

## COMMUNITY HORTICULTURE FACT SHEET #41 PLANT-PROTECTION STRUCTURES

Many of the plants we grow in the Puget Sound area are natives of much warmer climates. If we give them good cultural care and the weather cooperates, our plants do well. Usually though, the plants would have done better if we had a longer, warmer summer. We can extend the growing season and provide more heat for plants by growing them under protection.

Greenhouses or cold frames have always been built with glass and precise frames that were expensive. Now substitutes are available that are quite inexpensive and easier to use. They work well for starting vegetables and flowers and for growing cool-season crops such as lettuce during the fall and winter. They speed germination, increase growth and hasten maturity. They pay for themselves in vegetable production alone. "Bragging rights," when you out-produce a friend or neighbor, are a bonus.

### **MATERIALS**

**Corrugated Fiberglass** is usually sold for covering patios. It is semi-rigid and comes in colors or clear (actually opaque); use clear. It is 26 inches wide and available in lengths of 8, 10 or 12 feet. The long lengths are difficult to handle. It should last 20 years in the garden and is quite inexpensive.

**Rolled Plastic** comes in several weights: 6 MIL or 8 MIL, used for storm windows, is very clear. Sheets 3-5 feet wide are often sold by running foot. Though somewhat expensive, it will last 3 to 4 years with care. 4 MIL is folded and rolled in 10 or 12-foot widths and 25-foot lengths. It is sold in black or clear

(opaque), is fairly inexpensive and should last a year. 3 MIL is cheaper, but not recommended. It's like 4 MIL, but thinner and may not last all summer.

*NOTE:* There are rigid plastics that may be better yet, but they are expensive and tricky to use. We don't recommend starting with them.

### **MODIFYING MICRO-CLIMATES**

**Wind** Plants do not experience "wind chill" like warm-blooded organisms, but they do suffer stress in wind, usually related to its drying effect. Just stopping wind may greatly enhance plant growth on breezy sites.

**Greenhouse Effect** Even on cloudy days, sunlight reaches the ground. Glass and clear plastics allow over 90% of the sun's rays through to warm plants and soil. Rays reflected off these objects are of a longer wavelength that does not escape readily. It reflects from surface to surface causing further heating. On very cold winter days the sun can raise temperatures 60 degrees or more. With an all-glass or plastic structure much of the sunlight can pass through-in one side and out the other. Often structures are built with the north wall made from a non-transparent material to prevent this.

### **SUGGESTED STRUCTURES**

Ward Briggs, former WSU Master Gardener, and Holly Kennell, Cooperative Extension Agent, have tested various structures for many years in the Northwest, learning much by trial and error.

### **GREENHOUSES**

Ward feels most small commercial greenhouses and greenhouse windows are expensive, provide little growing and/or have no solid north wall.

He suggests a do-it-yourself greenhouse on the south side a building. His 8' high, 8' x 16' shed-style wood frame was covered completely with fiberglass panels. A later version had a fiberglass roof and 8 MIL plastic walls. It was easier to build, but needs new plastic every 4 years.

Holly likes greenhouse windows, but she agrees that they have too little space to be very useful. A factory-made greenhouse has space, but is, admittedly, a costly luxury. She feels the best justification for a greenhouse, purchased or homemade, is that it allows you to work "outside" comfortably on rainy days. She suggests solving the north wall problem by keeping the greenhouse's north side packed with plants, so little light can pass through.

### COLD FRAMES

Cold frames can be made in different ways. The only requirements are that they let in light and are sealed to keep in warmth. The other major design consideration is ease of opening for ventilation, weeding, watering and harvesting.

Wood used in cold-frame construction may be treated with copper naphthenate wood preservative. A final coat of white paint increases the reflective light available.

Ward and Holly have used several kinds of cold frames for years and consider them very valuable. Many cold frames can be moved around the garden seasonally to protect different crops (lettuce in fall, chard in winter, spinach in early spring and tomatoes in May).

**Lean-to** Old framed windows or glass doors are commonly available to be recycled into cold frames. Simply lean them against a sunny south-facing wall and cover the ends with wood, plastic or Styrofoam panels. Several windows of similar height may be lined up along a wall to create a long cold frame.

Frames with glass broken out can be covered with clear plastic. (Cover back and front for a

bit of insulation.) Plastic-covered frames are usually lighter and easier to handle than glass.

**Tent** No south-facing wall handy? Try leaning windows together, pup-tent style, to cover a bed. Windows should be hinged or latched together at the top for stability in wind. Some type of framework is needed for strength and to allow one side to be opened without the other falling. If you don't have enough windows, the north side of your tent may be made wood.

**Box** Old framed windows can also be used as covers for shallow, bottomless box cold frames. The window is hinged to the top of the box; alternatively, it may be supported by and slide on a piece of wood on the lower box edge. The box size is determined by the size of the window.

Most box cold frames are about 3 feet by 6 feet long. The back wall of your box cold frame should be taller than the front wall. This will maximize the amount of sunlight reaching the plants inside. Make the back at least 24 inches tall and the front at least 12 inches to allow enough room for growing plants. Sink a box frame several inches below the soil level or mound soil up around its base to insulate it.

**Hut** Ward replaced the conventional cold frames he used for tomatoes with a more versatile design that evolved over time. It has a permanent roof, which keeps the plants dry and helps prevent late blight.

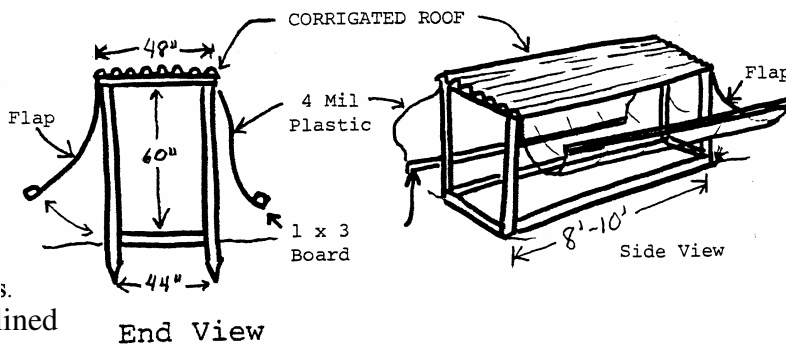


Figure 1. Tomato Hut

He raises the sides to ventilate during the summer and lowers them in the fall to protect the plants from light frost. The plastic tubing and clamps are necessary to prevent the wind from tearing the big flaps.

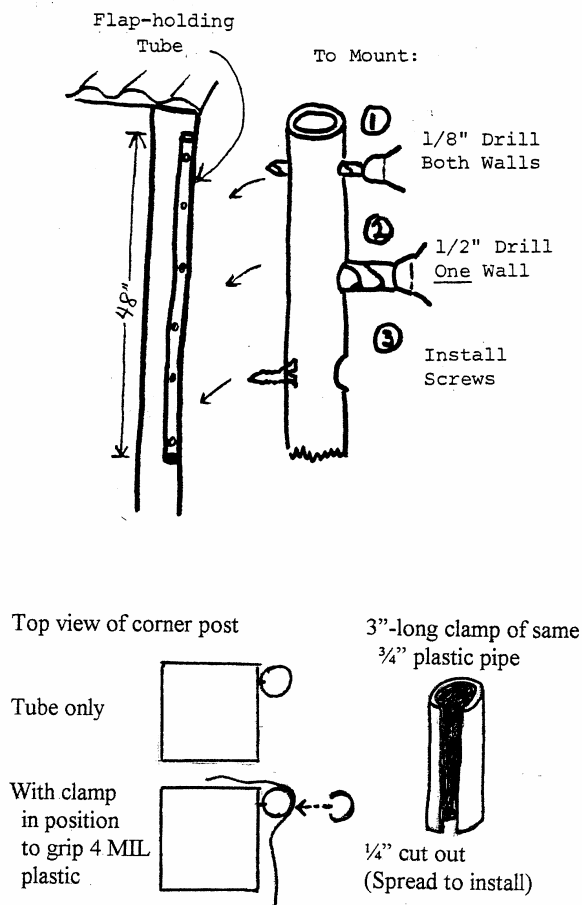


Figure 2. Flap-holder Details

**Using the cold frame** Use a maximum-minimum thermometer to monitor the temperature in the cold frame. The temperature is controlled by the amount you open the frame and the length of time it is open. The sun may over-heat the cold frame, even on cold days. Check the weather forecast and adjust as necessary. Automatic ventilator “arms” that raise the cover when temperatures reach a certain point are available for box cold frames. These save a great deal of worry about accuracy of weather predictions, if you aren’t home during the day.

Close the frame in late afternoon before the sun sets. This traps the sun's heat to keep the cold frame warm overnight. On extremely cold nights you may need to cover the cold frame

with straw, carpet or other materials for added warmth.

## TUNNELS

Both Ward and Holly really like using tunnels, but each uses a totally different kind.

Ward’s tunnels are simply 8-foot lengths of corrugated fiberglass bent into arches. The panels pay for themselves quickly and last a long time. Originally, they were bent around and fastened to end boards. These were bulky to store over winter and they sometimes blew over in a strong wind.

He discovered that he could use stiff wire to hold the panels in the desired shape, stand a piece of plywood at each end and have a temporary tunnel that was easy to dismantle. Now he can store many fiberglass sheets, wires and end boards in the same space formerly taken by 2 tunnel boxes. Wires also eliminated the need for weights on the tunnels during strong winds. To make long tunnels, overlap the sheets, place a wire at each overlap and another at each mid-panel. (The 4 loops in each wire are optional, but they hold the panel better and serve as handles for pushing the wire into the soil.)

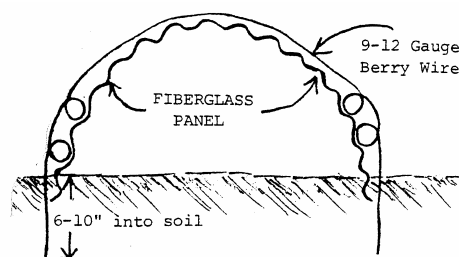


Figure 3. Tunnel

Ward starts vegetables, especially squash, corn, bean and other heat-lovers, under the tunnels. He uses the same panels many times each year. For example, a tunnel might cover peas first, move to beets or carrots about March 10, to beans 4-6 weeks later and then shelter newly planted squash late May through June. Tunnels also can revive last year’s Swiss chard for early greens and protect the first strawberry blossoms from frost.

Ward uses tunnels inside his greenhouse and tomato hut to increase early-season heat. He

covers tomato plants until the leaves touch it and begin to burn.

Holly's version of the tunnel is different, because she gardens in beds not rows. Her tunnel is actually a bed cover of clear plastic over plastic pipe hoops. It's made by cutting a 100 foot roll of black plastic water pipe into chunks about 8 feet long. (The stiff PVC pipe isn't as easy to use, since it's not as flexible.) The length will depend on the bed width and the tunnel height desired.

Pound 18-inch stakes into the ground every two feet on the long sides of the bed. The "stakes" can be stiff PVC, dowels, rebar or anything strong, but smaller in diameter than the black plastic pipe. Arch the black plastic pipe across the bed and slip the ends over a pair of stakes. When all the pipes are in place, drape clear plastic over the hoops, covered wagon style.

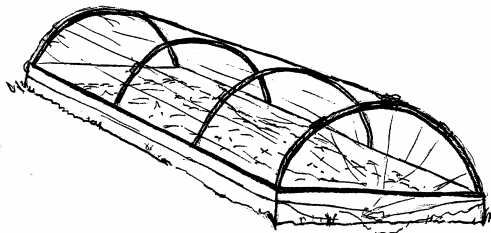


Figure 4. Plastic bed cover

The plastic is held to the hoop with clips made from the same pipe. Cut off 2 - 3 inch pieces from what is left of your roll. Make them into clips as shown in Figure 2.

If you have wood-framed raised beds, you can eliminate the need for the stakes. Attach metal or plastic pipe brackets every two feet on the

long sides of the frame. Slip the water pipe into these to put up a tunnel.

## **CULTURAL NOTES**

**Watering:** Greenhouses, cold frames and bed covers may require water every couple of days. In any of the structures, heavy dew in the morning and around dusk indicates that the air is saturated and watering may be postponed. Plants may dry out sooner than you expect, so watch them carefully. Ward's narrow row-cover tunnels may not require watering while in place, if the soil is wet at planting time. If they do, you do not have to remove the tunnel; just water well along the sides.

**Slugs:** Plant protection structures provide a warm, moist habitat ideal for slugs, but that's good. You can bait them in there and reduce later populations. Neither pets nor rain will disturb the bait and the tunnel (or frame) turns out to be a trap. Ward keeps his slug bait with his bent wires, so he doesn't forget to feed his slugs!

**Excess Heat:** You may be concerned about how hot it gets inside your plastic structure. Unfortunately, worry over excess heat causes many people to vent or remove a structure before it is necessary or desirable. As long as the air inside is very moist, the heat generally will not hurt the plants. In fact, many plants grow like crazy in jungle-like, steamy, 100°F-plus temperatures. Ventilation is important for tomatoes once the plants begin to bloom, since they will not set fruit at very high temperatures. With tunnels, Holly likes to close up the windy side and leave the leeward side open, unless cold temperatures are predicted.