Dehydration of Garden Products

By

Bessie E. McClelland

Extension Nutritionist

Acknowledgment

The material included in this pamphlet has been compiled from information obtained from the Food Products Laboratory of the California Agricultural Experiment Station; from South Dakota Extension Circular 350 "Drying Fruits and Vegetables at Home"; Montana Extension Circular 56 "How to Dry Garden Products" and from suggestions offered by the Home Economics Department of the Montana Agricultural Experiment Station.
Dehydration of Garden Products

By
Bessie E. McClelland
Extension Nutritionist

Drying is the oldest method of food preservation. It is so simple and requires so little outlay for equipment that it is especially useful when there is a shortage of jars or other equipment. Drying preserves foods by the removal of water, the product being reduced by the drying process to a fraction of its original volume. The organisms which cause spoilage cannot grow without moisture. The method is valuable for non-acid vegetables such as sweet corn, peas, beans, and spinach because there is no danger of botulinus poisoning.

Factors of Success in Drying

Successful drying depends not alone on the removal of water. Checking the action of enzymes is necessary if the product is to have a good appearance and flavor. Enzymes are responsible for color and flavor changes in the ripening and maturing of fruits and vegetables. The change in appearance seen when the cut surfaces are exposed to the air is due to the action of these enzymes. Vegetables may be precooked in steam or boiling water to check enzymatic action. Steam is preferable for most vegetables. Fruits, due to their sugar content, are easier to dry than vegetables. Steaming is not necessary but most of them are improved by soaking in a salt and sugar solution. A few fruits such as cherries are dipped into boiling water before drying.

Warm circulating air absorbs moisture more rapidly than does still, cool air, hence for uniform and rapid drying arrange for warm air to circulate freely about the product. Wire trays so made that they allow air to circulate under as well as over the product are most satisfactory. A fan, if available, can be used to hasten drying.
If too high a temperature is used in the first stages of drying, the surface of the product becomes overdried and delays the drying of the interior. Most products dry best between 100° and 150° F. When fresh fruits and vegetables have become about one-half or more dried, they scorch very easily. Therefore, during the last stages of drying, regulate the temperature carefully. For most products the temperature during the last half of the drying period should not exceed 150° F.

Sources of Heat for Drying

The material can be dried in any of the ways listed but some methods give better results than others.

1. With commercial or homemade driers, which use an oil burner or some other source of heat. Some have a fan arrangement to facilitate the removal of water by rapid circulation of warm air over the product. See directions at end of this leaflet for construction of dehydrators.

2. In the oven arranged on wire trays or racks. The oven should be left partially open so that the temperature will not go too high. A wire rack arrangement can be made to fill the oven to capacity. The product must be stirred frequently unless a fan can be used.

3. Above a cook stove or laundry stove on an arrangement of ventilated wire racks or trays. The temperature must be controlled so that over-heating with scorching does not result. This can be fairly rapid and the light would have little effect.

4. Out of doors exposed to sunshine and air. The dry atmosphere in Montana furnishes a good condition for out-of-door drying, but it is slower than oven. Products are placed on wire trays protected top and bottom with cheese cloth. There is little control of temperature by this method and exposure to direct sunshine and strong light tends to change color and flavor and to destroy some of the vitamins. Although the oldest method, this
is probably the least desirable from the standpoint of nutrition and is not recommended for vegetables.

(5) On a glassed-in porch which literally makes a sun drier. It acts like a hotbed, intensifying the sun’s heat, and so provides a higher temperature, which results in quick drying. This also has the disadvantage of too much light and products will sour quickly unless there is good circulation of air.

**Length of Time for Drying Product**

The time of drying will vary with the temperature, the kind of material to be dried and the size of the pieces. Vegetables must be “bone dry.” Fruit should be dried until leathery but not hard. Sliced vegetables, under good conditions, should dry in six to ten hours, sliced fruits in eight to twelve hours. Often some of the material is ready before the rest. In such cases, remove only the thoroughly dried products, and allow the rest to finish drying. If no fan is used it may take somewhat longer. The products will not be quite as good and must be stirred frequently to prevent souring.

**General Directions for Drying**

Select the product as carefully as for table use. Material that is inferior before drying cannot make a good product. Use extreme care in washing and preparing the material to insure cleanliness. Pare, slice or cut up as suited to the particular product. Steam or blanch the product in a colander until each piece is relaxed. Drain well. Spread in single layers preferably on cheese cloth or netting-covered wire screens. Dry as rapidly as possible, stirring occasionally. Much care must be taken if artificial heat is used, particularly after the food is half dried, to prevent any slightest amount of scorching which will impair the flavor. Do not allow temperature to go above 150° F. Use a thermometer. When vegetables are bone dry, cool them and store immediately in dust and insect-proof containers.
Vegetables

(1) Use vegetables fresh from the garden in prime condition.

(2) Wash, sort, trim, and prepare vegetables by paring, slicing, shredding, etc.

(3) Blanch the prepared vegetables by steaming, previous to drying. Steaming saves soluble food materials; sets the color; removes objectionable flavor; hastens drying by relaxing the tissues; checks ripening processes; and prevents undesirable changes in flavor caused by enzymes. It is preferable to boiling water.

(4) Steam vegetables by placing them in a wire basket, colander, sieve, or steamer over a kettle containing about an inch of boiling water. Boil briskly with cover on. Continue steaming until each piece is relaxed in appearance and texture, and heated completely to the center.

(5) Test to show when steam blanching is complete: Select small pieces of the steam-blanched vegetable from different parts of the steaming basket. Place pieces on a saucer and mash with a fork. Add a few drops of hydrogen peroxide (3 per cent diluted with an equal amount of water). Then add a few drops of benzidine solution (1 per cent in 50 per cent alcohol). A blue color indicates that blanching is incomplete. If vegetable is underblanched, continue steaming until the test shows no blue color.

(NOTE: If benzidine solution is not available, use a tincture of gum guaiac, 1 per cent in alcohol).

(6) Spread steamed vegetables on trays in layers one-half inch deep or less. Place immediately in the dehydrator.

(7) Vegetables must be dehydrated until "bone-dry." Time required is from six to ten hours.

(8) Pack cooled, dry material in insect-proof containers. Store in a cool, dark place.
## TABLE I
### SUMMARY OF VEGETABLES FOR DEHYDRATION

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Form for Drying</th>
<th>Blanching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>Use only tender tips</td>
<td>Boiling water 3 min. or 8-10 minutes in steam</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Stalks; trimmed, split if large</td>
<td>Steam 10-12 minutes</td>
</tr>
<tr>
<td>Beets</td>
<td>Peel and slice ½ inch thick</td>
<td>Steam 6-8 minutes</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>Cut in half</td>
<td>Steam 5-10 minutes</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Thin slices as for kraut</td>
<td>Steam 2-5 minutes</td>
</tr>
<tr>
<td>Carrots</td>
<td>Peeled, sliced ½ inch thick or shredded</td>
<td>Steam 6-10 minutes</td>
</tr>
<tr>
<td>Celery</td>
<td>¾ inch pieces or shredded</td>
<td>Steam 1-2 minutes</td>
</tr>
<tr>
<td>Chard leaves</td>
<td>Trimmed and washed</td>
<td>Steam 3-5 minutes</td>
</tr>
<tr>
<td>Corn</td>
<td>Cut from cob after blanching</td>
<td>Boiling water 8-12 minutes or steam 15-20 minutes</td>
</tr>
<tr>
<td>Kale</td>
<td>Trimmed leaves</td>
<td>Steam 3-5 minutes</td>
</tr>
<tr>
<td>Green lima beans</td>
<td>Shelled</td>
<td>Steam 5-10 minutes</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>Whole or sliced. Large ones better if peeled</td>
<td>Steam 5-8 minutes</td>
</tr>
<tr>
<td>Peas</td>
<td>Shelled</td>
<td>Steam 3-5 minutes</td>
</tr>
<tr>
<td>Peppers and pimentos</td>
<td>Whole</td>
<td>No blanch</td>
</tr>
<tr>
<td>Pumpkin and yellow squash</td>
<td>Peeled and sliced ¼ inch thick</td>
<td>Steam 4-6 minutes</td>
</tr>
<tr>
<td>Rhubarb</td>
<td>¾ to 1 inch pieces. Split if large</td>
<td>Steam 2-5 minutes</td>
</tr>
<tr>
<td>Spinach</td>
<td>Trimmed washed leaves</td>
<td>Steam 2-5 minutes</td>
</tr>
<tr>
<td>Summer squash and zucchini</td>
<td>Sliced ¼ inch thick, unpeeled</td>
<td>Steam 4-6 minutes</td>
</tr>
<tr>
<td>Turnips and rutabagas</td>
<td>Peeled and sliced or shredded</td>
<td>Steam 6-10 minutes</td>
</tr>
</tbody>
</table>
Fruits

Use fruits in prime condition, free from mold or blemishes. Apples, pears and large stone fruits are peeled, cored or pitted, quartered or sliced and soaked in a solution of salt and sugar for five minutes to prevent discoloration and protect vitamins. The fruit should be completely immersed in the solution and stirred gently. This solution contains:

- 1 gallon cold water
- 6 tablespoons salt (level)
- 1 cup sugar

This treatment is not necessary for other fruits.

Fruits should be dried until leathery but not hard. When hot, they will appear softer and less dry than when cool. Drying time will range from six to 24 hours, depending on thickness of pieces and type of drier used.

TABLE II
SUMMARY OF FRUIT DEHYDRATION

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Preparation for Drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>Peel and slice ½ inch thick. Soak five minutes in salt and sugar solution</td>
</tr>
<tr>
<td>Pears</td>
<td>Same as apples</td>
</tr>
<tr>
<td>Peaches</td>
<td>Peel and slice. Soak five minutes in salt and sugar solution</td>
</tr>
<tr>
<td>Apricots</td>
<td>Same as peaches</td>
</tr>
<tr>
<td>Plums</td>
<td>Pit, cut in half and soak in salt and sugar solution</td>
</tr>
<tr>
<td>Cherries (small)</td>
<td>Dip for one minute in boiling water, then pit or not as desired</td>
</tr>
<tr>
<td>Cherries (large)</td>
<td>Pit, but do not dip in boiling water. Stems may be removed after drying</td>
</tr>
</tbody>
</table>
Packing and Storing Dehydrated Products

The dried products, if allowed to stand exposed to the air, are very liable to become insect infested. While products are drying and afterward while they are cooling, they must be protected from insects. Wire screen or tightly stretched cheesecloth may be used to keep flies and other insects from products that are being dried in the open.

Immediately after the material is cool, pack in insect-proof containers such as tight cans or jars, or cardboard cartons lined with wax-paper or cellophane. Store in a cool, dry, dark place. If products are sufficiently dry, they will not mold and should keep in perfect condition. Greens and cabbage will not hold their flavor as long as corn, snap-beans and most other vegetables.

Preparing Dehydrated Foods for the Table

(1) Restore moisture by soaking the dried product in cold water one to three hours. Use about six to eight times as much water as dried product.

(2) Cook the soaked food in the water used for restoration. Cook slowly and do not over-cook.

The Home Dehydrater

A home dehydrater affords a simple and economical method of preserving surplus vegetable and fruit products by carefully drying the materials under controlled conditions. There are two types of simple dehydraters that may easily be constructed at home from scrap lumber, boxes, and other materials:—Natural Draft dehydrater and Air Blast dehydrater.
Type I. Natural Draft Dehydrater (see cover)

DIRECTIONS FOR BUILDING

This dehydrater consists of an upright cabinet with the following inside dimensions: height, 36”; width, 15”; depth, 30”; supported on four legs.

Sides—Build two frames, preferably of 2” x 2” material, 30” wide and 60” high over all, with one brace of same material flush with top of the 60” uprights; one brace of same material 36” from top and one brace of 1” x 2” material, 8” from bottom. Cover these frames on both sides with 1/2” to 3/4” plain lumber lined with building paper. This provides a dead airspace which conserves heat and increases the efficiency of operation. The top should be made of double thickness also and provided with a screened vent. A more attractive cabinet can be made by making a double wall of waterproofed plywood. The inside wall should be given four coats of shellac or varnish.

The lower part below the cabinet is usually left open as shown on the cover illustration. Sheet metal may be used to enclose this space to within four inches of the floor if there is need for greater conservation of heat. At least four inches must be left open to allow for draft.

Tray Runways—To the wall thus formed, nail one tray runway of 1” x 1” x 30”, 6” from the top. Place remaining six runways 4” apart, measuring from top of one runway to top of next. Place the two sides of the dehydrater in a vertical position and insert two measuring sticks 15” long, one on the upper runway; one on the lower runway between the sides. Measure the width of the dehydrater over all. Cut lumber accordingly for rear wall and top.

Nail one 3” piece on top at door end. Allow a 3” opening (ventilator), as shown in figure, for escape of moist air. Cover remainder of top.

Rear Wall—Cover rear wall to a depth of 36” and nail a brace of 1” x 2” material, 8” from bottom. (See cover.)

Door—Nail 1” x 2” brace to frame, even with lower edge of side wall. Build door to fit dehydrater. (See cover.) Attach with two hinges and a door clasp.
Trays—Cut seven pieces of hardware cloth, 14½" wide and 24" long. Cut 28 pieces of lumber ½" x 1" x 28", and 28 pieces of lumber ½" x 1" x 13½", for tray frames. Place two pieces of each length together to measure 14½" x 24" over all. Place wire screen on these strips and place four similar strips over the netting in position to make corners of tray firm. Nail firmly together.

Heat Spreader—On each side 6" from corners and 3½" above the lower edge of the cabinet, insert a screw eye or small nail from which to suspend, by pieces of wire, the heat spreader. This is a piece of sheet iron 12½" x 18½".

Heater—Place a heater under the center of the heat spreader, allowing 2" space between the two for circulation of air. It may be either a kerosene, electric or gas heater.

Cheese Cloth—To prevent the product from sticking to the trays or falling through the spaces in the wire screen, cut pieces of cheese cloth or other thin cloth to fit and place on trays.

Operating the Dehydrater

Position of Trays—Place the trays of prepared fruits and vegetables in the dehydrater with the topmost tray touching the door, the second tray touching the rear wall, the third touching the door, and so on, the remaining trays alternating in a similar fashion until the lowermost tray rests against the door. This forms the air channel which forces the air to flow evenly over all trays. An even flow of air is of great importance, as it carries to the products the heat which causes the drying and carries away the moisture liberated by the heat.

It is not necessary that the dehydrater be completely filled with loaded trays. It may be used with any number of trays from one to seven. Several different varieties of fruits and vegetables may be dried at the same time.

Thermometer—Place a thermometer on the center of the lowermost tray. (See cover.)

Temperature—Heat the lowermost tray to not above 150° F. and maintain a temperature range as nearly as possible to 150° F. The dehydrater should be opened at intervals of one-half hour,
more or less, and the fruit or vegetables on the trays examined and trays changed in position to cause uniform drying. When fresh fruits and vegetables are first placed in the dehydrator, there is little danger of scorching; but when they become about one-half dried they scorch very easily and a slight scorching destroys the flavor. Therefore, during the latter stages of drying use less heat and regulate carefully.

SMALL AIR BLAST DEHYDRATER

Figure 1.

Type II. Small Air Blast Dehydrater (see figure 1)

The small dehydrator described below is inexpensive and very satisfactory for home use.

It consists of a horizontal box or tunnel 143/8" x 157/8" inside cross section and 5' long. It is supported on four legs which extend to the top of the tunnel; these being made of four pieces
2" x 2" x 4', placed outside the tunnel. Four pieces 2" x 2" x 157/8" placed across the top and bottom at the ends and joining the legs give rigidity. The walls of the tunnel are made of 4 pieces of 5 ply ¾" plyboard 157/8" x 5'. However, the tunnel may be made of tongue and groove or other suitable material.

Inside the tunnel and extending its full length are four tray runways of 1" x 1" x 5' wooden strips placed 2 1/2" apart. The trays rest on these runways. Near the fan end is a door 14¾" wide for removal and examination of the trays.

The trays are 14¼" x 14¼" and are made of ¼" mesh galvanized screen with frames made of wooden strips ½" x 1" x 13¼".

At one end of the tunnel is a shelf extending 1' beyond the end of the tunnel and level with the floor of the tunnel. A medium size household ventilating fan rests on this shelf and furnishes the blast of air used in drying.

In using the dryer the trays of prepared fruits or vegetables are slid into the tunnel on the runways at the end opposite the fan. The tunnel holds 16 trays. In warm weather artificial heat may not be needed, in cool weather or cool locations a combination electrical heater and fan should be used. In either case, the air blown through the tunnel dries the product rapidly.

**Type III. Suspended Stove Dryer**

The suspended stove drier is one of the simplest and least expensive to build. It is made of three trays of ¼ inch mesh wire netting edged with wood suspended in an upright frame.

A light rope or wire is drawn from each corner at the top of the drier. Those four suspension cords are fastened to the end of a long arm attached to a wall bracket. Thus this drier can be swung over the stove. It is lowered and raised by a rope over a pulley.

Additional muslin may be thumbtacked around the cage to protect the products from dust and insects while drying. The
products may absorb odors from the food being cooked on the stove unless the homemaker is careful not to cook strong flavored foods during the drying.

This drier has the advantage that it can be pulled out of the way above the heads of the workers. Light material is used for construction of the joints as shown in figure 2.

**SUSPENDED STOVE DRYER**