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MONTANA STATE UNIVERSITY EXTENSION MontGuide

Drying Vegetables

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Drying food is simple, easy to learn and yields foods that are tasty and nutritious. The purpose of drying is to remove enough water from the food so that bacteria, yeast and molds cannot grow to harmful amounts, causing food poisoning and spoilage.

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Safety is the Top Priority

Safely preserving foods at home by canning, drying, and freezing requires using processing methods that not only preserve the food but also destroy bacteria and molds that cause foodborne illness or food poisoning. Protect yourself and others when sharing home-preserved foods by learning safe preservation techniques. The safest recipes and resources are those that have been researched and rigorously tested by the United States Department of Agriculture (USDA) and Extension Services associated with land-grant universities. Many home-preserved recipes are not tested for safety, so it is critical to use the resources below.

Recommended Research-based Food Preservation Resources

National Center for Home Food Preservation (NCHFP), USDA sponsored website is the most current source for publications, video clips, tutorials for the beginning home food preserver, frequently asked questions, and seasonal tips: http://nchfp.uga.edu/

USDA Complete Guide to Home Canning, 2015. Earlier editions not recommended. Available on NCHFP website, click on 'publications'.

So Easy to Preserve, 6th edition, 2014 only. Earlier editions not recommended. http://www. soeasytopreserve.com

The following publications are available at local stores or order online. *The All New Ball Blue Book of Canning and Preserving,* 1st ed., 2016; *The Best Ball Home Canning and Preserving Recipes: Fresh Flavors All Year Long,* 1st ed. 2016; *Ball Blue Book Guide to Preserving, 37th ed.,* 2014. Earlier editions not recommended.

Advantages of Food Drying

Food drying is one of the oldest methods of preserving food and is simple and easy to learn. Drying removes moisture from food so that bacteria, yeasts, and molds cannot grow and spoil food. Making safe dry foods requires cleanliness in every step, protecting the food from airborne spoilers and other contaminants, and using food-grade containers, equipment and ingredients.

Methods of Drying

Vegetables can be dried in a food dehydrator or in an oven 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, causing a greater likelihood of food molding. Low humidity aids the drying process. If the surrounding air is humid, then drying will be a slower process. Increasing the air current speeds up drying by moving the surrounding moist air away from the food. Most foods can be dried indoors using modern food dehydrators or conventional ovens.

Drying with a Dehydrator

A food dehydrator is a small electric 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. Costs vary from $50 to $350 depending on features.

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.
- Countertop design.
- An enclosed thermostat from 85°F to 160°F and a dial for regulating temperature.
- A fan or blower.
- Four to ten 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. One has horizontal air flow and the other has vertical air flow. In units with horizontal flow, the heating element and fan are located on the side of the unit. 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 drop down onto the heating element. Vertical air flow dehydrators have the heating element and fan located at the base or in the lid. If different foods are dried, flavors can mix and liquids can drip onto the heating element when it is at the bottom.

Oven Drying

Everyone who has an oven has a food dehydrator.

Oven drying is slower than dehydrators because it does not have a built-in fan for air movement. It takes twice as long to dry food in an oven than in a dehydrator, and it uses more energy.

An oven must have a setting as low as 140°F to use it for drying. If an oven does not go this low, then 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.

Vine Drying

A 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 vines and pods are dry and shriveled, pick the beans and shell them. If the beans are still moist, finish drying them in an oven or a dehydrator.

Pasteurization: Vine-dried beans need a pasteurization treatment to kill insects and their eggs.

- Freezer Method: Seal the food in plastic freezer 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 the tray in an oven preheated to 160°F for 30 minutes.

Preparing Vegetables for Drying

Some vegetables are more suitable for drying than others (refer to Table 2, page 4). To prepare vegetables for drying, wash in cool water to remove soil and chemical residues. Remove any fibrous or woody portions and core when necessary, removing all decayed and bruised areas.

Pretreating Vegetables

Refer to Table 1 (page 3) to determine which vegetables need to be pretreated (blanched) before drying. Blanching is a necessary step in preparing some vegetables for drying. Blanching is the process of heating vegetables to a temperature high enough to destroy enzymes. Blanching stops the enzyme action which could cause loss of color and flavor during drying and storage, and also shortens the drying and rehydration time.

Vegetables can be water blanched or steam blanched. Water blanching usually results in a greater loss of nutrients, but it takes less time than steam blanching. Refer to Table 1 for required time necessary for steam or water blanching.

Water blanching: Fill a large pot ⅔ full of water, cover and bring to a rolling boil. Place vegetables in a wire basket or colander and submerge them in the water. Cover and blanch according to the directions for each vegetable in Table 1. Start counting blanching time as soon as the water returns to a boil.

Steam blanching: Use a deep pot with a close-fitting lid and a wire basket or colander placed so the steam will circulate freely around the vegetables. Add water to the pot and bring to a rolling boil. Loosely place vegetables in the basket no more than 2 inches deep. Place the basket of vegetables in the pot. Make sure the water does not come in contact with the vegetables. Cover and steam according to the directions for each vegetable in Table 1.

After blanching, dip the vegetables briefly in cold water. When they feel only slightly hot to the touch, drain the vegetables by pouring them directly onto the drying tray held over the sink. Wipe the excess water from underneath the tray and arrange the vegetables in a single layer.

Drying Vegetables

Follow directions in Table 1 for drying in either the food dehydrator or oven.

The heat left in the vegetables from blanching will cause the drying process to begin more quickly. Watch the vegetables closely at the end of the drying period. They dry much more quickly at the end and could scorch. Refer to Table 1 to determine estimated drying time. Vegetables should be dried until they are brittle or "crisp."

Post-Drying Treatment and Storage

All safe packaging material must be food grade. Approved by FDA as not containing or transferring chemicals hazardous to human health into food, food grade materials are clearly labeled for food use. These include glass canning jars, ceramic containers, plastic freezer bags, plastic freezer containers with tight lids, and freezer wraps of plastic, paper, or foil. Examples of containers not approved for food contact include trash bags and plastic or fiberboard containers that have previously held non-food materials. It is important to package and seal dried foods properly to avoid insect infestation and moisture reabsorption.

Before packing, make sure the food has completely cooled. If the food is packaged warm, sweating can occur which may provide enough moisture for mold growth. Pack foods into clean, dry insect-proof containers.

TABLE 1. Drying Vegetables: Selecting, Preparing, Blanching and Drying Times

Vegetable	Preparation	Blanch		Est. Drying Time Dehydrator (hours)
		Steam (minutes)	Water (minutes)	
Asparagus	Wash thoroughly. Cut large tips in half.	4-5	3½-4½	4-6
Bean, green	Wash thoroughly. Cut in short pieces or lengthwise. (May freeze for 30 to 40 minutes after blanching for better texture.)	2½	2	8-14
Beets	Cook as usual. Cool and peel. Cut into shoestring strips ⅛ inch thick.	Already cooked. No further blanching required.		10-12
Broccoli	Trim and cut as for serving. Wash thoroughly. Quarter stalks lengthwise.	3-3½	2	12-15
Brussels sprouts	Wash thoroughly. Cut in half lengthwise through stem.	6-7	4½-5½	12-18
Cabbage	Remove outer leaves, quarter and core. Cut into strips ⅛-inch thick.	2½-3**	1½-2	10-12
Carrots	Use only crisp, tender carrots. Wash thoroughly. Cut off roots and tops; preferably peel, cut in slices or strips ⅛ inch thick.	3-3½	3½	10-12
Cauliflower	Wash thoroughly. Cut into same size pieces as you would for serving.	4-5	3-4	12-15
Celery	Trim stalks. Wash stalks and leaves thoroughly. Slice stalks.	2	2	10-16
Corn, cut	Select tender, mature, sweet corn. Husk and trim. Cut kernels from the cob.	No blanching needed.		6-8
Eggplant	Use the directions for summer squash.	3½	3	12-14
Garlic	Peel and finely chop garlic bulbs. No other pretreatment is needed. Odor is pungent.	No blanching needed.		6-8
Greens (chard, kale, turnips, spinach)	Use only young, tender leaves. Wash and trim very thoroughly.	2-2½	1½	8-10
Horseradish	Wash, remove small rootlets and stubs. Peel or scrape roots. Grate.	No blanching needed.		4-10
Mushrooms (WARNING: See footnote***)	Scrub thoroughly and rinse. Discard any tough, woody stalks. Cut tender stalks into short sections. Do not peel small mushrooms. Peel large mushrooms. Slice.	No blanching needed.		8-10
Okra	Wash, trim and slice crosswise in ⅛ to ¼ inch disks.	No blanching needed.		8-10
Onions	Wash and remove outer 'paper shells.' Remove tops and root ends, slice ⅛ to ¼ inch thick.	No blanching needed.		3-9
Parsley	Wash thoroughly. Separate clusters. Discard long or rough stems.	No blanching needed.		1-2
Peas, green	Shell.	3	2	8-10
Peppers and Pimentos	Wash, stem and core. Remove 'partitions.' Cut into disks about ⅜ by ⅜ inch.	No blanching needed.		8-12
Potatoes	Wash and peel. Cut into shoestring strips ¼ inch thick or cut in slices ⅛ inch thick.	6-8	5-6	8-12
Pumpkin and hubbard squash	Cut or break into pieces. Remove seeds and cavity pulp. Cut into 1 inch strips. Peel rind. Cut strips crosswise into pieces about ⅛ inch thick.	2½-3	1	10-16
Squash, summer	Wash, trim and cut into ¼ inch slices.	2½-3	½	10-12
Tomatoes, for stewing	Steam or dip in boiling water to loosen skins. Chill in cold water and peel. Cut into sections about ¾ inch wide or slice. Cut small pear or plum tomatoes in half.	3	1	10-18

* Drying times vary depending on the initial moisture content of the product and the particular dehydrator being used. Drying times in a conventional oven could be up to twice as long, depending on air circulation.

** Steam until wilted.

*** WARNING: The toxins of poisonous varieties of mushrooms are not destroyed by drying or cooking. Only a certified expert can differentiate between poisonous and edible varieties. Morrell mushrooms are especially hard to differentiate from the poisonous False Morrell. Please contact your county Extension agent for determining the procedure needed to verify if the mushroom is safe to consume.

TABLE 2. Suitability of vegetables for drying.

Vegetable	Suitability for Drying	Vegetable	Suitability for Drying	Vegetable	Suitability for Drying
Asparagus	Poor to fair	Greens, collard, spinach	Poor	Pumpkins	Fair to good
Beans, green	Fair to good	Horseradish	Good[3]	Radishes	Not recommended[5]
Bean, lima	Fair	Kale	Poor	Rutabagas	Fair to good
Beets	Fair to good	Kohlrabi	Fair	Spinach	Poor
Broccoli	Not recommended	Lettuce	Not recommended[4]	Squash, summer	Poor to fair
Brussels sprouts	Poor[1]	Mushrooms	Good	Squash, winter	Not recommended
Cabbage	Fair[2]	Okra	Fair to good	Sweet potatoes	Fair
Carrots	Good	Onions	Good to Excellent	Swiss chard	Poor
Cauliflower	Poor	Parsley	Good	Tomatoes	Fair to good[6]
Celery	Poor	Parsnips	Good	Turnips	Fair to good
Corn, sweet	Good	Peas	Fair to good	Turnip greens	Poor
Eggplant	Poor to fair	Peppers, green or red	Good	Yams	Fair
Garlic	Good	Potatoes	Good	Zucchini	Poor to fair

[1] Difficult to dry because of small size and layered leaves; strong flavor.

[2] Cabbage readily absorbs moisture from the air. Keeps well only if stored at extremely cold temperatures.

[3] Odor extremely strong during processing; use adequate ventilation.

[4] High water content; product will be undesirable for use.

[5] Product would be of low quality.

[6] Dried tomatoes re-absorb moisture readily which causes undesirable color and flavor changes and shortens shelf life. Black color can develop because of oxidation..

Dried foods should be stored in a dark, dry, cool place. Low temperatures extend the shelf life of the dried product. Most dried vegetables can be stored for 1 year at 60°F, 6 months at 80°F.

Vacuum Sealing

Vacuum sealing foods can increase the shelf life of some foods, but it is NOT a food preservation method by itself. If the food required refrigeration or freezing before vacuum sealing, it must still be kept refrigerated or frozen. Essentially vacuum sealing removes oxygen. Lower levels of oxygen helps reduce food spoilage. But on the other hand, this reduction in oxygen increases the risk of botulism, a potentially deadly foodborne illness caused by a bacteria that grows best when oxygen is removed during vacuum sealing.

Using Dried Vegetables

Cover dried vegetables with cold water and let them soak until they are nearly restored to their original texture (½ to 2 hours). For additional flavor you can soak in bouillon or vegetable juice. If they are soaked longer than two hours, the vegetables should be refrigerated. Using boiling liquid speeds up the soaking time. Save and use the soaking liquid in cooking.

When using dried vegetables in soups and stews, add them without soaking and they will rehydrate as they cook. Leafy vegetables, cabbage and tomatoes do not need to be soaked. Add enough water to keep them covered and simmer until tender.

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To order additional publications, please contact your county or reservation MSU Extension office, visit our online catalog at **https://store.msuextension.org** or e-mail **orderpubs@montana.edu**

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