savor summer

DRYING PRODUCE WITH THE SUN

by Eben Fodor

Drying food you've harvested from your garden or picked up at the local farmers market is fun and easy. And when you're using a solar dehydrator, the fuel is free.

A solar food dryer can become an important tool for capturing the summer's bounty and enjoying healthful produce throughout the year. We all know the anticipation of plucking the first ripe tomato from the vine—and then the reality that, in no time, you've got more tomatoes than you can give away.

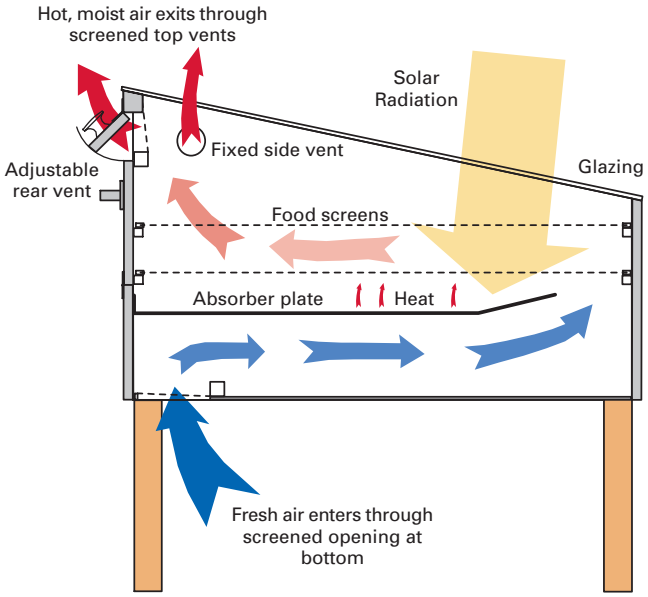
Some folks turn to canning and freezing to preserve their harvest, but drying can offer distinct advantages. First, it's simple and easy—if you can slice a tomato, you can dry food. Second, dried foods tend to retain more nutrients than canned foods, and don't require the energy of a freezer. Dried food is concentrated, reducing bulk and weight to one-half to one-fifteenth that of hydrated food, requiring fewer containers and less storage space. These convenient foods are easy to pack and can last as long as frozen foods, without the risk of freezer burn. Then there's the taste—~~even~~ with most of the water removed, a food's flavor comes through completely.

Simple Solar Design

Sun-drying foods outdoors on a screen or tray is low tech and economical, but leaves a lot of room for improvement. Open air sun-drying generally takes a while to get the food dry, putting it at risk for rot and assault from rain, dust, rodents, and insects. Indoor electric food dryers generally work well, but can consume 100 to 1,000 watts every hour they run, which roughly translates into $1 to $2 (or more) per load, depending on electricity rates. But if you have a sunny area on your patio, deck, or yard, a solar dryer, made of a few basic materials, such as glass, plywood, and screens, can produce outstanding results—without energy costs or pollution.

The same energy that grows your fruits and vegetables can also dry your harvest.

~~Basic~~ Solar Food Dehydrator



A well-designed solar dryer will work in most of the world, and anywhere in the lower 48 states where you can get two days of sunshine in a row. You can successfully dry foods in muggy climates and at outdoor temperatures down to about 50°F—as long as the sun is shining.

The basic solar dryer captures the sun's radiant energy and converts it to useful heat. It starts with an enclosure that surrounds the air and material to be heated. Solar energy passes through a clear or translucent material (usually a single pane of glass) on the enclosure's face and is absorbed by a matte-black surface—an "absorber plate." The absorber radiates the captured solar energy as heat into the ~~box~~, warming the air inside.

Most food dehydrator designs can be scaled to fit your needs.

For food drying, the air entering the dryer needs to be heated to temperatures between 100°F and 150°F, and moved across the food to remove moisture. Heat does two critical things to speed up drying. First, it raises the temperature of the air, enabling it to hold more moisture. Second, it warms the food, increasing the "vapor pressure" of the liquid water in the food to increase the rate at which water evaporates into the surrounding air.

Air movement is the second essential element of drying. It carries the moist, saturated air away from the food and replaces it with drier, heated air that can absorb more water. Airflow should be kept at a rate that allows the air to be heated at least 30°F above the ambient temperature, assuring that the air will rapidly absorb moisture from the food.

Natural convection can be used to move the air, so no fan is needed. When air is warmed, it expands, becomes lighter than the surrounding air, and rises to the top of the dryer. If

Preserving Local Choice

Inexpensive fossil fuel has allowed us to have produce any time we want. Winter grapes and plums from Chile, peppers from Mexico, tomatoes from gas- or oil-heated hothouses, and apples and pears from refrigerated storage warehouses are abundant in grocery stores across the United States.

Although most of us don't yet feel the pinch in our pocketbooks from this energy-intensive (and inefficient) food supply, we're paying the price in other ways. Transporting food over long distances (1,500 miles on average) consumes vast quantities of fossil fuels—about 10 to 15 calories of fossil-fuel energy are put into our food system for every calorie of energy we get as food.

Plus, shipping generates large amounts of carbon dioxide (CO_2) emissions. In our increasing demand for freshness, food is being shipped by faster, more polluting methods. Airfreight generates 50 times more CO_2 than shipping by sea. Much of our "fresh" produce is picked unripe and then gassed to "ripen" after transport, or highly processed in factories using preservatives, irradiation, and other means to keep it stable for transport and sale—using even more energy.

An alternative to this energy-hungry system is to expand the local food supply, supporting local farms, community supported agriculture groups, and farmers markets. Some people stick to a "250-mile rule" for buying food, voluntarily limiting their food purchases to items grown within a 250-mile radius of their home. But when the growing season is over, what can you do to extend your self-reliance in a sustainable way? For many, solar food drying offers one efficient, renewable solution to this challenge.

Preventing Pests

The food in your dryer may pique the interest of a wide variety of animals and bugs, but proper design and a few tricks can keep them away. Screen all vent openings to keep out flies and yellow jackets. Sturdy construction and good latches on the loading door will stymie clever raccoons and other dexterous creatures. To prevent an ant or cockroach invasion, dust each leg of the dryer with diatomaceous earth, a popular nontoxic insecticide made from fossilized sea algae (diatoms), or place each leg in a container with an inch or two of water to make a moat.

Dealing with Humidity

Consider a muggy summer day of 85°F with a relative humidity (RH) of 80 percent. If left in the open, food would dry very slowly. At 80 percent RH, the air can absorb only a small amount of moisture before becoming saturated (100 percent RH). But heating this air to 120°F in a solar dryer reduces the RH of the air to about 28 percent, increasing its capacity for holding moisture almost threefold.

Courtesy Appalachian State University

Well-designed through-pass collectors, like this Appalachian Food Dryer, are another solar food dehydrator design option.

we create an airflow pathway that allows cooler outside air to enter at the bottom of the dryer and warm air to exit at the top, we've created the necessary conditions for natural convection to work. The hotter the dryer gets, the faster the air will flow. Ideally, the airflow path should move across as much of the food as possible. A well-designed dryer will dehydrate food quickly—typically in one to two days. The operating principal of solar food dryers is different than "solar cookers" in that a flow of fresh air is encouraged in dryer, and undesirable in a cooker, which requires higher temperatures.

Building It Right

Solar food dryers must be able to endure the elements and keep your food dry. Exterior-grade plywood should be used for the cabinet, and the legs should be made from rot-resistant wood or other materials that can survive ground contact. Treated wood should not be used in any part of the dryer that comes in contact with the food or your hands during loading and unloading.

Any clear or translucent material that transmits a high percentage of solar radiation is a good candidate for the dryer's glazing. A single pane of clear, uncoated window glass is one of the best solar glazing materials. It transmits 86 to 92 percent of incident solar radiation and filters out most of the ultraviolet (UV) radiation, to help protect nutrients from degradation. It is better than plastic because it holds up well outdoors without yellowing or becoming hazy, is easy to clean, and can last indefinitely if not broken. Plus, it's inexpensive and readily available.

The screens for the food must be made from a mesh that allows plenty of airflow. They should also be made from an inert (nonreactive), food-safe material that can withstand temperatures as high as 200°F without stretching or sagging when loaded with food. Many available screen materials, such as galvanized metal and aluminum, are not suitable for food applications. Food-safe polypropylene screens are available, and are strong and easy to clean. They also come in various mesh sizes to accommodate different types of foods. Food-grade stainless steel screening is an option, although it's expensive and, in some dryer designs, may reflect some of the incoming solar energy, making the dryer less efficient.

The author's design, with extra mobile pest ~~extermination~~ on patrol.

DIY Solar Dryer Considerations

The best design will be ready to go when you are. It may sound appealing to build a dryer with a huge capacity, but a big, bulky dryer will be cumbersome to move and reposition toward the sun, require more materials, and be more expensive to build. Most people want units that are lightweight, easy to transport, and have little to no setup time.

A box-type design with about 5 square feet (0.5 m^2) of glazing area, constructed with exterior-grade plywood and topped with a clear pane of window glass, can work well. Its capacity is plenty for most home users, and a direct-heating design speeds drying by boosting the effective temperature by about 20°F. The clear glazing allows you to visually monitor the food without opening the unit. Two large food trays made from lightweight aluminum frames with polypropylene screens provide 10 square feet of drying area, enough capacity for up to 6 pounds of fresh food.

Be sure to size vents adequately to encourage good airflow through the dehydrator. Manually adjustable venting allows for temperature control, and screening on openings keeps out insects and other critters.

If you're in a climate that experiences extended periods of cloudy weather during the drying season or want to dry foods in the off season, consider designing your dryer with backup electric heating. Incandescent lightbulbs mounted inside the box can serve this function well.

A box-type dryer can be built in a weekend. If you use new materials, the complete dryer, with an adjustable vent and backup heating, can be built for about $170. For even greater savings, get resourceful and construct your dryer from reclaimed materials. Use screws to assemble the pieces to make repairs and replacing parts easier.

A high-performance solar dryer will dry food quickly—on par with a good electric dryer. It will provide years of savings, along with the satisfaction of harnessing renewable sunshine. Solar food drying is a great way to discover the amazing power of the sun and is a truly sustainable solution for preserving healthy, high-quality, locally grown produce to enjoy all year 'round.

Access

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Instructions for making a SunWorks ~~box-type~~ dryer are available in *The Solar Food Dryer: How to Make & Use Your Own High-Performance, Sun-Powered Food Dehydrator*, by Eben Fodor, 2006, Paperback, 128 pages, 0-86571-544-0, $14.95 from New Society Publishers • 800-567-6772 • www.newsociety.com

"The Design, Construction & Use of an Indirect, Through-Pass, Solar Food Dryer," Dennis Scanlin, *HP57*

"Improving Solar Food Dryers," Dennis Scanlin, Marcus Renner, David Domermuth & Heath Moody, *HP69*