\frac{1}{2}$ to 3 teaspoons. If using sodium meta-bisulfite, use 1 to 2 tablespoons.) Place the prepared fruit in the mixture and soak 5 minutes for slices, 15 minutes for halves. Remove fruit, rinse lightly under cold water and place on drying trays. Sulfated foods can be dried indoors or outdoors. (This solution can be used only once. Make a new one for the next batch.)

Ascorbic Acid: Ascorbic acid (vitamin C) mixed with water is an alternative method to prevent fruit browning. The protections do not last as long as sulfuring or sulfating. Ascorbic acid in powdered or tablet form is available at a drugstore or grocery store. One teaspoon of powdered ascorbic acid is equal to 3000 mg. of ascorbic acid in tablet form. (If you buy 500 mg tablets, this would be six tablets.)

Directions for Use: Mix 1 $\frac{1}{2}$ tablespoons of ascorbic acid mixture with one quart of water. Place the fruit in the mixture and soak 3 to 5 minutes. Drain the fruit well and place on dryer trays. After this solution is used twice, add more ascorbic acid mixture.

Fruit Juice Dip: Fruit juices high in vitamin C can also be used to pretreat fruit, though it is not as effective as pure ascorbic acid. Juices high in vitamin C include orange, lemon, pineapple, grape and cranberry. Be aware that each juice adds both its color and flavor to the fruit to be dried. Directions for Use: Place enough juice to cover fruit in a bowl. Add cut fruit. Soak 2 to 5 minutes, remove fruit, drain well and place on dryer trays. This solution may be used twice, before being replaced (The used juice can be consumed.)

Honey Dip: Many store-bought dried fruits are dipped in a honey solution. A similar dip can be made at home. Keep in mind that honey dipped fruits are higher in calories. Directions for Use: Mix $\frac{1}{2}$ cup sugar with $1\frac{1}{2}$ cups boiling water. Cool to lukewarm and add $\frac{1}{2}$ cup honey. Place fruit in dip and soak 3 to 5 minutes. Remove, drain well and place on dryer trays.

Syrup Blanching: Blanching fruit in syrup helps fruits such as apples, apricots, figs, nectarines, peaches, pears, plums and prunes retain color fairly well during drying and storage. The results

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are similar to candied fruits. **Directions for use:** Combine 1 cup sugar, 1 cup light corn syrup and 2 cups water in a saucepot. Bring to a boil. Add 1 pound of prepared fruit and simmer 10 minutes. Remove from heat and let fruit stand in hot syrup for 30 minutes. Lift fruit out of syrup; rinse lightly in cold water, drain on paper toweling and place on dryer trays.

Steam Blanching: Steam blanching helps retain color and slow oxidation. However, both the flavor and texture of the fruit is changed. **Directions for use:** Place several inches of water in a large saucepot with a tight fitting lid. Bring water to a boil. Place fruit not more than 2 inches deep, in a steamer pan or wire basket over boiling water. Cover tightly with lid and begin timing immediately. See “Drying Fruits at Home” chart times. Check for even blanching half way through the blanching times. Some fruit may need to be stirred. When done, remove excess moisture using paper towels and place on dryer trays.

Drying the Prepared Fruit: After selecting your preferred drying method, be sure to place the fruit in a single layer on the drying trays. Since fruits contain sugar and are sticky, spray the drying trays lightly with a cooking spray before placing fruit on trays—to assist with cleaning the trays afterwards. Do not allow pieces to touch or overlap. Follow the directions for your preferred drying method and dry until the food tests dry. See Table 1 for approximate drying times. Foods dry much faster toward the end of the drying period, so watch closely.

The optimum temperature for drying most food is 140° F or slightly lower. Some recommendations will state 125°F for fruit. 140°F should always be used when drying vegetables. If higher temperatures are used, the food will cook instead of drying. When the food cooks on the outside and the moisture cannot escape, “case hardening” can occur. The food will eventually mold. Thus, the drying process should never be hurried by raising the drying temperature. After fruit has dried for one to two hours, turn each piece gently. Turn again as needed. Foods shrink as they dry; so trays can be consolidated as they dry.

Determining Dryness of Fruits: Most dried fruits are eaten without rehydrating them; they should not be dehydrated to the point of brittleness. Most fruits should have 20 percent moisture content when dried. To test for dryness, cut several pieces in half. There should be no visible moisture and you should not be able to squeeze any moisture from the fruit. While some fruits may remain pliable *they should not be sticky or tacky. A piece of fruit folded in half should not stick to itself. Dried berries should rattle when shaken.*

After drying, fruit should be cooled for 30 to 60 minutes before packaging. If fruit is not cooled the warm food can lead to sweating or moisture buildup. However, leaving the fruit for a longer period of time could allow moisture back into the fruit.

Fruit Leather: Fruit leathers are homemade fruit rolls. They are a chewy, dried fruit product. They are made by pouring pureed fruit onto a flat surface for drying. After drying, the fruit is pulled from the surface and rolled. A mixture of fruits and/or vegetables can be used in combination too. Check the Cottage Food Law list of acceptable foods for what can be added to such combinations and label as directed.

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Drying Vegetables

Vegetables can also be preserved by drying. Select vegetables at peak flavor and eating quality. This usually is just as they reach maturity. Sweet corn and green peas, however, should be slightly immature so they retain their sweet flavor before their sugars change to starch. Vegetables are dried to the brittle stage as they contain less acid than fruits. At this stage, only 10% moisture remains and no microorganism can grow. Fresh-to-dried ratios are displayed in Table 2 for a variety of produce.

Begin preparing vegetables by washing vegetables in cool water to remove soil and chemical residues. Peel, trim, core, cut, slice or shred, keeping pieces about the same size or thickness. Keeping pieces uniform in size so they will dry at the same rate. Prepare only as many as can be dried at the one time.

Pretreat Vegetables by blanching. Check the drying pamphlet in the appendix for which ones do require blanching and which ones do not. Blanching is the process of heating vegetables to a temperature high enough to destroy enzymes present in tissue. Blanching stops the enzyme action which could cause both the loss of color and flavor during drying and storage. Blanching shortens both the drying and rehydration time by relaxing the tissue walls allowing moisture to escape and later allowing the moisture to re-enter more rapidly. Vegetables can either be water blanched or steam blanched. There is a greater loss of nutrients when using the water blanching method, but it takes less time than steam blanching.

Water Blanching: Fill a large pot $\frac{2}{3}$ full of water, cover and bring the water to a rolling boil. Place the vegetables in a wire basket or colander and submerge into water. Cover and blanch according to directions. Begin timing when water returns to a boil. If this process takes longer than one minute, there are too many vegetables. Reduce the amount in the next batch.

Steam Blanching: Use a deep pot with a tight fitting lid and a wire basket, colander or sieve placed so the steam circulates freely around the vegetables. Add water to pot and bring to a rolling boil. Place vegetables loosely in basket no more than 2 inches deep. Place basket in pot being sure the vegetables do not come in contact with the water. Cover and steam according to directions.

Cool and Dry the prepared vegetables after blanching by spread out the vegetables on a clean towel to dry. When still warm, place on the drying trays arranging vegetables in a single layer. The remaining heat left in the vegetables will cause the drying process to begin more quickly. Watch the vegetables closely at the end of the drying process. They dry more quickly and could scorch. Some vegetables will need other steps after blanching such as green beans which should be briefly frozen before drying. See the drying pamphlet in the appendix.

Vegetables need to dry to brittle or “crisp”. At this stage they should only have 10 percent moisture.

Drying Herbs

Drying is the easiest method of preserving herbs. Expose leaves, flowers or seed to warm, dry air. Leave herbs in a well-ventilated area until the moisture evaporates. Sun drying is not recommended as the herbs can lose flavor and color. Harvest most herbs for drying just before the flowers first open. Gather herbs in the early morning after the dew has evaporated to

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minimize wilting. Do not leave in the sun or unattended after harvest. Rinse herbs in cool water and gently pat dry to remove excess moisture.

Preheat dehydrator with a thermostat set to 95° to 115° F. In areas with higher humidity (60% or more) temperatures as high as 125° may be needed. After rinsing and removing excess moisture, place the herbs in a single layer on dehydrator trays. Drying times can be between 1 to 4 hours (check your dehydrator instruction booklet for specific details). Check periodically. Herbs are dry when they crumble, and stems break when bent.

Microwave – Microwave ovens are a fast way to dry herbs when only a small quantity is being dried. Follow the directions that come with your microwave oven. When the leaves are crispy dry and crumple easily between the fingers, they are ready to be packaged and stored.

Note: Dried herbs are usually 3 to 4 times stronger than the fresh herbs. To substitute dried herbs in a recipe that calls for fresh herbs, use ¼ to 1/3 of the amount listed in the recipe.

Conditioning, Storage and Packaging

Conditioning: All dried foods should be conditioned before packing because different pieces of food dry differently. Too much moisture left in a few pieces can cause the whole batch to mold.

Pack the food loosely in plastic or glass jars. Seal the containers and let them stand for 7 to 10 days. The excess moisture in some pieces will be absorbed by the drier pieces. Shake the containers daily to separate the pieces and check the moisture condensation. If condensation develops in the container, return the food to the dehydrator for more drying.

Packaging and Storing: Dried foods are susceptible to insect contamination, moisture reabsorption and must be stored immediately. The food must first be cooled completely as warm food causes sweating. The sweating could provide enough moisture for mold to grow. Food needs to be packed in clean, dry insect proof containers and packed as tightly as possible without crushing.

Dried foods should be stored in clean, dry home canning jars, plastic freezer containers with tight fitting lids or in plastic freezer bags. Vacuum seal packaging is also a good option. Pack the selected container with enough food that can be used all at once. Each time the container is reopened, the food is exposed to air and moisture that can lower the quality of the food and result in spoilage. Fruits that have been sulfured should not touch metal. Fruit should be stored in a plastic bag before storing in a metal can. Sulfur fumes will react with the metal and cause color changes in the fruit.

Packaged foods should be stored in a cool, dry, dark place. Recommended food storage times for dried foods range from 4 months to 1 year. Food quality is affected by heat. The storage temperature helps determine the length of storage; the higher the temperature, the shorter the storage time. Most dried fruits can be stored for 1 year at 60°F, 6 months at 80°F. Vegetables have about half the shelf life of fruits.

Storage Treatments: Foods could have been exposed to insect infestation or larvae prior to handling or during the drying process. Two pasteurization methods may be used to kill the insects and eggs:

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Freezer Method – After food has been conditioned, pack in airtight containers, removing as much air as possible. Place in a freezer at 0°F for at least 48 hours.

Oven Method – After food has been conditioned, place food in a single layer on a tray or in a shallow pan. Place in an oven preheated to 160°F for 30 minutes.

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Drying and Storage Questions and Answers

Q: I found some wild mushrooms in my back yard, may I dry them?

A: No, mushroom found in the wild are not from approved source. Only fruits, vegetables and herbs from an approved source can be dried by a Cottage Food Operation.

Q: I dehydrated apple slices and they molded. Is there anything I can do to save them?

A: No, they need to be discarded. The next time you dry fruit, be sure to “Condition” the fruit. This can be accomplished by packing food loosely in plastic or jars. Seal the containers and let them stand for 7 to 10 days. The excess moisture in some pieces will be absorbed by the drier pieces. Shake the containers daily to separate the pieces and check for moisture condensation. If condensation develops in the container, return the food to the dehydrator for more drying.

Q: I dehydrated apricots; they are real hard on the outside but did not dry on the inside. What did I do wrong?

A: The apricots were dried at a temperature above 140° F. As a result the apricots cooked rather than dehydrating. When the food cooks on the outside and the moisture cannot escape, “case hardening” can occur.

Q: How can I tell when fruits are sufficiently dry?

A: Fruit: When they are pliable and leather like having no pockets of moisture.

Q: How can I tell when vegetables are sufficiently dry?

A: Vegetables: When they are crisp and brittle. They need to be much dryer than fruits. See table for approximate times below:

Resources

Preserving Food: Drying Fruits and Vegetables: University of GA, 2000 *Food Storage Information*, Food Marketing Institute Consumer Information, www.fmi.org/consumer/foodkeeper/brochure.cfm

How to Use Dried Foods by Barbara J. Willenberg, Department of Food Science and Human Nutrition University of Missouri-Columbia. Reprinted 6/03

Drying Fruits and Vegetables, 3rd Edition, A Pacific Northwest Extension Publication # PNW 397, Revised 2009.

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Steps for Drying Vegetables				
Vegetable	Preparation	Blanching Time* (mins.)	Drying Time (hrs.)	Dryness test
Asparagus	Wash thoroughly. Halve large tips.	4-5	6-10	Leathery to brittle
Beans, green	Wash. Cut in pieces or strips.	4	8-14	Very dry, brittle
Beets	Cook as usual. Cool, peel. Cut into shoestring strips 1/8" thick.	None	10-12	Brittle, dark red
Broccoli	Wash. Trim, cut as for serving. Quarter stalks lengthwise.	4	12-15	Crisp, brittle
Brussels sprouts	Wash. Cut in half lengthwise through stem.	5-6	12-18	Tough to brittle
Cabbage	Wash. Remove outer leaves, quarter and core. Cut into strips 1/8" thick.	4	10-12	Crisp, brittle
Carrots, parsnips	Use only crisp, tender vegetables. Wash. Cut off roots and tops; peel. Cut in slices or strips 1/8" thick.	4	6-10	Tough to brittle
Cauliflower	Wash. Trim, cut into small pieces.	4-5	12-15	Tough to brittle
Celery	Trim stalks. Wash stalks and leaves thoroughly. Slice stalks.	4	10-16	Very brittle
Chili peppers, green	Wash. To loosen skins, cut slit in skin, then rotate over flame 6-8 minutes or scald in boiling water. Peel and split pods. Remove seeds and stem. (Wear gloves if necessary.)	None	12-24	Crisp, brittle, medium green
Chili peppers, red	Wash thoroughly. Slice or leave whole if small.	4	12-24	Shrunken, dark red pods, flexible
Corn, cut	Husk, trim. Wash well. Blanch until milk in corn is set. Cut kernels from the cob.	4-6	6-10	Crisp, brittle
Eggplant	Wash, trim, cut into 1/4" slices.	4	12-14	Leathery to brittle
Horseradish	Wash, remove small rootlets and stubs. Peel or scrape roots. Grate.	None	6-10	Brittle, powdery
Mushrooms**	Scrub. Discard tough, woody stalks. Slice tender stalks 1/4" thick. Peel large mushrooms, slice. Leave small mushrooms whole. Dip in solution of 1 tsp. citric acid/quart water for 10 minutes. Drain.	None	8-12	Dry and leathery

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Steps for Drying Vegetables Continued...

Vegetable	Preparation	Blanching Time* (mins.)	Drying Time (hrs.)	Dryness test
Okra	Wash thoroughly. Cut into 1/2" pieces or split lengthwise.	4	8-10	Tough, brittle
Onions	Wash, remove outer paper skin. Remove tops and root ends, slice 1/8 to 1/4" thick.	4	6-10	Very brittle
Parsley; other herbs	Wash thoroughly. Separate clusters. Discard long or tough stems.	4	4-6	Flaky
Peas	Shell and wash.	4	8-10	Hard, wrinkled, green
Peppers; pimentos	Wash, stem. Remove core and seeds. Cut into 1/4 to 1/2" strips or rings.	4	8-12	Tough to brittle
Potatoes	Wash, peel. Cut into 1/4" shoestring strips or 1/8" thick slices.	7	6-10	Brittle
Spinach; greens like Kale, Chard, mustard	Trim and wash very thoroughly. Shake or pat dry to remove excess moisture.	4	6-10	Crisp
Squash, summer or banana	Wash, trim, cut into 1/4" slices.	4	10-16	Leathery to brittle
Squash, winter	Wash rind. Cut into pieces. Remove seeds and cavity pulp. Cut into 1" wide strips. Peel rind. Cut strips crosswise into pieces about 1/8" thick.	4	10-16	Tough to brittle
Tomatoes	Steam or dip in boiling water to loosen skins. Chill in cold water. Peel. Slice 1/2" thick or cut in 3/4" sections. Dip in solution of 1 tsp. citric acid/quart water for 10 minutes.	None	6-24	Crisp

* Blanching times are for 3,000 to 5,000 feet. Times will be slightly shorter for lower altitudes and slightly longer for higher altitudes or for large quantities of vegetables.

** **WARNING:** The toxins of poisonous varieties of mushrooms are **not** destroyed by drying or by cooking. Only an expert can differentiate between poisonous and edible varieties.

Source: Kendall, P. P. DiPersio and J. Sofos. *Drying Vegetables*. Colorado State University Extension

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Yield of Dried Vegetables			
	Amount purchased or picked	Amount dried product	
Produce	Pounds	Pounds	Pints
Beans, lima	7	1 1/4	2
Beans, snap	6	1/2	2 1/2
Beets	15	1 1/2	3 to 5
Broccoli	12	1 3/8	3 to 5
Carrots	15	1 1/4	2 to 4
Celery	12	3/4	3 1/2 to 4
Corn	18	2 1/2	4 to 4 1/2
Greens	3	1/4	5 1/2
Onions	12	1 1/2	4 1/2
Peas	8	3/4	1
Pumpkin	11	3/4	3 1/2
Squash	10	3/4	5
Tomatoes	14	1/2	2 1/2 to 3

Source: *Drying Foods at Home*, Marjorie M. Philips, Extension Service. University of Arkansas, Little Rock, Arkansas