



5 a Day the Sun-Dried Way



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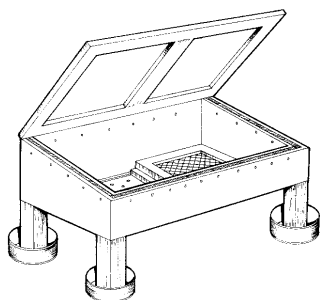
The 5 A Day Program gives a simple, positive message ~ eat 5 or more servings of fruits and vegetables every day for better health. This improved solar dryer can help you reach your 5 A Day goal.

Why Sun Dry Fruits and Vegetables?

Eating more fruits and vegetables can improve our health and reduce the risk of cancer, heart disease, and diabetes. For many people, however, the availability of fresh fruit and vegetables is limited for much of the year. Drying food in the sun is an ancient way to preserve local produce when it is abundant, using a free and non-polluting energy. Traditionally food was dried by laying thin strips on mats in the sunshine or by hanging it to dry more slowly in the shade. These simple methods, unfortunately, often produce dried food that has lost most of its vitamins and is contaminated with bacteria, yeast or mold.

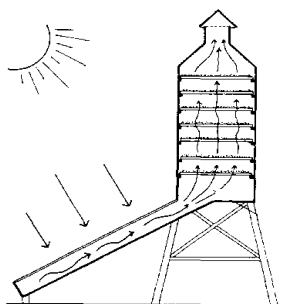
Solar Food Dryers

These two basic designs for solar dryers, from UN FAO drawings below, have addressed some of these problems, but still are limited.



One layer of drying tray

The sunlight that falls on the dryer is trapped and directly warms the drying tray. These dryers have poor air flow and often fail to reach ideal drying temperatures on cloudy days.



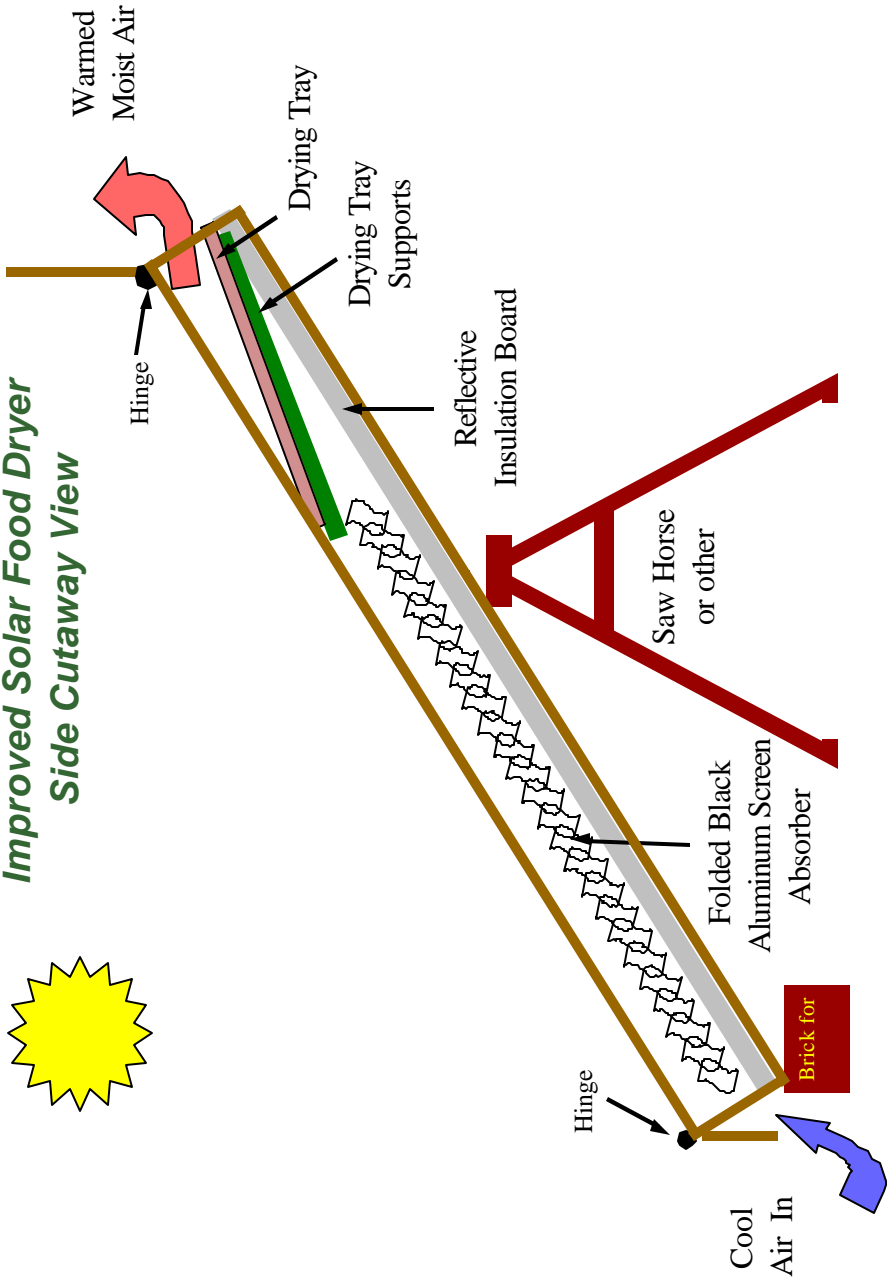
Many layers of drying trays

The solar collector increases the heat and air flow to the drying chamber. The many layers of trays then reduce the airflow, which often leads to uneven drying and moldy food.

Improving Solar Food Dryers

Leaf for Life has developed an improved solar food dryer that combines the best features from these two basic designs. Linking the simplicity of a one tray deep dryer with an efficient solar collector increases both the heat and airflow and thus accelerates the rate of drying. This enables us to dry a range of fruits and vegetables on cooler or cloudier days. This booklet shows you how to build and use this improved solar dryer.

Improved Solar Food Dryer Side Cutaway View

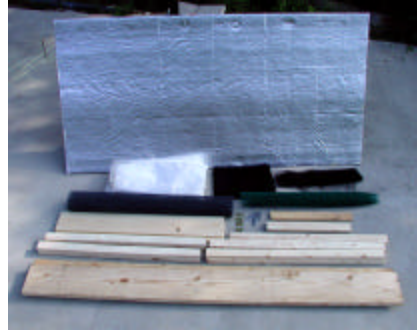


Build Your Own Improved Solar Dryer

Tools: This dryer can be built with these basic hand carpentry tools: hammer, saw, tape measure, square, scissors, staple gun, screwdriver, razor knife, tin snips and pencil.

Materials List:

- A. 2- 2"X10"X96" frame sides
- B. 2- 2"X4"X48" lower frame brace
- C. 2- 2"X4"X45" upper frame brace
- D. 2- 1"X2"X27" tray support
- E. 2- 1"X10"X48" vent doors
- F. 2- 2"X2"X44.5" tray frame
- G. 2- 2"X2"X24" tray frame
- H. 1- 1/2"X48"X96" reflective insulation board (polyisocyanurate)
- I. 48"X25' black or charcoal aluminum screen
- J. 9'X5' clear 4 year 6 mil UV treated polyethylene sheeting
- K. 56"X30" black polyester cloth (washed)
- L. 2- 12"X50" black netting for vents
- M. 48"X30" hardware cloth (galvanized or plastic)
- N. 4- 2 1/2" hinges (galvanized or brass)
- O. 4- 2 1/2" inside corner braces
- P. 24"X44.5" food grade polypropylene screen



Substituting Materials:

The dryer was built with materials available at most building supply stores in the USA. **1" (one inch) = 2.54 cm; 1' (one foot) = 30.5 cm.**

☞☞ Using 1" thick wood framing (A,B,C) will make a lighter and more portable but less sturdy dryer. You can use naturally rot resistant wood or treat wood with linseed oil, but avoid arsenic pressure treated wood.

☞☞ Glass will last longer than treated polyethylene (J), but it is very heavy and brittle. You can extend the life of polyethylene by keeping sunlight off it when it is not being used for an extended time. Fiberglass and acrylic glazings are also available from greenhouse supply firms.

☞☞ Polyisocyanurate (H) is very safe and stable in heat. If this type of board is not available several layers of cardboard covered with aluminum foil could be substituted. Don't use polyurethane or Styrofoam as they can soften and emit fumes at high temperatures.

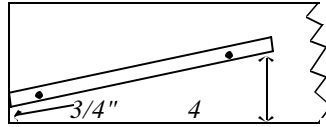
☞☞ You can replace polypropylene (P) with other heat stable plastic screen, but not with fiberglass screen as it will stick to food.

Step-By-Step Instructions



1. Attach Tray Supports

Nail or screw the tray support (D) to the frame sides (A).



2. Frame Dryer Bottom

Nail the four lower frame braces (B) to the frame sides (A) with 16d nails. Two should be flush with the end of the frame sides and the other two evenly spaced over the length of the frame sides. (centered at 32" and 64").



3. Cut and Fit Insulation Board

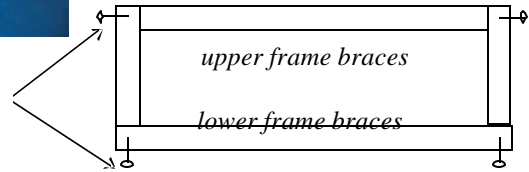
Cut a half inch thick reflective insulation board (H) to fit snugly into the frame. A razor knife will easily cut the insulation board.



4. Frame Dryer Top

Nail the upper frame braces (C) flush with the top of the frame sides so the glazing can be smoothly fastened. One should be centered at 27" from the top for attaching the black cloth (J).

16d
galvanize
d



5. Attach Top and Bottom Vent Doors with Hinges

The top and bottom vents are hinged wooden doors that can be adjusted to control the air flow. The top vent is also the door for removing the drying tray. Screw hinges (N) into the edge of the vent doors (E) about 3" from the end of the boards, then screw the hinges into the upper frame braces (C).



6. Make Sure Top and Bottom Vents Open Freely

You can add a third hinge in the middle of each vent door if needed for extra rigidity.



7. Staple Black Cloth

Staple black polyester cloth (K) securely to the frame. This will absorb heat from the sunshine and protect the drying food directly under it from ultraviolet rays. Be sure to wash it first as the color may run.



8. Fit Folded Screen into Dryer

Fold aluminum screen (I) into pleats of about 9" and staple it to the sides of the dryer. It should fit snugly in the dryer up to the black cloth (K). The screen absorbs solar energy and transfers the heat to the air entering through the lower vent. Black sheet metal can also be used but it will not heat the drying tray as well as screen.



9. Fasten Glazing

Stretch the greenhouse grade polyethylene sheeting (J) over the dryer frame. Double the plastic under about an inch on the top and bottom and about an inch over the sides of the dryer. Make sure it is stretched tight then staple securely. This takes two people and a bit of patience.



10. Staple Netting over both Vents

Both vents have a layer of sheer cloth netting (L) hanging between them and the dryer to keep out insects and dust. It should be a couple inches wider and longer than the vent doors. This fabric should have a weave that is open enough to allow free air movement.



11. Build Drying Tray

The drying tray is a wooden frame 44.5" X 27" (F & G). Reinforce the corners with steel inside corner braces (O) for rigidity.



12. Attach Hardware Cloth

Nail or staple 1/2" plastic or metal hardware cloth (M) securely on the bottom of the drying tray frame to support the food. Trim the edges as neatly as possible so that the tray doesn't snag the netting that covers the vent door. Cut food grade plastic screening (P) to fit inside the tray for easy cleaning.

How to Use the Dryer

Preparing fruits and vegetables for drying

☞☞ Harvest in the morning so that food has all day in the sun to dry.

☞☞ Most vegetables store better if they are blanched before drying. Blanching is done by steaming or microwaving the vegetables for about three minutes, more for tougher vegetables or bigger pieces. Blanching kills some harmful microorganisms, neutralizes enzymes that can affect flavor later, and softens the food for quicker drying.

☞☞ Generally fruits don't need blanching but benefit from a dip in an ascorbic acid (vitamin C) solution. Mix about 2,000 mg of vitamin C (crush a few tablets) in a liter of water and briefly dip the fruit pieces. This improves the color, flavor and nutrition of the dried fruit. A vitamin C dip may also be used on vegetables.

☞☞ Cut the fruit or vegetables into small uniform pieces. Food dries because water evaporates from its surface. Fine chopping or thin slicing creates more surface and faster, more even drying.

☞☞ Fill the drying tray so that air can move through the food.



Setting up your dryer

☞☞ Set your dryer up where it will be in full sun most of the day. The ideal location is protected from strong winds, dogs, baseballs and road dust and fumes, and near the garden and the kitchen.

☞☞ Face your dryer so that the bottom faces due south or within 15 degree of it. (due north if you

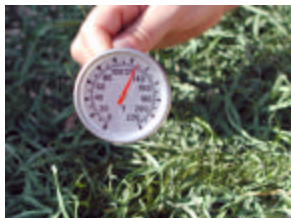
live in the southern hemisphere).

☞☞ Support the bottom of the dryer with bricks or boards to raise it a few inches of the ground.

☞☞ Raise the top of the dryer as high as possible while still allowing comfortable access to the dryer tray. Place a sawhorse or some other sturdy support under the dryer. Support the dryer on the framing, not the insulation.

Controlling temperature and air flow

☞☞ The ideal temperature for drying most foods is between 110-150⁰F (44-62⁰C). Greens do better towards the low end of this range and fruit at the high end. Herbs are best dried at about 90⁰F (33⁰C).



☞☞ Placing a compost thermometer in the drying tray is very useful for learning how the temperature in your dryer responds to changes in sun angle, cloudiness, amount of food on the drying tray, and vent openings. Once you are familiar with the dryer's performance you won't need the thermometer. Unlike most thermometers, ones designed for compost cover the entire temperature range you might encounter in your dryer. They cost between \$15-20 US and are available through garden supply catalogs or online at www.biconet.com/compost/thermometer.html

☞☞ There are several ways to raise the temperature in your dryer. These include adding glazing area or a second layer of glazing, more layers of screen, more insulation, or reflectors. Generally these are unnecessary and add to the cost and complexity of the dryer. Bear in mind that temperatures over 150⁰F (67⁰C) can damage food quality.

☞☞ On a clear sunny day with vents closed the dryer may heat up to 190⁰F (90⁰C), so it is important to leave the vents open when you dry food. Try opening the bottom vent about 1/2" (125mm) and the top vent about 1" (250mm) on an average drying day and double that on a very hot clear day. You can use a brick to keep the bottom vent open and a small block of wood to hold the top vent (door) open.

☞☞ As air around the black screen is heated it becomes less dense and rises until it leaves the dryer through the top vent. This creates a partial vacuum and draws in more air through the bottom vent. Air flow is critical because it replaces the humid air surrounding the food tray with drier air drawn in through the bottom vent. This speeds drying and prevents overheating.

☞☞ If food is left in the dryer overnight or on very cloudy days the vents should be closed. This reduces how much moisture the food will reabsorb from the cool air. Remember to open the vents in the morning.

Using Dried Fruits and Vegetables



Sun-dried tomatoes are a gourmet addition to pasta dishes. When making sauce, add dried tomatoes to thicken it and reduce cooking time.



Adding a tablespoon of dried greens to a fruit juice smoothie packs nutritional power into a morning drink.



Dried vegetables are a natural addition to soups and help you reach the recommended 5 servings of fruits and vegetables a day.



Dried apples, peaches, or pears add flavor and nutrition to a bowl of granola for breakfast.

As a general rule, fruits are dry when they feel leathery and vegetables are dry when they feel brittle. If you are not sure if a food is dry enough to store, it is better to be ‘too dry’ rather than ‘not dry enough.’ Bacteria, yeast, and mold can’t thrive below 12% moisture.

Glass canning jars with tight lids or heavy duty zip lock plastic bags are two of the best ways to store dried fruits and vegetables. Squeeze as much air out as possible before sealing. The sealed foods should be kept in a cool dark place, safe from rodents and insects. Most fruits and vegetables will keep for six months or more. The storage time will be significantly less at higher temperatures and more at lower temperatures. A root cellar or refrigerator can extend storage time.

If you plan to store food for more than six months, it is a good idea to pasteurize it after drying. This can be done by heating it to 175⁰ F (80⁰C) for 10 minutes or freezing it for 2 days.

More Solar Food Drying Resources

Indirect, Through-Pass, Solar Food Dryer

www.humboldt1.com/~michael.welch/extras/fooddeh.pdf

Understanding Solar Food Dryers

<http://idh.vita.org/pubs/docs/book28.html>

A Review of Solar Food Drying

<http://solarcooking.org/dryingreview.htm>

Fiberglass glazing (Sun-Lite)

<http://www.solar-components.com/>

Living Foods Dehydrators (food grade polypropylene)

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