



4-H FOODS PRESERVATION FACT SHEET

Drying Vegetables

Drying is one of the methods for preserving vegetables. Dried vegetables are frequently used in soups and stews.

HOW DRYING PRESERVES VEGETABLES

Drying removes the moisture from the vegetables so that bacteria, yeasts and molds cannot grow and spoil the vegetables. It also slows down the action of enzymes, but does not inactivate them. Because drying removes moisture, the vegetable becomes smaller and lighter in weight. The optimum temperature for drying vegetables is 140° F. If higher temperatures are used the vegetables may "case harden", that is cook and harden on the outside while trapping moisture on the inside. The vegetables will eventually mold when the moisture equilibrates in the item. Thus, the drying process should never be hurried by raising the drying temperature.

For vegetables, drying time is critical to tenderness. The longer the drying time, the less flavorful and poorer the product. Drying time can be hastened by drying small, uniformly cut pieces.

PREPARING VEGETABLES

"Vegetables at a Glance" (Table 1) lists vegetables that are suitable for drying. Dry vegetables immediately after harvesting. Choose produce that is at peak maturity and free from disease. To prepare vegetables, wash in cool water to remove soil and chemical residues. Trim, peel, cut, slice or shred vegetables according to the directions for each vegetable (Table 2).

Remove any fibrous or woody portions and core when necessary, removing all decayed and bruised areas. Keep pieces uniform in size so they will dry at the same rate. A food slicer or food processor can be used. Prepare only as many vegetables as can be dried at one time. Holding vegetables, even in the refrigerator, after washing and preparation for drying will result in loss of quality and nutrients.

PRETREATING VEGETABLES

Blanching is a necessary step in preparing most vegetables for drying. Blanching is the process of heating vegetables to a temperature high enough to destroy enzymes present in the tissue. It stops the enzyme action which causes loss of color and flavor during drying and storage. It also sets the color and shortens the drying and rehydration time by softening the tissue walls so moisture can escape or re-enter more rapidly. In water blanching, the vegetables are submerged in boiling water. In steam blanching, the vegetables are suspended above the boiling water and heated only by the steam. Water blanching usually results in a greater loss of nutrients, but it takes less time than steam blanching. (See Table 2 for blanching times.)

Not all vegetables require blanching. Onions, green peppers and mushrooms can be dried without blanching.

Water Blanching

Fill a large kettle two-thirds full of water, cover and bring to a rolling boil. Place the vegetables in a wire basket or a colander and submerge in water. Cover and blanch according to directions for each vegetable (see Table 2). Begin counting time after water begins to boil again. If it takes longer than one minute for the water to come back to boiling, too many vegetables were added. Reduce the amount in the next batch.

Steam Blanching

Use a deep kettle with a close-fitting lid and a wire basket, colander or sieve placed so the steam will circulate freely around the vegetables. Add water to the kettle and bring to a rolling boil. Loosely place the vegetables no more than two inches deep in the basket. Place the basket of vegetables in the kettle. Make sure the water does not come in contact with the vegetables. Cover and steam according to the directions for each vegetable (see Table 2). Begin counting time immediately. Small pieces of vegetables may need to be stirred occasionally to expose surfaces to steam.

COOLING & DRYING THE PREPARED VEGETABLES

After blanching, dip the vegetables briefly in cold water or ice bath, only long enough to stop the cooking action. Do not cool them to room temperature. When they feel only slightly hot to the touch, they will be cooled to about 120° F. 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. Place the tray immediately in the 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.

It is best not to dry strong smelling vegetables like onions or garlic in the home. The odors may linger in the drapes, clothes and furniture. Place the dehydrator in a carport, covered porch or covered patio. Keep the dehydrator away from rain. (Note: Food takes less time to dry in arid climates. Avoid drying during humid weather.) Also avoid drying strong smelling vegetables with other vegetables because their flavors will blend.

There is an additional step to the process of drying green beans which produces a product more similar to canned green beans. After the green beans have been blanched, place them in a single layer in a freezer for 30 to 40 minutes. Then start the drying process.

Drying Vegetables in the Dehydrator

An electric dehydrator will provide you with the most successful results since the high moisture content of most vegetables makes oven drying impractical. Here are some general directions for using your dehydrator. For best results, follow the directions that came with your dehydrator.

1. Distribute vegetables on trays in a single layer. Different kinds of vegetables may be dried at the same time. Strong smelling vegetables should be dried separately. Dry vegetables of

similar size on the same tray. Avoid overlapping. Do not add fresh vegetables to partially dried vegetables.

2. Preheat the dehydrator to 140° F.
3. After the trays are placed in the dehydrator, the temperature will drop. Watch your dehydrator temperature to assure that it returns to 140° F to complete the drying. Temperature plays a key role in the drying process.
If the temperature is too high, vegetables may "case harden", that is cook and harden on the outside while trapping moisture on the inside.
4. Examine the vegetables occasionally, 1 ½ - 2 hour intervals, depending on the vegetables.
5. At the start of the drying process there is little danger of scorching, but when nearly dry, the vegetables scorch easily. Even slight scorching destroys the flavor and may lower the nutritive value, so be careful not to allow the temperature to rise above 140° F, especially during the latter stage of drying.
6. Be sure to place the dehydrator in a well-ventilated room, so that the water vapor will be carried away.
7. The time for drying varies according to type of vegetables, size of pieces and load on the tray. The time at 140° F usually ranges from six to 16 hours. (See Table 2 for approximate drying times.)
8. Be sure to cool the vegetables before testing for dryness. See section following for how to determine dryness.
9. After vegetable has finished drying, and the dehydrator has cooled, trays may be cleaned with hot, soapy water, rinsed, and dried.

Drying Vegetables in the Oven

Here are some general directions for using your oven to dry vegetables.

1. First, check your oven dial and see if it has a reading as low as 140° F. Use an oven thermometer to check the temperature of the "warm" setting. If your oven does not go this low, then your vegetables will cook instead of dry.
2. Trays should be narrow enough to clear the sides of the oven and should be three or four inches shorter than the oven from front to back. Cake cooling racks placed on top of cookie sheets work well for some vegetables. The oven racks, holding the trays, should be 2 ½ to 3 inches apart for air circulation with three inches of space at the top of the oven.
3. Load two to four trays with no more than four to six pounds of prepared vegetables distributed among them. Vegetable pieces should be in a single layer. More than one kind of vegetable can be dried at the same time. Strong smelling vegetables should be dried separately.
Dry vegetables of similar size on the same tray. Avoid overlapping. Do not add fresh vegetables to partially dried vegetables.
4. Place an accurate and easy-to-read oven thermometer on the top tray toward the back.
5. Preheat the oven to 140° F and then add the loaded trays.
6. Low humidity aids the drying process. Vegetables contain a lot of water. To dry vegetables, the water must move from the vegetables 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 vegetables. To speed the drying time, increase the air flow. For air circulation, leave the oven door propped open about four inches.

Circulation can be improved by placing a fan outside the oven near the door. Change the position of the fan frequently during drying to vary the circulation of the air.

Because the door is left open, the temperature will vary. Adjust the temperature dial to achieve the needed 140° F.

7. Maintain the temperature at 140° F. It takes less heat to keep the temperature at 140° F as drying progresses, so watch the temperature carefully toward the end of drying.
8. Examine the vegetables often, and turn the trays frequently. At the start of the drying process, there is little danger of scorching, but when nearly dry, the product may scorch easily. Even slight scorching destroys the flavor and may lower the nutritive value, so be careful not to allow the temperature to rise above 140° F, especially during the latter stage of drying.
9. Because of variations in air circulation, drying times in conventional ovens could be up to two to three times as long as those given for dehydrator drying in Table 2. See the following section for how to determine dryness.

DETERMINING DRYNESS OF VEGETABLES

Vegetables are sufficiently dried when they are hard and brittle or tough and leathery, depending on the vegetable. Edges will be sharp. Beans, corn and peas are hard and will shatter when hit with a hammer. Leafy thin vegetables should be brittle. Larger chunks or slices of vegetables should be leathery.

PACKAGING & STORING DRIED VEGETABLES

Dried vegetables are susceptible to insect contamination and moisture reabsorption. First, cool completely. Properly package and store dried vegetables immediately. Warm food picks up moisture from the atmosphere which could provide enough moisture for mold to grow. Pack vegetables in clean, dry, insect-proof containers as tightly as possible without crushing.

Glass jars or moisture-vapor resistant freezer containers make good containers for storing dried vegetables. Heavy-duty plastic bags are acceptable, but are not insect and rodent proof. Plastic bags with a 3/8-inch seal are best to keep out moisture.

Pack vegetables in amounts that will be used at one time in a recipe or within a few days. Every time a package is re-opened, the food is exposed to air and moisture. The quality of the vegetables may be adversely affected.

Dried vegetables should be stored in cool, dry, dark areas. Recommended storage times for dried vegetables range from four months to one year. For best quality, keep dried vegetables at room temperature only one to two months; they should last six to twelve months in the refrigerator. (Source: Keeping Food Fresh, 1989.) Because vegetable quality is affected by heat, a lower storage temperature helps extend the length of storage; the higher the temperature, the shorter the storage time.

Vegetables that are packaged seemingly "bone dry" can spoil if moisture is reabsorbed during storage. Check dried vegetables 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. Vegetables affected by moisture, but not spoiled, should be used immediately or re-dried and repackaged. Moldy vegetables should be discarded.

TABLE 1
VEGETABLES AT A GLANCE

Vegetable	Suitability for Drying	Vegetable	Suitability for Drying
Artichokes	Fair	Mushrooms	Good
Asparagus	Poor to fair	Okra	Fair to good
Beans, green	Fair to good	Onions	Good to excellent ²
Beets	Fair to good	Parsley	Good
Broccoli	Not recommended ¹	Peas, green	Fair to good
Cabbage	Fair ¹	Peppers, green or red	Good
Carrots	Good	Potatoes	Good
Cauliflower	Poor	Pumpkins	Fair to good
Celery	Poor	Radishes	Not recommended ⁴
Corn, sweet	Good	Spinach	Poor
Eggplant	Poor to fair	Squash, summer	Poor to fair
Garlic	Good ²	Squash, winter	Not recommended
Horseradish	Good ²	Swiss chard	Poor
Kale	Poor	Tomatoes	Fair to good ⁵
Lettuce	Not recommended ³	Turnip greens	Poor

¹ Cabbage readily absorbs moisture from the air. Keeps well only if stored at an extremely cold temperature.

² Odor extremely strong during processing; place dryer outdoors or in basement area.

³ High water content; product will be undesirable for use.

⁴ Product would be of low quality.

⁵ Dried tomatoes re-absorb moisture readily which causes undesirable color and flavor changes and shortens shelf life. Package tightly. Black color can develop because of oxidation.

TABLE 2
DRYING VEGETABLES AT HOME

Vegetable	Preparation	Blanching Time (Minutes)		Drying Time Dehydrator (Hours)
		Steam	Water	
Artichokes, globe	Cut hearts into 1/8" strips. Heat in boiling solution of 3/4 cups water & 1 tablespoon lemon juice.	---	6 - 8	4 - 6
Asparagus	Wash thoroughly. Cut large tips in half.	4 - 5	3 ½ - 4 ½	4 - 6
Beans, green	Wash thoroughly. Cut in short pieces or lengthwise. (May freeze in a single layer for 30 to 40 minutes after blanching for better texture.)	2 - 2 ½	2	8 - 14
Beets	Cook as usual. Cool; peel. Cut into shoestring strips 1/8" thick.	---	---	10 - 12
Cabbage	Remove outer leaves; quarter & core. Cut into strips 1/8" thick.	2 ½ - 3*	1 ½ - 2	10 - 12
Carrots	Use only crisp, tender carrots. Wash thoroughly. Cut off roots & tops; preferably peel, cut in slices or strips 1/8" thick.	3 - 3 ½	3 ½	10 - 12
Cauliflower	Prepare as for serving.	4 - 5	3 - 4	12 - 15
Celery	Trim stalks. Wash stalks & leaves thoroughly. Slice stalks.	2	2	10 - 16
Corn, sweet	Select tender, mature sweet corn. Husk & trim. Cut the kernels from the cob after blanching.	5 - 6	4 - 5	6 - 10
Eggplant	Use the directions for summer squash.	3 ½	3	12 - 14
Garlic	Peel & finely chop garlic bulbs. No other pretreatment is needed. Odor is pungent.	---	---	6 - 8
Greens (Swiss chard, kale, turnip, spinach)	Use only young tender leaves. Wash & trim very thoroughly.	2 - 2 ½	1 ½	8 - 10
Horseradish	Wash; remove small rootlets & stubs. Peel or scrape roots. Grate.	---	---	4 - 10
Mushrooms (WARNING, see footnote**)	Scrub thoroughly. Discard any tough, woody stalks. Cut tender stalks into short sections. Do not peel small mushrooms. Peel large mushrooms, slice.	---	---	8 - 10
Okra	Wash, trim, slice crosswise in 1/8 to 1/4" disks.	---	---	8 - 10

Vegetable	Preparation	Blanching Time (Minutes)		Drying Time Dehydrator (Hours)
		Steam	Water	
Onions	Wash, remove outer "paper shells". Remove tops & root ends, slice 1/8 to 1/4" thick.	---	---	3 - 9
Parsley	Wash thoroughly. Separate clusters. Discard long or tough stems.	---	---	1 - 2
Peas, green	Shell.	3	2	8 - 10
Peppers, green or red	Wash, stem, core. Remove "partitions". Cut into 3/8" slices.	---	---	8 - 12
Potatoes	Wash, peel. Cut into shoestring strips 1/4" thick, or cut in slices 1/8" thick.	6 - 8	5 - 6	8 - 12
Pumpkin	Cut or break into pieces. Remove seeds & cavity pulp. Cut into 1" strips. Peel rind. Cut strips crosswise into pieces about 1/8" thick.	2 ½ - 3	1	10 - 16
Squash, summer	Wash, trim, cut into 1/4" slices.	2 ½ - 3	1 ½	10 - 12
Tomatoes, for stewing	Stem or dip in boiling water to loosen skins. Chill in cold water. Peel. Cut into sections about 3/4" wide, or slice. Cut small pear or plum tomatoes in half.	3	1	10 - 18

* Steam until wilted.

** 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: Adapted from So Easy to Preserve, Cooperative Extension, The University of Georgia, 1993, and Michigan Cooperative Extension Food Preservation Handbook.

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