



# Drying Food

University of Illinois at Urbana-Champaign

College of Agriculture

Cooperative Extension Service

Circular 1227



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Drying is the oldest method of preserving food. The early American settlers dried foods such as corn, apple slices, currants, grapes, and meat. Compared with other methods, drying is quite simple. In fact, you may already have most of the equipment on hand. Dried foods keep well because the moisture content is so low that spoilage organisms cannot grow.

Drying will never replace canning and freezing because these methods do a better job of retaining the taste, appearance, and nutritive value of fresh food. But drying is an excellent way to preserve foods that can add variety to meals and provide delicious, nutritious snacks. One of the biggest advantages of dried foods is that they take much less storage space than canned or frozen foods.

Recommended methods for canning and freezing have been determined by research and widespread experience. Home drying, however, does not have firmly established procedures. Food can be dried several ways, for example, by the sun if the air is hot and dry enough, or in an oven or dryer if the climate is humid.

With the renewed interest in gardening and natural foods and because of the high cost of commercially dried products, drying foods at home is becoming popular again. Drying is not difficult, but it does take time and a lot of attention. Although there are different drying methods, the guidelines remain the same.

Although solar drying is a popular and very inexpensive method, Illinois does not have a suitable climate for it. Dependable solar dehydration of foods requires 3 to 5 consecutive days when the temperature is 95 degrees F. and the humidity is very low. The average relative humidity in central Illinois on days with 95 degrees F. temperatures is usually 86 percent. Solar drying is thus not feasible.

Drying food in the oven of a kitchen range, on the other hand, can be very expensive. In an electric oven, drying food has been found to be nine to twelve times as costly as canning it. Food dehydrators are less expensive to operate but are only useful for a few months of the year. A convection oven can be the most economical investment if the proper model is chosen. A convection oven that has a controllable temperature starting at 120 degrees F. and a continuous operation feature rather than a timer-controlled one will function quite well as a dehydrator during the gardening months. For the rest of the year it can be used as a tabletop oven.

## GUIDELINES

### Speed

For a good-quality product, vegetables and fruits must be prepared for drying as soon as possible after harvesting. They should be blanched, cooled, and laid out to dry without delay. Foods should be dried rapidly, but not so fast that the outside becomes hard before the moisture inside has a chance to evaporate.

Drying must not be interrupted. Once you start drying the food, don't let it cool down in order to start drying again later. Mold and other spoilage organisms can grow on partly dried food.

### Temperature

During the first part of the drying process, the air temperature can be relatively high, that is, 150 degrees to 160 degrees F. (65 degrees to 70 degrees C.), so that moisture can evaporate quickly from the food. Because food loses heat during rapid evaporation, the air temperature can be high without increasing the temperature of the food. But as soon as surface moisture is lost (the outside begins to feel dry) and the rate of evaporation slows down, the food warms up. The air temperature must then be reduced to about 140 degrees F. (60 degrees C.).

Toward the end of the drying process the food can scorch easily, so you must watch it carefully. Each fruit and vegetable has a critical temperature above which a scorched taste develops. The temperature should be high enough to evaporate moisture from the food, but not high enough to cook the food. Carefully follow directions for regulating temperatures.

## **Humidity and Ventilation**

Rapid dehydration is desirable. The higher the temperature and the lower the humidity, the more rapid the rate of dehydration will be. Humid air slows down evaporation. Keep this in mind if you plan to dry food on hot, muggy summer days. If drying takes place too fast, however, "case hardening" will occur. This means that the cells on the outside of the pieces of food give up moisture faster than the cells on the inside. The surface becomes hard, preventing the escape of moisture from the inside.

Moisture in the food escapes by evaporating into the air. Trapped air soon takes on as much moisture as it can hold, and then drying can no longer take place. For this reason, be sure the ventilation around your oven or in your food dryer is adequate.

## **Uniform Drying**

Drying the food evenly takes a little extra effort and attention. Stirring the pieces of food frequently and shifting the racks in the oven or dryer are essential because heat is not the same in all parts of the dryer. For the best results, spread thin layers of uniformly-sized pieces of food on the drying racks.

## **NUTRITIVE VALUE**

Dried fruits are a good source of energy because they contain concentrated fruit sugars. Fruits also contain a rather large amount of vitamins and minerals. The drying process, however, destroys some of the vitamins, especially A and C. Exposing fruit to sulfur before drying helps retain vitamins A and C. Sulfur destroys thiamine, one of the B vitamins, but fruit is not an important source of thiamine anyway. Many dried fruits are rich in riboflavin and iron.

Vegetables are a good source of minerals and the B vitamins thiamine, riboflavin, and niacin. Both fruits and vegetables provide useful amounts of the fiber (bulk) we need. Save the water used for soaking or cooking dried foods because this nutrient-rich water can be used in recipes to make soups, sauces, and gravy.

## **TYPES OF FOOD TO DRY**

Many kinds of fresh fruits, vegetables, herbs, meat, and fish can be dried. If you have never tried drying food before, though, it's a good idea to experiment first by drying a small quantity in the oven. This way you can see if you like the taste and texture of dried food. At the same time, you can become familiar with the drying process.

Fruits are easier to dry than vegetables because moisture evaporates more easily, and not as much moisture must be removed for the product to keep. Ripe apples, berries, cherries, peaches, apricots, and pears are practical to dry.

Vegetables that are also practical to dry include peas, corn, peppers, zucchini, okra, onions, and green beans. Produce from the supermarket is usually more expensive and not as fresh as it should be for drying. It is a waste of time and energy to dry vegetables such as carrots that can be kept for several months in a cool, dry basement or cellar.

Fresh herbs of all types are suitable for drying. The parts of the plant to dry vary, but leaves, seeds, or blossoms usually give the

best results.

Lean meats such as beef, lamb, and venison can be dried for jerky. Fish also is excellent when dried. Certain foods are not suitable for drying because of their high moisture content. Lettuce, melons, and cucumbers are a few foods that do not dry well.

## SUCCESSFUL DRYING

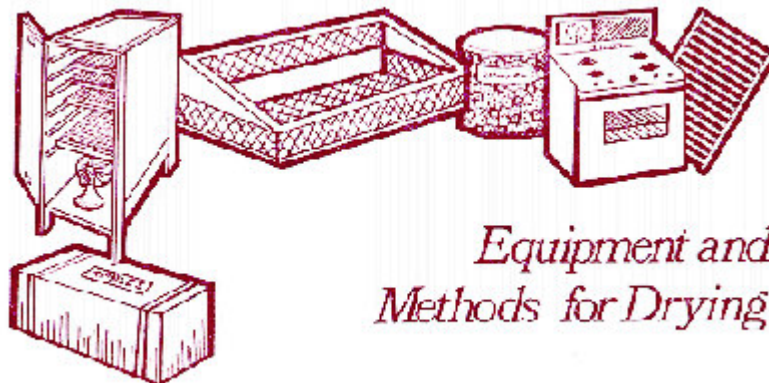
Don't be surprised to find a variety of suggestions for drying methods, temperatures, and lengths of time. The drying process is simply not as precise as canning and freezing because it involves so many different factors. You may need to use a trial-and-error approach to find what suits you best. Whatever method you use, be sure to remove enough moisture from the final product so that spoilage organisms cannot grow.

When you dry foods, remember the following:

- Cleanliness and sanitation are essential.
- The flavor of dried fruits and vegetables will be somewhat different from that of their fresh, canned, or frozen counterparts.



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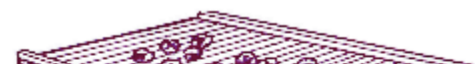
## EQUIPMENT

One of the advantages of drying foods rather than canning or freezing them is that you can get by with almost no special equipment. A kitchen oven, drying trays or racks, and storage containers are the only basic equipment needed. If you want to dry large quantities of food, you may decide to buy or make a food dryer, but it is not essential. For sun drying you need only racks and storage containers.

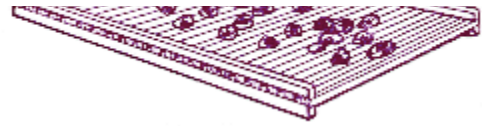
Although the following equipment is not absolutely necessary, it will help you make a more uniformly good product:

- a food scale to weigh food before and after drying
- an electric fan to circulate the air
- a thermometer to check the oven temperature
- a blancher for vegetables
- a sulfur box for fruit

Wood slats or stainless steel screen mesh are the best materials to use for the racks. Cake racks or a wooden frame covered with cheesecloth or other



loosely-woven cloth can also be used for drying racks.



Do not use solid metal trays or cookie sheets to dry food because air must circulate all around the food so that drying can take place from the bottom and the top at the same time. Pieces of meat for jerky can be placed directly on the metal racks in the oven if the pieces are large enough not to fall through the spaces in the racks.

Do not use racks made of galvanized screen, aluminum, copper, fiberglass, or vinyl. Galvanized screen contains zinc and cadmium. These metals cause an acid reaction that forms harmful compounds and darkens the food. Aluminum becomes discolored and causes an off-flavor in sulfured fruit. Copper materials destroy vitamin C. Fiberglass may leave dangerous splinters in the food, and vinyl melts at temperatures used for drying.

## METHODS

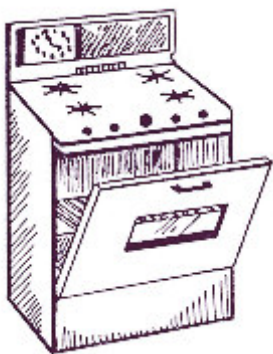
### Oven Drying

Oven drying is the simplest way to dry food because you need almost no special equipment. It is also faster than sun drying or using a food dryer. But oven drying can be used only on a small scale. An ordinary kitchen oven can hold only 4 to 6 pounds of food at one time.

Set the oven on the lowest possible setting and preheat to 140 degrees F. (60 C.). Do not use the broiler unit of an electric oven because the food on the top tray will dry too quickly! Remove the unit if it has no separate control. Some gas ovens have a pilot light, which may keep the oven warm enough to dry the food.

It is important to keep the oven temperature at 140 to 160 F. (60 to 70 C.). So put an oven thermometer on the top tray about half way back where you can see it easily. Check the temperature about every half hour.

Arrange 1 to 2 pounds of prepared food in a single layer on each tray. Put one tray on each oven rack. Allow 1-1/2 inches of space on the sides, front, and back of the trays so that air can circulate all around them in the oven. To stack more trays in the oven, use blocks of wood in the corners of the racks to hold the trays at least 1 inches apart. Dry no more than four trays of food at a time. A lighter load dries faster than a full load.



Keep the oven door open slightly during drying. A rolled newspaper, a block of wood, or a hot pad will keep the door ajar so that moist air can escape while the heat stays in the oven. Four to six inches for electric ovens or 1 to 2 inches for gas ovens is usually enough space for ventilation, but use a thermometer to check the oven temperature to make sure it stays at 140 F. An electric fan placed in front of the oven door helps to keep the air circulating.

Shifting the trays often is important for even drying because the temperature is not the same everywhere in the oven. Rotate the trays from top to bottom and from front to back every half hour. It helps to number the trays so you can keep track of the order in which you rotate them. Stirring fruit or vegetables every half hour or so also helps the food to dry evenly. jerky needs to be turned over occasionally to keep it from sticking to the trays.

### Food Dryer

A commercial or homemade food dryer or convection oven provides automatically controlled heat and ventilation. Most households will not need a dryer unless they dry large quantities of food. A food dryer takes less electricity than drying the same amount of food in an electric oven. However, the temperature is usually lower (about 120 degrees F. or 50 C.), so drying takes a little longer than in an oven.

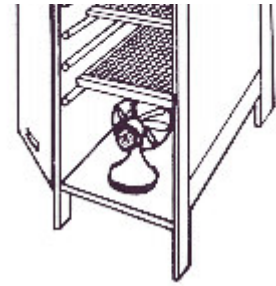
You can buy a dryer at hardware, housewares farm supply, or health food stores. The price of commercial dryers varies greatly depending on the size, type of heating element, and other, special features. Directions for making an inexpensive dryer (see illustration above) are given in several of the publications listed at the end of this circular. An old refrigerator or



icebox can be converted into a food dryer. just be sure the temperature is controlled and the ventilation is adequate.

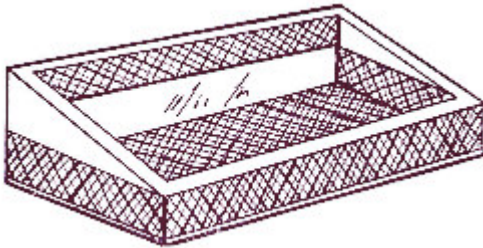
When using a dryer, preheat it to 125 F. (52 C.). Place the food on trays and stack the trays in the dryer. Gradually increase the temperature to 140 F. (60 C.). It takes 4 to 12 hours to dry fruits or vegetables in a dryer.

Do not use space heaters to dry food. These stir up dust and dirt, which contaminate the food. For the same reason, do not try to dry food on a furnace vent or clothes dryer.



## Sun Drying

Sun drying is the old-fashioned way to dry food because it uses the heat from the sun and the natural movement of the air. But bright sun, low humidity, and temperatures around 100 degrees F. are necessary. In Illinois the humidity is usually too high for successful sun drying. This process is slow and requires a good deal of care. The food must be protected from insects and covered at night. Sun drying is not as sanitary as other methods of drying. Don't sun dry food if you live near a busy road or in an area where the air is not clean.



If you decide to sun dry foods, you might want to use a natural-draft dryer (see illustration above). The advantage of this kind of dryer is that it hastens drying by trapping heat from the sun. It also protects the food from insects and birds. Its construction is described in several of the recommended publications.

Place pieces of food on drying trays and then cover them with a layer of cheesecloth or netting to keep off dust and insects. Place the dryer in direct sunlight on a roof or high surface away from animals, traffic exhaust, and dust. After the food is almost dry, put it in an airy, shady place to prevent

scorching during the final stage of drying.

Be sure to bring the dryer indoors at night if the temperature drops more than 20 degrees F. Dew and sudden temperature change put moisture back into the food and lengthen the drying time. Fruits and vegetables take 3 to 7 days to dry in the sun. The length of time depends on the type of food and the atmospheric conditions. Natural heat is slower and less dependable than controlled drying in an oven or food dryer.



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*Drying Fruits*

## SELECTION AND CLEANING

For dried fruit that is naturally sweet and flavorful, be sure to start with good-quality fruit. Select fruit that is fresh, fully ripe, and sound -the same quality you would choose for table use.

Sort and wash the fruit thoroughly. Discard any bruised or overripe pieces. Decay on one piece may give a bad flavor to the whole batch. Sanitation during the handling and drying process is very important.

## PRETREATMENT

Almost all kinds of fruit need some treatment before drying. Apples are peeled, cored, and sliced. Fruits with pits, such as peaches and apricots, are usually halved and pitted. Most fruits do not need to be peeled before drying. But the skins of some fruits such as cherries are tough and waxy, so you will have to "crack" the skins first. Fruit should be cut into uniform pieces or slices so that it will dry more evenly. Remember that thin pieces dry faster than thick ones.

### Cracking Skins

Blueberries, cherries, grapes, plums, and a few other fruits have relatively tough skins with a waxlike coating. The skin must be "cracked" or "checked" in many places to remove the waxy coating and to let the inside moisture come to the surface to evaporate. To crack the skin, put the fruit in-to boiling water for 30 to 60 seconds. Then dip in very cold water. Drain thoroughly on absorbent towelling.



We recommend cracking the skins in water rather than dipping the fruit in lye solutions because handling lye can be dangerous.

### Protecting Light-Colored Fruits

When apples, peaches, pears, apricots, or other light-colored fruits are cut and exposed to the air, the flesh turns brown rapidly. This darkening is caused by a chemical change called oxidation. If oxidation is not stopped, it will injure the texture, flavor, aroma, and appearance of the fruit.



While you are working with light-colored fruits, treat them with an antioxidant to keep them from turning brown. Mix a small amount of ascorbic acid (2 teaspoons for apples and 1 teaspoon for other light-colored fruit) in 1 cup of water. Sprinkle the solution over the cut fruit as you are working. Stir lightly to coat all pieces. This amount is enough for about 5 quarts of fruit. Commercial antioxidants contain ascorbic acid plus other ingredients, but they are more expensive than pure ascorbic acid. You can buy ascorbic acid in most drugstores.

It's not a good idea to soak fruit in salt or vinegar water because this adds water to the fruit and lengthens the drying time. Soaking also dissolves out some of the water-soluble vitamins. The vinegar-salt solutions also tend to dull the color of the fruit.

The ascorbic acid coating is only a temporary treatment. For permanent, antidarkening action the fruit still needs to be specially treated before drying.

### Sulfuring

Sulfuring is the best antioxidant treatment for preserving color. Without a permanent, antioxidant treatment, apples and other fruits with light-colored flesh will turn dark during drying and storage. Sulfur also helps prevent loss of vitamins A and C. Sulfur is not a preservative in itself, but it discourages insects and microbes, which can cause spoilage.

You don't need to worry about sulfur being harmful in the amounts used for treating fruits. Sulfur is a mineral that occurs naturally in foods and is necessary for life. Sulfur forms sulfurous acid when it combines with the water in the fruit, but the acid evaporates during drying. The residue is a harmless compound that the body easily excretes.

To keep fruit from discoloring, you should expose it to sulfur immediately after preparing it. There are two methods of sulfuring, each with its own advantages and disadvantages: using (1) sulfur fumes or (2) a sulfite solution.

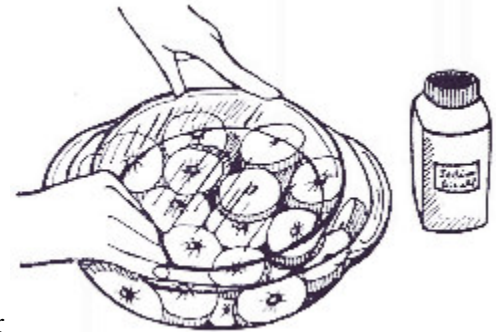
Sulfur fumes are more effective than sulfur solutions, but this method takes more time and equipment. You need a wooden or cardboard box and wooden trays or screens covered with cheesecloth. Several of the recommended references describe methods for making a sulfur box. They also explain how to load and operate the box.

The sulfuring time for each type of fruit is different, so check your references. Fruits sulfured by this method should not be dried indoors because the odor of the fumes is unpleasant. And take care: sulfur fumes are irritating to the eyes and nose.

Soaking fruit in a sulfite solution is easy. The pieces of fruit are, however, less thoroughly sulfured than they are by fumes. Because of the soaking involved, the fruit absorbs some water, so the drying time is lengthened. Fruit that is sulfured by this method may be dried indoors or out.

To make a sulfite solution, add 1 to 2 tablespoons of sodium bisulfite to 1 gallon of water. Mix thoroughly. Soak the prepared fruit in the solution for 5 to 10 minutes. Soak lighter fruit longer. Use a weighted plate to keep the fruit submerged in the solution. Drain the pieces of fruit and then blot them dry on absorbent towelling. Do not rinse the fruit in water. Start the drying procedure immediately.

Sodium bisulfite is usually available at drugstores, winemakers' shops, and some health food stores. If not, check with your local Cooperative Extension Office. Use only pure reagent or food-grade bisulfite. Don't use practical-grade bisulfite because it is not pure enough for sulfuring fruit. Do not use garden-dusting sulfur either.



## Steam Blanching

Steam blanching fruit is an alternative to sulfuring, but it is not as effective. More vitamins are lost and drying takes longer. For these reasons steam blanching is not recommended.

## DRYING

You are now ready to begin drying. Arrange pretreated fruit in a single layer on the drying trays. Then place the trays in the oven or dryer. Be sure to stack the trays at least 1-1/2 inches apart. If you are drying juicy fruits such as apricots, cut them in half and remove the pits. Then set the pieces on the racks with the cut side up. This way the flavorful juices will not drain out and be lost.

If you are drying food in the oven, remember to leave the door open slightly. If you have an electric fan, place it in front of the oven to speed up the drying. A dryer comes equipped with a fan to provide ventilation, so you won't need to leave the door ajar.

The length of time needed for drying will depend on the size and number of pieces dried at one time. Drying fruit can take anywhere from 6 hours for very thin or small pieces such as apple slices or grapes to 10 hours for larger juicy fruits such as peach or apricot halves. Temperature and humidity will also affect the drying time. When the pieces are dry, they should be leathery. Cut a piece of fruit to be sure; there should be no moisture inside the fruit.

## FRUIT LEATHERS

You might want to try making fruit "leathers," which are a tasty variation of dried fruits. They are made by pureeing almost any type of fruit, then spreading the puree on a cookie sheet or similar tray to dry. Cover the cookie sheet with plastic wrap and pour the thick puree onto the sheet. Spread it out to form a layer only 1/4-inch deep. The fruit puree can be sweetened with honey or corn syrup, and spices, nuts, or coconut flakes can be sprinkled on top. Start with very little because the drying process will

concentrate the flavors. Dry the puree until it is leatherlike and pliable but has no sticky spots. Fruit leathers make delicious snacks, treats, or gifts. They can be eaten as is, or they can be reconstituted and used in many dishes. They will keep longest in the refrigerator or freezer.

## USING DRIED FRUIT

Dried fruit may be eaten as is. It is great for children's lunches, after-school snacks, or parties. Dried fruit can also be used in cookie or granola recipes or with breakfast cereal.

To use dried fruit in prepared dishes, reconstitute it first by soaking it in cool water for about 2 hours, or until plump. Or pour boiling water over the fruit, just enough to cover, and simmer about 15 minutes, or until tender. Add more water if necessary. Do not overcook because the fruit will get mushy and lose flavor. After the fruit has been reconstituted, it can be used in any recipe that calls for fresh, canned, or frozen fruit.



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## SELECTING, CLEANING, AND CUTTING

You may be surprised to learn that a great many vegetables can be dried successfully at home. Be sure start with fresh, mature produce. Harvest or buy on the amount you can dry at one time - 4 to 6 pounds you plan to use your oven. Wash all dirt off the vegetables and cut out any bad spots.

Cut the vegetables into pieces of a suitable size. Keep in mind that thin pieces will dry faster than thick one. For example, french-cut green beans take less time dry than cross-cut beans.

## BLANCHING

Almost all vegetables need to be blanched (scalded in boiling water a short time before drying. Blanching stops the enzyme action, which drying cannot stop. If vegetables are not blanched, enzymes will destroy the color and flavor during drying and storage. A few vegetables such as mushrooms, okra, and onions do not need to be blanched before drying.

Blanching also protects certain nutrients and help reduce the drying time somewhat. Some nutrients however, are lost during blanching in boiling water because they dissolve into the water. Steam blanching takes more time, but fewer water-soluble nutrients are lost. To minimize the loss of nutrients, blanch only for the required length of time. But don't underblanch; the enzymes will not be



inactivated, and the quality of the dried vegetables will be inferior.



Blanch the cut pieces of vegetables in a large amount of water. Follow the blanching times for freezing vegetable. Chill in ice water or in cold running water the same length of time recommended for blanching. Drain well and blot the pieces dry on paper towelling to remove excess moisture. Save the water. It will add flavor and valuable nutrients to your soups, stews, and gravies.

## DRYING

Spread the prepared vegetables in thin layers on the drying trays. Then stack the trays in the oven or dryer. Make sure to leave at least 1 inches between the trays so that the air can circulate freely around them. If the trays are too close together, drying will take longer.

If you are using an oven, keep the door open slightly and use an electric fan. A food dryer is equipped with a fan for ventilation, so close the door. Keep the oven temperature at 140 degrees F. (60 C.). Stir the pieces of vegetables about every half hour so that all surfaces are exposed to the air. Also, shift the trays around on the racks periodically because the temperature inside the oven varies somewhat from top to bottom and from front to back.

Vegetables take from 4 to 12 hours to dry. The length of time depends on the kind and amount of food being dried, the method you use (oven or food dryer), and the drying temperature. When sufficiently dry, the vegetables will be hard and brittle. You can test them by hitting a piece with a hammer; the piece should shatter.

## SPECIAL HANDLING OF VEGETABLES

Mature beans, peas, and soybeans may be fully or partly dried on the vine.

Carrots, turnips, parsnips, rutabagas, and potatoes are better stored fresh than dried. They can be kept for several months in a cellar or basement.

Broccoli and asparagus are better frozen than dried because freezing helps preserve their fresh flavor and texture.

Combinations of vegetables can be dried at the same time. just remember that vegetables have different drying times, so some will be dry before others.

Vegetables with a strong odor should not be dried at the same time as other vegetables because those with a mild flavor may absorb the strong odor.

Salad seasoning ingredients should be dried separately, then mixed and stored together for delightful blends. A good mix for salads might include tiny bits of carrots, tomatoes, celery, onion, spinach, green peppers, and parsley.

Soup vegetables should always be dried separately. Then you can combine them in different ways so that you will have a vast variety of gourmet soups at your fingertips. You can blend the flavors to suit your own taste; just let your imagination be your guide. These home-prepared combinations will be much cheaper than those available commercially.

## USING DRIED VEGETABLES

You don't need to soak dried vegetables before cooking them, but soaking will shorten the cooking time. Reconstitute by soaking 1 cup of dried vegetables in 2 cups of water for about 2 hours. Add more water if necessary. Vegetables will return to almost their original size and shape. Reconstituted vegetables are tasty additions to stews, casseroles, and soups. The water you use for soaking and cooking contains valuable nutrients, so use it in sauces and gravies.

Vegetable mixes for seasoning salads should not be soaked. Simply combine the dried vegetables with the other salad

ingredients and add your favorite dressing.



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Folklore often depicts the magical powers of herbs. But good cooks the world over have discovered another kind of power in the subtle flavors and aromas of herbs. If you grow and dry your own herbs, you will always have a fresh, inexpensive supply close at hand for making delicious foods.

Herbs do not add calories or nutritional value to foods, but they do add flavor. So if you want to cut down on calories, you can use herbs and spices to give zest to familiar, low-calorie foods. For someone on a salt-free diet, herbs can enhance the flavor of otherwise tasteless foods. A pinch of rosemary, for example, dropped into the water that potatoes or rice are boiled in will give a delightful taste to these vegetables.

## SELECTION

You can grow and dry a wide variety of herbs. Some that are especially popular are thyme, tarragon, rosemary, mint, sage, sweet basil, bay leaf, parsley, marjoram, savory, oregano, chervil, chives, and dill. The foliage of these plants is attractive, and they give off a soft, pleasant fragrance. If you plant your herb garden near the kitchen, you can enjoy the plants and harvest the leaves easily as they reach the peak of quality. Young, tender leaves are more flavorful and aromatic than older leaves.

## PREPARATION

Cut the stalks when the leaves are mature or the plants have just started to bloom. Use only the tender, leafy tops and flower clusters. Discard the leaves below 6 inches from the top of the stalk. They are not as pungent as the top leaves. Remove any dead or discolored leaves. Rinse with cold water to wash off dust and dirt. Blot off excess moisture with paper towelling. When drying dill, harvest the plant as soon as the seeds are ripe.

## DRYING METHODS

### Air



For air drying, tie six to eight stems together in a small bunch. Then tie a large brown paper bag around the bunch to protect the herbs from the light. Be sure the leaves do not touch the sides; otherwise, they may stick to the bag

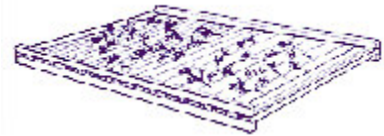


and not dry properly. Make several holes in the bag for ventilation. Hang it in a warm, dry, airy room or attic. Herbs will dry in 1 to 2 weeks.

If you like, you can remove the leaves from the stems before drying. Place the leaves on a tray in a warm, dry, airy place away from direct sunlight. For best results, use a cloth-covered rack or an open mesh screen. Turn or stir the leaves occasionally to assure even drying. Herbs should not be sun dried because light destroys the natural aroma. A poor-quality product will result if the herbs are exposed to direct sunlight.

## Oven

For oven drying, place clean, fresh leaves in a single layer on racks. There should be at least 1 inches around the racks and between them so that the air can circulate freely. You can use blocks of wood to separate the trays. Set the oven on the very lowest setting and dry the herbs slowly. Keep the oven door propped open slightly for ventilation and to control the heat. Drying will be complete in 2 to 4 hours.



## Microwave Oven

If you have a microwave oven, you can use it for drying herbs. Place the herbs between paper towels and set them on the rack. Close the door and turn the oven on a medium setting for 2 to 3 minutes. Then check for dryness; the leaves should feel brittle and should crumble easily. If they are not done, turn the oven on for 30 seconds longer. Although this process actually cooks the herbs, the end product is just about the same.

## STORING

When the leaves are dry, shake them from the stems and discard the stems. Crush the leaves if desired. But keep in mind that whole herbs retain their flavor longer than crushed or ground herbs. Store dried herbs in small airtight containers away from the light. Containers such as metal cans or tinted glass that exclude light are best.

If stored in a cool, dry, dark place, whole dried herbs retain their flavor and aroma up to one year. A warm storage area may hasten the loss of flavor. A damp environment encourages caking, color change, and infestation. Close the containers tightly after each use so that the volatile oils are not lost.

Do not use old herbs. If you aren't sure an herb is fresh, rub a bit of it between your palms and breathe in the aroma. If there is little or no aroma, replace the herb with a fresh supply.

## USING

To release the full flavor, cut or chop the dried leaves into fine bits before adding to food. Or crush the leaves by rubbing them between your palms or by grinding them with a mortar and pestle. For the best results, add herbs to the liquid in the recipe.

Keep seasoning blends subtle. When combining herbs, use one having a pronounced flavor with two to four others having a less pronounced flavor. All of the herbs in the following famous combinations can be grown and dried at home:

- bouquet garni, bunches of herbs and sometimes spices tied together or put into a cheesecloth bag. The usual combination is celery leaves, onion, parsley, and thyme. The combination varies for different dishes.
- fines herbes, a mixture of three or more herbs. Combinations used are (1) chervil, chives, and parsley; or (2) basil, sage, and savory.

The amount to use depends on your taste preferences, the piquancy of each herb, and the effect it has on different foods. If you do not have a recipe, start with 1/4 teaspoon of herb per pound of meat or pint of sauce, and increase as desired. If the recipe calls for fresh herbs, you can substitute dried herbs. Use a fourth of the recommended amount, for example, 1/4 teaspoon of



dried herb instead of 1 teaspoon of fresh. Avoid using the same herbs in several dishes to be served at the same meal.




The flavor of an herb will be at its best if you add it to the recipe at the proper time. Add herbs as follows:

- to soups and stews during the last half hour of cooking. The delicate flavor and aroma of herbs can be lost by overcooking.
- to uncooked foods such as tomato juice cocktail 3 to 4 hours before serving, or even overnight, to release the full flavor of the herb.
- to quickly cooked dishes or sauces as soon as you begin cooking the food. To draw out more flavor, barely moisten herbs with a little lemon juice, water, cooking oil, or other liquid suitable for the food you are preparing, and let stand for 10 minutes or more before using.

Herbs may be used to flavor vinegar, mustard, and butter. Choose your favorite herbs to add variety to these everyday ingredients, following the recommended steps.

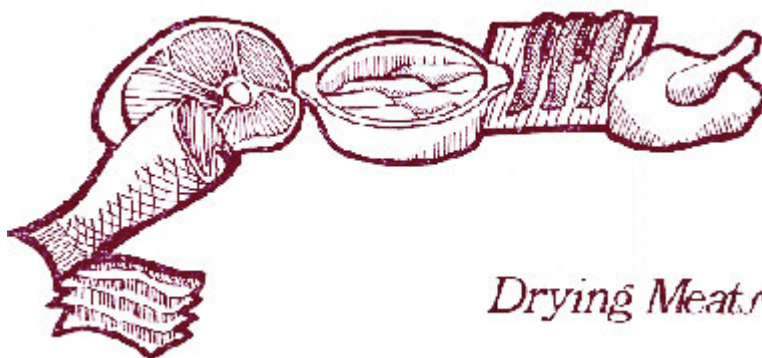
Use whole spices and herbs for beverages and pickles. Leaving whole spices in pickles can cause unsightly darkening. Tie herbs and whole spices in a small square of cheesecloth so that they can be removed easily before serving. This will also prevent seasoning specks in the finished product. The same method can be used when whole spices and herbs are added to other foods.

|  |   |  |
|--|---|--|
|  <p><i>Sweet Basil</i></p>                               |  <p><i>Bay Leaves</i></p>                   |  <p><i>Sage</i></p>                                       |
| <p>Use in tomato and egg dishes, stews, vegetables, meats, soups, and salads. Add a touch to hamburgers, noodles, and salad dressings.</p> | <p>Drop a few leaves into stewing chicken, fish chowder, tomato soup, and corn chowder. Remove the leaves before serving.</p> | <p>Essential in poultry seasoning. Use with onion for stuffing pork, duck, and goose. Rub powdered leaves on pork loin and ham.</p>          |
|  <p><i>Marjoram</i></p>                                 |  <p><i>Chives</i></p>                      |  <p><i>Parsley</i></p>                                   |
| <p>Add a pinch to poultry, meats, egg dishes, poultry stuffings, soups, potato salad, creamed potatoes, and green beans.</p>               | <p>Use as a substitute for onion. Sprinkle as a garnish over vegetables, baked potatoes, meats, and soups.</p>                | <p>Attractive as a garnish with soups, vegetable salads, meats, and poultry. Good as a seasoning with almost any vegetable or meat dish.</p> |

|   |   |  |
|---|---|--|
|  <p><i>Oregano</i></p>   |  <p><i>Rosemary</i></p>  |  <p><i>Thyme</i></p>   |
| <p>Delicious in pizzas or other Italian dishes, chili, meat loaf, veal dressings, and bean, tomato, or lentil soups. Gives a flair to sour cream served over sliced tomatoes.</p> | <p>Blend with parsley and butter, and spread on chicken breasts and thighs when roasting. Add sparingly to creamed soups, poultry, stews, and sauces.</p> | <p>Usually blended with other herbs. Leaves can be used with meat, poultry stuffing, gravies, soups, egg and cheese dishes, vegetables, and seafood.</p> |



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Drying, smoking, and salting were the only methods of preserving meat for thousands of years. Early American settlers dried much of their meat because they could not carry a fresh supply when traveling across the country. Today, dried meat, more commonly known as jerky, is usually prepared in an oven instead of being dried in the sun as it was years ago.

Jerky is a popular snack. It is sold almost anywhere that carries snack foods - from grocery stores to gas stations. It is a favorite with campers, hikers, and hunters because it is compact, lightweight, and keeps a long time.

Drying meat is considered "playing with food" by some people because, thanks to today's modern food industry, fresh meat is almost always available. But jerky has value as a convenient backpacking food and as a nutritious snack food. Besides, jerky is fun to make at home, and it costs only about half as much as an equal weight of commercially made jerky.

## PREPARING THE MEAT

Any lean meat can be dried. Beef and venison are especially good; fish and poultry dry well, too. Be sure to use fresh, lean meat and cut off all fat and connective tissue. Fat becomes rancid easily and will spoil the dried meat.

Partly freezing the meat before cutting makes it easy to slice. Slice with the grain into long, thin, even strips. Slice with the grain instead of crosswise makes the jerky chewy and less brittle. The strips should be about 1/8 to 1/4 inch thick, 1 to 1-1/2 inches wide, and 4 to 12 inches long. Thin slices of meat will dry faster than thick ones. Any wild game meat should be frozen for at least 30 days to lower the chances of trichinosis infection by killing parasite larvae.



Meat may be dried as is, or it may be seasoned to suit your own taste. Salt and pepper are the



basic ingredients. In the drying method, however, salt is used only as a seasoning, not as a preservative. It is crucial, therefore, that the oven temperature be maintained above 140 degrees F. to prevent spoilage during the drying process. Keep in mind that too much seasoning will overpower the meat flavor.

Place seasoned meat in a crockery, plastic, glass, or stainless steel bowl or pan, and cover. Marinate the meat overnight or for about 12 hours in the refrigerator at 40 F. (4 C.).

The marinade recipe on the following page makes delicious jerky.



## Marinade Recipe

5 lbs. lean meat  
 1/2 cup soy sauce  
 2 tbsp. Worcestershire sauce  
 1/2 tsp. each pepper, garlic powder, ground ginger  
 2 tsp. hickory smoke-flavored salt (optional)



Mix marinade ingredients in a bowl. Add strips of meat and stir to coat all surfaces. Cover and refrigerate overnight. Remove strips, blot off excess moisture.

The flavor of jerky can be varied by marinating the strips in mixtures such as teriyaki sauce, sweet and sour sauce, hot chili sauce, or your own favorite marinade. Or you may simply coat the meat with the marinade. The marinade should not contain oil because oil will become rancid and spoil the meat. For full flavor allow enough time for the seasoning to be absorbed into the meat (about 12 hours).

## DRYING METHODS

### Oven Drying

Arrange the seasoned strips of meat on cake racks or directly on oven racks. The edges of the strips may touch, but they should not overlap. Leave space at the edges of the racks so that air can circulate around the meat as it dries. Set the oven on the lowest possible temperature and maintain at about 140 degrees to 150 F. (60 to 65 C.). Use an oven thermometer to check the temperature. To prevent the meat from sticking to the racks, turn the strips over every hour or so.



Keep the oven door slightly ajar to allow the moist air to escape and to control the oven temperature. An electric fan placed in front of the oven door will help the air circulate and shorten the drying time. When drying marinated meat, you may need to line the bottom of the oven with aluminum foil to catch the drippings. Oven drying takes from 10 to 12 hours.

### Drying in a Food Dryer

You can also use a food dryer for making jerky. Place the slices of meat on the racks. Put a piece of aluminum foil below the bottom rack if necessary to catch the drippings. Leave 1 inches of space around the foil to allow hot air to rise from the heating unit. Turn the strips of meat over occasionally to keep them from sticking to the rack.

Do not dry seasoned meat at the same time you are drying other foods in the dryer because the meat will give a strong odor to

the other foods. This is also true if you are drying meat in the oven. Making jerky in the food dryer will take a little longer than in the oven because the temperature is usually slightly lower.

## Smokehouse Drying

If you have a smokehouse, you can use it for making jerky. Lay seasoned strips of meat on racks or hang them from the ceiling of the smokehouse. Starting temperature should be 80 degrees F. (27 C.), then it should be increased gradually to 120 F. (49 C.). Smoke the jerky until it is the desired texture (24 to 48 hours).

Use any hardwood such as hickory or oak for smoking. Do not use pine, fir, or conifers because the resin (sap) bums and creates an undesirable smoke. Put aluminum foil or a metal tray under the meat to catch the drippings. If you don't do this the drippings will bum and produce smoke that gives the meat an unpleasant flavor.

## Air Drying



Meat strips can be air dried, but this requires very hot, dry weather. Place strips on the grill of an outdoor barbecue. Or string them on heavy string or fishing line and hang outside in a sunny, airy place for several days. Bring the meat indoors at night so that it doesn't absorb moisture.

Air drying is not as satisfactory as oven drying or smoking because the temperature cannot be controlled. Also, the meat may be exposed to insanitary conditions from dirt in the air. Outdoor drying may invite unwanted guests such as dogs, cats, wild animals, and insects. If practical, cover the meat loosely with cheesecloth to prevent contamination.

## TESTING FOR DRYNESS

Don't let the meat get too hard and dry for your taste. If the jerky is not dry enough, though, it will spoil. The finished product is dark brown or almost black and feels hard and dry. Test a piece by bending it. It should break like a green twig -not snap clean like a dry stick. Be sure to let the jerky cool before testing, because when it is warm, it will still be pliable no matter how dry it is. The final product will be about a fourth of the original weight.

## STORING JERKY

As soon as the meat is sufficiently dried, remove the racks from the oven or dryer and pat off any beads of melted fat that may have formed. Let the jerky cool first, then take it off the racks. Store in clean, airtight plastic, glass, crockery, or metal containers with tightfitting lids. Pack tightly to remove as much air as possible, but do not crush. Store in a cool, dry place such as the pantry, basement, or kitchen cupboards.

Although jerky will last almost indefinitely, it starts to lose its flavor-after a few months.



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## *Storing and Using Dried Foods*

### **BEFORE STORING**

#### **Testing for Dryness**

Many factors affect the length of time needed for drying foods: temperature, air circulation, humidity, the kind of food being dried, the amount of food on a tray, the size of the pieces of food, and the total amount of food in the oven or dryer. Pieces on the edges of the trays will dry faster than pieces in the center. If slices are not all the same thickness, thin pieces will dry before the others. For these reasons you must test samples of the food from each batch you dry.

You should test only a few pieces at a time. Be sure to let the pieces cool before testing. Warm food will feel soft and moist even when it is dry. Remove the pieces of food from the tray when they test dry. Return the rest of the food to the oven or dryer until drying is complete. When you think the food is dry, there are several ways you can test it to be sure.

Test fruit by squeezing a handful. If the pieces of fruit spring apart and there is no moisture left on your hand when you open it, then drying is complete. To double check, cut through a piece of fruit; there should be no moisture on the inside. Dried fruit should be pliable and leathery. When you use an oven, drying takes as little as 6 hours to more than 10 hours.

Most vegetables will be hard and brittle when completely dry. A dried piece will shatter when hit with a hammer. Exceptions are mushrooms, green peppers, and squash; they will be pliable and leathery. Vegetables usually dry in 4 to 12 hours.

Herbs require 2 to 3 days' drying time when air dried and 2 to 3 hours if dried in the oven. You know herbs are dried when they are brittle and the leaves can be easily crushed.

Dried jerky is dark brown to black. To test for dryness, bend a piece. It should bend like a green twig, not break apart completely like a dry stick. There should be no moisture inside.



#### **Conditioning**

It is very hard to dry all the pieces of food evenly. Depending on the size of the pieces and the location on the tray, some pieces will be too dry and others will be not quite dry enough. But you can condition food so that the whole batch will be uniformly dry.

After the food is dried, cool it on the tray, then put the pieces of food in a large closed container such as a crock, a plastic jar, or a coffee can. Make sure the food is cool, because it will sweat if it is put into the container while still warm.

Keep the container covered in a warm, dry, airy room. Stir the food once a day for a week to 10 days. Then package the pieces of food in smaller airtight containers and store. This conditioning allows the moisture from the underdried pieces to be absorbed by the overdried pieces. If drops of moisture appear on the sides or lid of the container, the food is not dry enough. Return it to the dryer and dry it some more.



## Pasteurizing

Dried food is sometimes contaminated by insects or molds, which can cause spoilage. Sulfuring fruit usually prevents this type of contamination. After meat and vegetables have been dried, they can be pasteurized to make them safe. It is especially important to pasteurize food dried outdoors, where it was probably contaminated.



To pasteurize, heat the oven to 175 degrees F. (80 C.). Set the pieces of dried food in a single layer on a tray or cookie sheet. Heat in the oven with the door closed for 15 minutes. Remove from the oven and allow the food to cool before packaging. Alternatively, the dried food can be pasteurized by freezing it for 1 to 2 weeks and then storing it.

## STORING

After the food has been thoroughly dried, cooled, conditioned, and pasteurized, you can be sure of its quality and safety if you store it properly. Place dried food in moisture- and vaporproof containers with tight-fitting lids. Glass jars, coffee cans, and plastic freezer bags or cartons may be used. Containers that keep out light are best.

If you use a coffee can, place sulfured fruit in a plastic bag first to prevent contact of the fruit with the metal. The sulfur can react with the metal and give an off-flavor to the fruit.



It is best to package food in small quantities. Use pint-sized containers or small plastic bags. The bags should then be put into a large can or jar. If food is stored in large quantities, the unused portion may become contaminated each time you open the container. Be sure to pack the food tightly. Force out as much air as possible from the package before closing it. But take care not to crush the food.

All dried food deteriorates over a period of time, but storing it in a cool, dry, dark place will help to preserve the color and flavor. Kitchen cupboards or a pantry are good places if they don't get too hot. A dry basement or a closet on the north side of the house is also suitable. You may store dried food in the refrigerator or freezer if you have the space. Once a package of dried food is opened, it should be resealed tightly and if possible stored in the refrigerator to prevent contamination and mold growth. Properly dried and stored, vegetables and jerky will keep about 6 months, fruits and

herbs about a year.

As a safety measure, examine stored food occasionally. If you find signs of a little moisture but no spoilage, pasteurize the food. If the food appears quite moist, repeat the drying process until thoroughly dry. Remember to cool the pieces before repackaging.

If you see any mold growth on the food, throw away the entire batch. It's not safe!

## USING AND COOKING

### Fruits

Dried fruits make tasty snacks and are very handy for taking on camping or hiking trips. Dried fruits can also be chopped up and used dry with breakfast cereal, granola, or cookies.

Fruit can be reconstituted for use in recipes by pouring just enough boiling water over it to cover and simmering it for 15 minutes. Or pour cool water over it to cover, then soak for a few hours. Soak only until the fruit is plump because soaking too long makes the fruit mushy and less flavorful. To retain nutrients, cook the fruit in the same water used for soaking.

Most dried fruit needs no extra sugar because some of the starch in the fruit turns to sugar during the drying process. If you wish to sweeten the fruit, do so after cooking; otherwise the fruit will become mushy. Reconstituted fruit is especially good in cakes, pies, and other desserts. If the recipe calls for water, use the water in which the fruit was soaked.

## Vegetables

When you reconstitute pieces of vegetables, they should become nearly the same size they were when fresh. Add 1 to 2 cups of water to 1 cup of dried vegetables. Add more water later if necessary. Blanched dried vegetables should be soaked about 2 hours before cooking. Unblanched vegetables will take longer. Dried beans and peas can be soaked overnight or boiled 2 minutes and then soaked 1 hour before cooking.

Dried vegetables taste best if used in soups, stews, or other dishes cooked with liquid and seasonings. The seasonings help to enhance the natural flavor of the vegetables.

## Herbs

To become a successful, creative cook, start using some of the fine herbs such as sweet basil, marjoram, or summer savory. But be miserly in your measure; herbs can easily overpower the flavor of the food they are used to season.

You can make your own favorite blend of herbs for a variety of uses. A combination of marjoram, oregano, basil, and thyme used in equal parts is a good basic blend for soups, stews, sauces, casseroles, and salads. Sage, savory, and rosemary may be added to the blend for use with poultry, Italian dishes, or other spicy foods. You can adjust the amounts to suit your taste.

You do not need to reconstitute herbs before you use them. To substitute dried herbs for fresh herbs, use 1/4 teaspoon of dried herbs for 1 teaspoon of fresh.

## Jerky



Jerky makes a delicious snack or backpacking staple. Serve it as a party food for children or at cocktail parties. Your guests will be delighted.



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*Selected References*

The books listed below have been of use in preparing this publication and are recommended for further reading. They have been divided into two categories, depending on the accuracy of their instructions and advice.

## Excellent

**How to Dry Foods.** DeLong, D. HP Books, Tucson, Arizona, 1979.

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**Canning, Freezing and Drying.** Editors, Sunset Books and Sunset Magazine, Lane Publishing Company, Menlo Park, California, 1975.

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This circular was prepared by Judy Troftgruben, Extension Specialist, Foods and Nutrition (1977), and revised by Mary Keith, Assistant Professor, Foods and Nutrition, and Extension Specialist, Foods, Cooperative Extension Service, University of Illinois at Urbana-Champaign. April, 1984

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Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. WILLIAM R. OSCHWALD, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign.

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