



Extending the Garden Season I: Classic Cold Frames & Cloches



Would you like to extend your growing season in the spring and fall? Among the options you might consider are cold frames, hot beds, and cloches.

A cold frame is simply a mini-

ature greenhouse that provides warmth from the sun and blocks the wind. The sun's rays enter through a transparent cover and create a greenhouse effect that heats the interior of the cold frame. Many gardeners use cold frames to harden off transplants in the spring, but you can also grow salad vegetables in the fall and very early spring. Lettuce, radishes, and scallions will grow to full size in a cold frame before their regular outdoor planting season.

There are many different cold frame designs. The most common one is a wooden box with a clear lid that is hinged for easy opening. On a sunny day, air in cold frames can get too hot for plants, therefore the lid should be propped open so cool air may enter the frame. A system to manually or automatically vent the warm air is essential.

Almost any transparent material that light gets through will work for the cover: glass, polycarbonate, clear fiberglass, polyethylene, or flexible greenhouse coverings—the differences

between them are insignificant to the plants, but some will last longer in the garden and are less likely to break. Many people use old windows or storm windows. However, some old frames may be covered with lead-based paint and flaking lead paint in a vegetable garden is certainly not a good idea. Also, make sure the wood isn't rotting and the glass is secured firmly inside the frame. Windows are also design to shed water when they are vertical. Remember they will only be angled slightly so will collect water and snow. Depending on the angle, the weight of snow can mean glass isn't the best option.

Finally, don't rule out the old-fashioned cloche method. Frequently used for tomatoes or peppers, cloches add three to four weeks to the spring

growing season. These transparent "houses" cover a single plant. Examples include empty milk jugs, soda bottles, plastic covered tomato cages, or glass cloches. Old pillowcases are great for slipping over taller upright plants and cloches made out of various materials work well for smaller plants that cannot be brought inside. Large glass jars, milk jugs or buckets can provide similar frost protection.



"To get the full benefit of the frost protection materials, plants need to be covered before temperatures have dropped below freezing," advises Elizabeth Wahle, an Illinois Cooperative Extension Educator. "Secure the containers to keep them from blowing away in windy conditions. The protection needs to be taken off every morning when the sun comes out. Plants can easily overheat."

Sources:

Illinois Extension Service; Elizabeth Wahle and Rhonda J. Ferree, Extension Educators, Horticulture

www.rodalorganicle.com/garden/make-your-own-coldframe

Plans and resources:

theselfsufficientliving.com/cold-frame-plans-easy-build/

www.youtube.com/watch?v=r6m6pfN6kIU



Protect your garden from frost

You can employ different ways to reduce the amount of cooling in and around your garden and protect your garden from frost.

Your garden will warm up more during the day if it slopes toward the sun. Residual heat in plants and soil may determine whether your garden sustains frost damage during the night. Cool air, which is dense and heavy, will flow away from plants growing on a slope—what the experts call drainage.

A garden on a south-facing slope offers two advantages: more exposure to the sun, and better drainage of cold air. In deep valleys, nighttime temperatures may be as much as 18° F lower than the temperature on the surrounding hills.

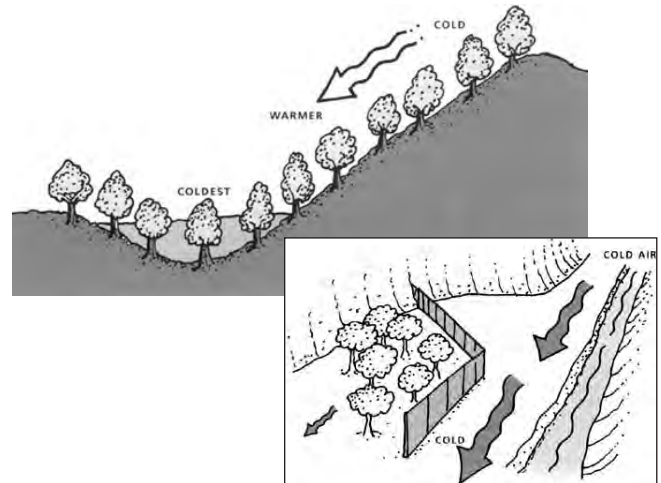
Trees surrounding your garden act like a blanket and reduce the amount of heat radiating from the soil, perhaps keeping the temperature high enough to protect your plants from early fall frosts.

Trees and shrubs can also act as a wind block, protecting plants, or you can create either a windblock or divert cold-air drainage with a fabric barrier.

A stone wall benefits the garden by acting as a heat sink, absorbing warmth from the sun during the day and radiating it slowly at night. The water in a nearby lake or pond (if it is one acre or larger) does the same.

Moisture is also a player in determining whether frost will nip your tomatoes. When moisture in the air condenses on plants and soil, heat is produced, sometimes raising the temperature enough to save the plants. On the other hand, if the air is dry, moisture in the soil will evaporate, removing some heat.

Good soil, full of organic matter, retains moisture, reducing the rate of evaporation. Mulch also helps prevent evaporation.



Images © FAO, Frost protection: fundamentals, practice, and economics - Volume 1
www.fao.org/docrep/008/y7223e/y7223e0c.htm

Plants themselves can modify cooling. Dark ones with a maroon or bronze cast may absorb more heat during the day. And those that have been planted close together create a canopy that entraps heat from the soil. More important, a plant's coldhardiness determines its ability to withstand colder temperatures.

If it has been a glorious fall day, with a clear sky and low humidity, chances are that temperatures will drop enough at night to cause frost. If you decide that frost is a possibility, cover your plants, especially the tender ones like impatiens, peppers, and tomatoes. Use newspapers, straw, old sheets and bedspreads, plastic tarps, or evergreen branches. Cover the whole plant; you're trying to retain radiated heat. It's best to have all covers in place well before sunset.

The first frost of the fall is often followed by a prolonged period of frost-free weather. Cover tender flowers and vegetables on frosty nights, and you may be able to enjoy extra weeks of gardening.



Extending the Garden Season II: Easy and Versatile Low Tunnels



Easy to make and easy to fit into most gardens, low tunnels extend the season or protect crops from insects. When you no longer need it, remove the cover and keep growing in the same spot, or pull out the hoops to store or use elsewhere.

Low tunnels are simply some type of hoop to support a row cover and keep it from touching your plants. While lighter-weight row covers, known as floating row covers, can be used without a support on some plants, the rubbing and friction and moisture-damage they may cause can be a problem for many plants. And when it comes to snow and ice, or supporting heavier fabrics and plastics, some type of hoop to hold the fabric is essential. (In the winter, any leaf touching fabric, plastic or glass coverings will likely die.)

Much, much large hoop houses are called high tunnels, and you can stand in them. But low tunnels allow a wide variety of plants to grow way beyond frost, as they are tall enough down the center for many plants, and allow shorter plants like lettuce to grow near the edges.

Low tunnels allow a choice of the many weights of spunbonded fabric available to cover various seasonal needs. The fabrics allow up to 90% of light to get through to the plants—on all sides of the plants, as there is very little “frame” to these struc-

tures. The most common weight and brand is Agribon+ 19, at 0.55 oz per sq. yd and 85% transmission of light. Weights go up to 2 oz per sq yd, although you can also double-up the lighter weights like putting another blanket on the bed, or just add a plastic layer over the fabric on colder days and remove it based on the forecast. (Ideally you can build with smaller and larger hoops to create an extra pocket of air between two layers.) For severe cold, plastic can be used, in which case you have to be sure to allow venting, just like you do with a cold frame. Construction-grade plastics work fine, but do degrade and transmit a bit less light than special UV-resistant, super transparent varieties made for greenhouse use. There is also a slitted plastic variety which self-vents.

The hoops you make or buy for frost protection can serve with light-weight fabric to keep insects off plants during the main growing season, warm up the environment for heat-loving veggies, and hold up shade cover for growing lettuce in mid-summer. For example, leafy greens subject to flea beetles can be protected under grow cover the entire growing season; squash and melons can resist squash vine borers initially, but you have to remove the covering to allow pollinators in once female flowers appear or you will have no fruit!

Making or buying hoops

You can make your own hoops from 1/2” electrical conduit (EMT) or PVC plastic piping.

The electrical conduit is better able to withstand snow loads and is very versatile in the garden, and will not degrade over time like PVC. PVC may also react with the plastics in a plastic covering and lower its life. A 10’ section is around \$2 vs. PVC at about \$1.50. I use PVC fittings and PVC pipe to create a purlin (a horizontal beam along the length of a roof, connected to a main rafter) to connect the hoops and support the fabric between hoops. Just remember to put the connector on the hoop while you are bending it or you won’t be able to get it on later. You can get a specialty bender for different hoop sizes, use a standard conduit bender if you have one, or build a template with scrap plywood and screws. It’s possible to bend PVC without a tool or a template by hammering rebar or a larger pipe



Photos courtesy Johnny's Seeds



White House Assistant Chef Sam Kass and Agriculture Deputy Secretary Kathleen Merrigan prepare hoop houses at the White House Garden and the final result, below
<http://blogs.usda.gov/2010/12/06/high-hopes-for-high-tunnels-3/#sthash.OpjAdCco.dpuf>

into the ground, inserting the end of the PVC into it and slowly bending, or you can steam-heat the pipe and easily bend it to the form you need. Don't do this when it's really cold, as it will be brittle.

The arc you create should accommodate the size of the fabric/plastic coverings you have and work with (usually 83") as well as the size of your beds. If you create too large a hoop you will need much wider fabric than is economically available. Generally that means 6' maximum of bent hoop above the soil level (leaves 6" of fabric on each edge to hold down); with EMT you want another foot on each side to push into the soil; with PVC you will probably cut to this length and insert over rebar or other buried anchors.

For smaller use, especially temporary protection, Hoop Loops made from 6-gauge galvanized steel are available from Johnny's Seeds in three sizes. Just stick these 22" tall supports in the ground every few feet and run twine through the loops to create a structure to hold up the row cover in minutes.

Hold-downs to keep covers in place

When you first use this method you will be amazed at the wind's ability to rip away your coverings. It's this same wind which is most damaging to plants! Holding down the edges is obvious and essential. Some people bury the edges under soil or use rocks, but for the most part this is not sufficient. Plastic and metal staples are available. The large row cover pegs from Johnny's will last years and really do the job. Two-by-four lengths of wood laying on the edges of the fabric are also effective. Adding a length of twine between your hoops on the inside of the tunnel will not only increase the stability and keep the cover from touching plants, but it will allow you to use low-cost clothes pins to hold the cover in place. Others use rope along the outside and anchored into the ground. If you have lots of room at the end of your row you can gather the fabric together at the ends, tie the bundle with a cord, stretch it out taut, and anchor it about 3-feet from each row end.

Light snows are no problem for the fabric coverings, but any heavy snow should be removed to prevent the weight from collapsing your coverings. Plus, it will turn to ice as the interior heats up!



Your row covers will last a few years, but holes are likely; they can be patched by sewing scraps in with dental floss according to some. Store them dry and folded and keep them from blowing away when not in use.

Watering is seldom needed in the winter, but check carefully in late winter or early spring as things heat up and the day length increases, especially if you are using plastic, which prevents the entry of moisture.

The protection factor may be only a few degrees, but you can combine it with other techniques, like leaf mulch, wind breaks, containers of heat-holding water or stone, to grow under more severe conditions. In any case, a low tunnel will allow protection from the first few frosts and allow an earlier start in the spring.

Sources:

Materials for hoops and construction-grade plastic is available at local home improvement stores

Specialty hoop-benders, row cover, anchors, and mini-hoops are available from:

Johnny's Seeds,
www.johnnyseeds.com/c-234-season-extension-supplies.aspx

Grow Organic/Peaceful Valley,
www.groworganic.com/growing-supplies/frost-protection

Resources:

Coleman, Eliot; *The New Organic Grower's Four Season Harvest*, Chelsea Green Publishing Co., Post Mills, VT.

USDA:
www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mipmcar9780.pdf

Maine Organic Farmer's Association,
<http://www.mofga.org/default.aspx?tabid=844>



What to grow in the winter



Kale and Leeks, Lettuce and Spinach. These may be the crops you think of for season extension, and you would be

right, but don't stop there!

In general, hardy greens will grow best, and careful selection of the variety is helpful. Without heat and lights and a high tunnel, you are not growing tomatoes in Evanston in the winter!

For most winter crops, the time to start them is actually in August. You can start Spinach and Mache as late as mid-October, however. (You may need to start the Spinach seeds inside if soil temperature has dropped below 50 degrees, but Mache prefers cooler soils.) You can also start lettuce then outdoors for Spring harvest.

The reason plants need the late-summer start is a short day-length in the winter, which is one of the biggest challenges in northern latitudes for season extension, especially for early winter. Protected plants may survive, but they don't grow very fast. Eliot Coleman, guru of year-round gardening, calls the period of less than 10-hour day length the Persephone Period. See the sources for a chart from Johnny's Seeds for planting dates based on the number of weeks before the last 10 hour day, which for Evanston is around November 10. Day-length becomes 10 hours or longer again here around February 1.

Johnny's Seeds provides information on what they think are the most successful winter crops as well as winter varieties. Here are their findings:

Most Reliably Successful: Kale, Tatsoi, Spinach, Claytonia

Second Most Dependable: Pac Choi, Cilantro, Arugula, Mizuna, Cress

More Challenging: Carrots, Bunching Onions, Lettuce, Chard, Turnips, Radishes

Eliot Coleman rates plants and varieties for dependability, too, but his rankings differ. His Four-Season Harvest book also shows planting dates for coastal Maine, which is similar to Evanston.

WINTER HARVEST CROPS

In Eliot Coleman's order of Cold Tolerance and/or Winter Dependability

- | | |
|-----------------|---------------|
| 1. Mache | 12. Arugula |
| 2. Scallion | 13. Escarole |
| 3. Spinach | 14. Endive |
| 4. Tatsoi | 15. Radicchio |
| 5. Carrot | 16. Chicory |
| 6. Claytonia | 17. Parsley |
| 7. Sorrel | 18. Mizuna |
| 8. Chard | 19. Dandelion |
| 9. Minutina | 20. Turnip |
| 10. Lettuce | 21. Mustard |
| 11. Beet leaves | |

Sources

Planting chart

www.johnnyseeds.com/t-winter-harvest-planting-chart.aspx

Day-length chart

aa.usno.navy.mil/cgi-bin/aa_durtablew.pl?form=1&year=2015&task=-1&state=IL&place=Evanston

Winter growing (in Kentucky):

www.motherofahubbard.com

Everything:

Coleman, Eliot; The New Organic Grower's Four Season Harvest, Chelsea Green Publishing Co., Post Mills, VT.

Coleman, Eliot; The Winter Harvest Handbook, Year Round Vegetable Production Using Deep-Organic Techniques and Unheated Greenhouses, Chelsea Green Publishing, April 15, 2009, ISBN: 9781603580816