

## **DRYING FOODS**

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Food drying is one of the oldest methods of preserving food for later use. It can either be an alternative to canning and freezing or compliment these methods. Drying food is simple, safe and easy to learn. With modern food dehydrators fruit leathers, banana chips, pumpkin seeds and beef jerky can all be dried year-round at home. Dried foods are ideal for backpacking and camping. They are lightweight, take up little space and do not require refrigeration.

### **How Drying Preserves Food**

Drying removes the moisture from the food so that bacteria, yeasts and molds cannot grow and spoil the food. It also slows down the action of enzymes but does not inactivate them. When the food is ready for use, the water is added back and the food returns to its original shape. Foods can be dried in the sun, in an oven or in a food dehydrator by using the right combination of warm temperatures, low humidity and air current.

The optimum temperature for drying food is 140 °F. 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.

Low humidity aids the drying process. Food contains a lot of water. To dry food, the water must move from the food to the surrounding air. If the surrounding air is humid, then drying will be slowed down.

Increasing the air current speeds up drying by moving the surrounding moist air away from the food. To speed the drying time, increase the air flow.

Most foods can be dried indoors using modern food dehydrators, counter-top convection ovens or conventional ovens. Microwave ovens are recommended only for drying herbs, because there is no way to create enough air flow to dry denser foods.

### **Sun Drying**

Vegetables (with the exception of vine-dried beans) and meats are not recommended for out-of-doors drying. Vegetables are low in sugar and acid, which increases the risks for food spoilage. Meats are high in protein, making them ideal for microbial growth when heat and humidity can’t be controlled. It is best to dry meats and vegetables indoors using controlled conditions of an oven or food dehydrator.

The high sugar and acid content of fruits make them safe to dry out-of-doors when conditions are favorable for drying. It takes several days to dry foods out-of-doors, and because the weather is uncontrollable, this method can be risky. Hot, breezy days with a humidity below 60 percent are best, but usually these ideal conditions are not available in South Carolina when the fruit ripens, so that alternative methods are needed. A minimum temperature of 85 °F is needed with higher temperatures being better. Fruits dried out-of-doors must be covered or brought under shelter at night. The cool night air condenses and could add moisture back to the food, thus slowing down the drying process.

Equipment: Racks or screens placed on blocks allow for better air movement around the food. Because the ground may be moist, it is best to place the racks or screens on a concrete driveway or if possible over a sheet of aluminum or tin. The reflection of the sun on the metal increases the drying temperature.

Screens need to be safe for contact with food. The best screens are stainless steel, teflon-coated fiberglass and plastic. Avoid screens made from “hardware cloth.” This is galvanized metal cloth that is coated with cadmium or zinc. These metals can oxidize, leaving harmful residues on the food. Also avoid copper and aluminum screening. Copper destroys vitamin C and increases oxidation. Aluminum tends to discolor and corrode.

Because birds and insects are attracted to dried fruits, two screens are best for drying food. One screen acts as a shelf and the other as a protective cover. Cheesecloth could also be used to cover the food.

## Solar Drying

Recent efforts to improve sun drying have led to solar drying. Solar drying uses the sun as the heat source, but a specially designed dehydrator increases the temperature and air current to speed up the drying time. Shorter drying times reduce the risk of food spoilage or molding.

## Vine Drying

Another method of drying outdoors is vine drying. To dry beans (navy, kidney, butter, great northern, lima, lentils and soybeans) leave bean pods on the vine in the garden until the beans inside rattle. When the vines and pods are dry and shriveled, pick the beans and shell them. No pretreatment is necessary. If beans are still moist, the drying process is not complete and the beans will mold if not more thoroughly dried. If needed, drying can be completed in the sun, oven or a dehydrator.

Pasteurization: Sun-dried fruits and vine-dried beans need treatment to kill insects and their eggs.

Freezer Method: Seal the food in freezer-type plastic bags. Place the bags in a freezer set at 0 °F or below and leave them at least 48 hours.

Oven Method: Place the food in a single layer on a tray or in a shallow pan. Place in an oven preheated to 160 °F for 30 minutes.

## Food Dehydrators

A food dehydrator is a small electrical appliance for drying foods indoors. A food dehydrator has an electric element for heat and a fan and vents for air circulation. Dehydrators are efficiently designed to dry foods quickly at 140 °F. Food dehydrators are available from department stores, mail-order catalogs, natural food stores, and seed or garden supply catalogs. Costs vary from \$50 to \$350 or above depending on features. Some models are expandable and additional trays can be purchased later. Twelve square feet of drying space dries about a half-bushel of produce. The major disadvantage of a dehydrator is its limited capacity.

### 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 elements.
- Counter-top design.
- An enclosed thermostat from 85 to 160 °F and a dial for regulating temperature.
- A fan or blower.
- Four to 10 open mesh trays made of sturdy lightweight plastic for easy washing.

- A timer to turn the dehydrator off and prevent scorching if the drying time is completed during the night.
- UL seal of approval, a one-year guarantee and convenient service.

Types of Dehydrators: There are two basic designs for dehydrators. In horizontal air flow units, the heating element and fan are located on the side, whereas the vertical air flow dehydrators have the heating element and fan located at the base. The major advantages of horizontal flow are: it reduces flavor mixture so several different foods can be dried at one time; all trays receive equal heat penetration; and juices or liquids do not drip down into the heating element.

## Oven Drying

Everyone who has an oven has a food dehydrator. By combining the factors of heat, low humidity and air current, an oven can be used as a dehydrator. An oven is ideal for occasional drying of meat jerkies, fruit leathers, banana chips or for preserving excess produce like celery or mushrooms. Because the oven may also be needed for everyday cooking, it may not be satisfactory for preserving abundant garden produce. Oven drying is slower than dehydrators because it does not have a built-in fan for the air movement. (However, some convection ovens do have a fan.) It takes twice as long to dry food in an oven than in a dehydrator, and it uses more energy.

To Use Your Oven: First, check your dial and see if it has a reading as low as 140 °F. If your oven does not go this low, then your food will cook instead of dry. For air circulation, leave the oven door propped open 2 to 6 inches. Circulation can be improved by placing a fan outside the oven near the door. CAUTION: This is not a safe practice for a home with small children. Because the door is left open, the temperature will vary. An oven thermometer placed near the food gives an accurate reading. Adjust the temperature dial to achieve the needed 140 °F.

Trays should be narrow enough to clear the sides of the oven and should be 3 to 4 inches shorter than the oven from front to back. Cake cooling racks placed on top of cookie sheets work well for some foods. The oven racks, holding the trays, should be 2 to 3 inches apart for air circulation.

## Room Drying

This method of drying differs from sun drying since it takes place indoors in a well-ventilated attic, room, car, camper or screened-in-porch. Herbs, hot peppers, nuts in the shell and partially sun-dried fruits are the most common air-dried items. Herbs and peppers can be strung on a string or tied in bundles and suspended from overhead racks in the air until dry. Enclosing them in paper bags, with openings for air circulation, protects them from dust, loose insulation and other pollutants. Nuts are spread on papers, a single layer thick. Partially sundried fruits should be left on their drying trays.

## Dehydrofreezing

Dehydrofreezing is a new method of food preservation that combines the techniques of drying and freezing. Fruits dried at home normally have had 80 percent of their moisture removed; vegetables, 90 percent. However, by removing only 70 percent of the moisture and storing the fruit or vegetable in the freezer, a tastier product results. The low temperature of the freezer inhibits microbial growth. Also, the food takes up less room in the freezer. Dehydrofrozen fruits and vegetables have good flavor and color. They reconstitute in about one-half the time it takes for traditionally dried foods.

Dehydrofreezing is not freeze-drying. Freeze-drying is a commercial technique that forms a vacuum while the food is freezing. Freeze-drying is a costly process that can't be done in the home.

## Packaging & Storing Dried Foods

Dried foods are susceptible to insect contamination and moisture reabsorption and must be properly packaged and stored immediately. First, cool completely. Warm food causes sweating which could

provide enough moisture for mold to grow. Pack foods into clean, dry insect-proof containers as tightly as possible without crushing.

Glass jars, metal cans or boxes with tightly fitted lids or moisture-vapor resistant freezer cartons make good containers for storing dried foods. Heavy-duty plastic bags are acceptable but are not insect-and rodent-proof.

Pack food in amounts that will be used in a recipe. Every time a package is re-opened, the food is exposed to air and moisture that lower the quality of the food.

Fruit that has been sulfured should not touch metal. Place the fruit in a plastic bag before storing it in a metal can. Sulfur fumes will react with the metal and cause color changes in the fruit.

Dried foods should be stored in cool, dry, dark areas. Recommended storage times for dried foods range from four months to one year. Because 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 one year at 60 °F, six months at 80 °F. Vegetables have about half the shelf-life of fruits.

Foods that are packaged seemingly “bone dry” can spoil if moisture is reabsorbed during storage. Check dried foods frequently during storage to see if they are still dry. Glass containers are excellent for storage because any moisture that collects on the inside can be seen easily. Foods affected by moisture, but not spoiled, should be used immediately or redried and repackaged. Moldy foods should be discarded.

**Table 1. Remedies For Drying Problems**

<b>Problems</b>	<b>Cause</b>	<b>Prevention</b>
Moisture in the Jar or Container	Incomplete drying.	Test several pieces for dryness.
	Food cut unevenly, thus incomplete drying.	Cut food evenly.
	Dried food left at room temperature too long after cooling and moisture re-entered the food.	Cool quickly and package.
Mold on Food	Incomplete drying.	Test several pieces for dryness.
	Food not checked for moisture within a week.	Check container within one week for moisture in containers. Re-dry food at 140 °F until dry.
	Containers not airtight.	Use airtight containers.
	Storage temperature too warm plus moisture in foods.	Store foods in coolest area of home below 70 °F.
	Case hardening. Food dried at too high a temperature and food cooked on outside before the inside dried.	Dry food at 140 °F.
Brown Spots on Vegetables	Too-high drying temperature used.	Dry vegetables at 140 °F
	Vegetables over-dried.	Check periodically for dryness.
Insects in Jars	Lids do nt completely fit jars.	Use new canning lids.
	Foods dried out-of-doors but not pasteurized.	Pasteurize foods in oven at 160 °F for 30 minutes or in freezer for 48 hours.

Holes in Plastic Bags	Insects or rodents eat through plastic bags.	Avoid use of plastic bags except when food can be stored in refrigerator or freezer.
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For information on drying specific foods, request any of the following fact sheets: ***HGIC 3084, Drying Fruits***; ***HGIC 3085, Drying Vegetables***; ***HGIC 3086, Drying Herbs, Seeds & Nuts***.

If this document didn't answer your questions, please contact HGIC at [hgic@clemson.edu](mailto:hgic@clemson.edu) or 1-888-656-9988.

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