

Gathering Summary: Garden Season Extenders

How to maximize your garden output,
without spending a boatload of money.

by Don Bates,
March 23, 2011

Low Tunnels, Hoophouses, Cold Frames



Summary by Catherine Haug; Photos by Don Bates unless noted otherwise (see [Garden Season Extenders Slideshow](#) for more, & larger views).

(photo, right, shows row covers & hoop houses in a shoulder season)

Introduction

Don has gardened since childhood, when his father gave him the north side of the garage for his garden. But he is an engineer by profession.

About sustainability and peak oil: While he doesn't know how to prepare for a world with no oil, he can imagine one in which oil and its products are much more expensive/less available. It is possible to prepare for that reality. He chooses to use some petroleum products (e.g. greenhouse film) because they are presently available and inexpensive.

Don's philosophy, as indicated by his presentation's subtitle, is minimal cost and minimal intervention, while avoiding energy-intensive technology when possible.

NW Montana has a few gardening challenges, including: short season, cold nights, lousy Junes and low humidity. Effective use of season extenders can minimize these impacts upon the productivity of your garden.

The following topics were covered:

- Seed Starting - all season long;
- Multi-cropping and timed plantings, to extend season from Feb 15 through Nov 15;
- Low tunnels (row covers);
- cold frames
- hoophouses (high tunnels)
- combinations of these

He provided three handouts (now published as printable pdf files on the ESP website):

- [Garden Season Extenders: References & Resources](#);
- [Garden Season Extenders Slideshow](#); and
- [Planting Dates for Kalispell MT](#)

Recommended book *Four Season Harvest*, by Eliot Coleman. Eliot is from Maine, which has a latitude and climate similar to ours. (See [Amazon](#) for a peek inside).

Garden Possibilities

The first of his slides are of his garden and samples of his harvest at different times of the extended 2011 season:

- May: Cold frame and a fresh salad in May;
- July-August: Full garden. Planting as thick as possible minimizes weeds;
- August: Stir-fry harvest;



- October hoophouse: Red-ripe roma tomatoes & habaneros (*see photo, left*);
- November: Fall veggies (planted for fall harvest, but he left some in for later);
- January: A cold-tolerant kale dug from snow is super cold-hardy;
- February: Belgian endive, forced in sand-filled bucket (*see photo, above right*).

His very intensive garden provides 80% of their year-round produce; they are able to eat only 20% of the production in the summer.

Methods: Mixing it Up

Don practices multi-cropping by combining benefits of each of the various methods for different crops at different stages of growth, to maximize use of his space. For example, he starts seeds of early crops indoors before transplanting to the hoophouse, then following them with a warm-season crop such as tomatoes. Or in the garden, he follows quick crops (e.g., scallions, radishes, peas, & garlic) with fall crops (e.g., beets, napa cabbage), which are started in pots several weeks before transplanting into the garden in mid-summer.

Seed Starting

(*photo, left, of windowsill seed starts, Feb 15*)

A window with southern exposure and fluorescent bulbs is best for starting seeds. Don uses commercial seed-starting mix; in fall he saves buckets of compost to use for starting seeds in spring.



If choosing between warmth or sun, go for sun. They will get leggy in a warm but poorly lit window, which is something from which they may never recover. In a hoophouse or cold frame, they will have plenty of light to make them strong.

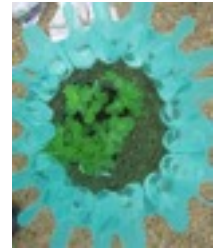
Move starts to the hoophouse or cold frame when they are up and strong. Frost hardy plants can stay in the hoophouse on all but the coldest nights; bring tender plants inside at night until danger of frost is passed.

Hardening off: Not required if move seedlings to the hoophouse/cold frame; required before transplanting in the garden to avoid sunburn, because the hoophouse/cold frame will not have exposed them to much UV light.

Wall-O-Water (Wall of Water)

(photo from [University of Oregon Study](#) by Littman, Spence)

An ingenious season extender made by [Wall-O-Water, Inc.](#) (based in Dillon, MT), they are quite inexpensive and work well. Plants won't freeze until tube water freezes - awfully cold. Good for tomatoes, peppers, squash. If tubes develop leaks; simply repair with silicone rubber.



To fill with water, put it around a 5-gallon bucket, then fill tubes from hose. Fill only $\frac{2}{3}$ full of water in the early season. The top will close up, like a teepee, helping to hold heat at night. About a week before planting, prep the area where you intend to plant, then set the Wall-o-Waters out to warm the soil. For squash, remove Wall-o-Water when plant starts to get crowded. See [wall-o-water.com](#) (9) and [ehow.com](#) (9) for more.



Low tunnels (row covers)

Don uses wire hoops made from coils of 9-ga galvanized fence wire. These are draped with covers of Remay or Agribon cloth. The cloth is held down by bricks. His tunnels are 30" wide and 16' long. (see photo, left). For full-size summer crops, you need longer lengths of wire for wider and taller rows.

There are 3 - 4 different weights of fabric for different levels of cold protection. Don uses the lightest, which allows 85% light penetration, but doesn't provide much frost protection; the heaviest one allows only 50% light transmission but better protects from frost.

Low tunnels can be used in spring, summer or fall, for different reasons. In spring mode, use narrow beds (30" wide). Let tunnels warm up the soil before sowing, for a 3 - 4 week jump on seed germination; then plant across the width. Pull back cover on warm day. When the plants get going, pull the hoops and let them grow.

For insect control, use a very thin fabric made specifically to keep out bugs and birds; leave on throughout the season. Very effective.

To construct: Don buys a coil of 9 ga. wire for \$17, and it's already about the right diameter. Cut 77" lengths of 9 ga. wire, then straighten the ends for 18", to make an inverted U-shape. Stab into ground, spacing hoops 30" apart and 30" wide.

Dig 5" deep trench along one side & bury one long edge of fabric. Bring fabric over hoops; secure other side and ends with flat bricks. Avoid round stones, as strong wind can lift fabric, rolling off the rocks.

Q: Why not visqueen?

A: It overheats.

Q: Will rain go thru?

A: Not really; it's necessary to remove the cover to water, then replace. Or use drip irrigation.

Cold frames

Hot frames are heated by manure under the device. Cold Frames are solar-heated (*see photo, right*), and provide lots of bang for the buck; a good place for flats of starts, as well as growing early or late crops.



Don's is a wood box with covers made from greenhouse film. They automatically open/close by use of automatic beeswax greenhouse openers. Don recommends using the kind with detachable bracket; good ones (Univent) are \$90/pair.

A closed cold frame will overheat quickly when sun comes out; without automatic openers, you will most certainly forget to open the covers at some point, killing everything inside. A cold frame provides much warmer temperatures in the spring. On a cloudy day it will be 50° inside; if sun is peeking through a cloud cover, it will be 60° inside. With a little sun, soil temps will easily reach 80° F, which is a good maximum temp.

Don's cold frame is designed to convert to a hoophouse by removing the hinged lid, then inserting the hoops into holes drilled in the wooden base of the cold frame.



To construct: Don built a 5' x 8' redwood box, using two 2x6s stacked on edge, with top edge of each end at a slant, allowing covers to drain. Position with high end on north side, so covers tilt to south. Cedar, concrete Hardy Plank, or Trex are other options. Don't use pressure-treated lumber because of toxicity. Because of its size, Don leaves space to stand inside his box so he can reach the center.

For the cover, you can use old windows but beware of lead paint. Also glass is too heavy for the automatic greenhouse openers. Don covered a wood frame with greenhouse film. Polycarbonate panels are light enough to be used with automatic openers, and have some insulating value, but are more expensive.

Don made two covers that are hinged at the middle of the box, then placed one greenhouse opener at each end for ventilation (*see photo, left*).

For additional frost protection on cold nights: cover cold frame with blankets or straw mats; bank sides with soil or straw as insulation; drape Remay directly over plants.

Audience comment: Habitat for Humanity Re-Store makes these for sale.

Q: The tunnels in polycarbonate greenhouse panels can suck up water by capillary action, leading to problems. Any way to seal the ends or otherwise avoid the problem?

A: Don has no experience with this. One member of audience said that sealing with silicon doesn't work because it gets gummy. Cat contacted Jeffrey F, who used triple-wall polycarb panels for his greenhouse. His response: "*Our greenhouse uses triple wall polycarbonate for the roof and much of the wall surface. I am not aware of any problem such as you describe. It hasn't happened here, and I have not read anything about it (and I researched this quite thoroughly).*"

Hoophouses

(Photo, right, of small hoophouse)

Especially useful for tall, long-season crops such as tomatoes & peppers, but also for early/late season crops, and for seedling rearing.



They get quite warm on a sunny day, so include a ventilation plan. They are also more humid and provide wind protection.

A single-layer cover of greenhouse film provides little frost protection, as nighttime temperatures are barely warmer than ambient temperature. For additional frost protection: use portable heater, or place a Remay cover directly on plants inside the hoophouse. Use Wall-o-Waters inside the hoophouse for tomatoes started before all danger of frost is past. More expensive approaches include using a double layer of film, or polycarbonate panels. (Note: while polyethylene film could be used instead of greenhouse film, it has a short life when exposed to UV rays, so it's lower cost doesn't really warrant its use).

Don's design utilizes 6 ml greenhouse film over a PVC hoop frame attached to a wood base. It has a ventilation door operated by an automatic greenhouse opener. And he can roll up the sides around a PVC pipe, using PVC elbows on the ends as a crank.

There are many different ways to build a hoophouse. Don has a small one (5'x8'; see photo above) and a large one (11.5'x12', with 7' center height).

Plants get big in these hoophouses, so plant accordingly - give them room to grow with adequate space between them.

Q: Do you leave the sides up all summer?

A: Yes and no. They are up/down as needed. Though the days can be warm, the nights can be cold, and tomatoes don't like cold nights.

Q: What about pollination in the hoophouse?

A: Read up on how each individual crop pollinates. For example, tomatoes wind-pollinate, but there is no wind in the hoophouse. You can create wind by the use of a fan, but Don walks along his rows and gently shakes the blooms to move the pollen every few days, and achieves nearly 100% fruitset.

He also notes that while honeybees get lost in a hoophouse, bumblebees can navigate inside them. So be sure to protect your native underground bumblebee hives. [see [Gathering Summary: Pollinators and their Habitat](#) for more].

Q: What about thinning?

A: Plant so that when a plant is as big as it wants to be, it's just crowding its neighbor, leaving no room for weeds and maximizes productivity.

Q: Do you overseed and then thin?

A: Yes.

Q: Do you provide supports for climbing plants?

A: Yes. Don tried to design the horizontal supports for his hoops so they would be right above a climbing crop, allowing him to hang supports from the horizontals. But you can also build a fence-like structure for climbers.

To construct a hoophouse:

(Photo, right, of large hoophouse)



Don's method:

- Wind can be a significant problem, so design the siting and ventilation of your hoophouse accordingly, with the ventilation door on the down-wind side. **DO NOT** underestimate the force of wind, especially if it gets inside the hoophouse; it will inflate it and blow it apart.
- Build a wood frame out of 2x6 redwood, to be the base.
- He drilled holes in the frame to support 12" lengths of 1/2" rebar. Each hoop (large hoophouse) is made from two 10' lengths of schedule 80, 1" PVC conduit ; each end of the hoop fits over the rebar. Caution: take care when placing PVC over rebar - it can really hurt if it gets away from you.
- In each corner, he used a 4' length of 1/2" rebar driven into ground to secure the hoophouse, noting, again, that one should not underestimate the problem of wind.
- Horizontal cross members are also 1" PVC, and secured to the hoops with bailing wire covered with white electricians tape.
- If you have a lot of wind, eliminate the frame and drive long rebar stakes directly into ground. Attach PVC, then dig a trench to bury the film along both long sides. You won't be able to roll up a side for ventilation, so you need ventilation at both ends of the hoophouse to prevent overheating
- To secure the plastic film to the hoops, get clips designed for PVC or for steel; note that 3/4" PVC has different outside diameter than 3/4" steel tubing. (see Don's Resources at the end of this document). Be sure to sand the corners so they won't tear the plastic. Then drill hole in them for sheet metal screws, to secure the clips to the hoop, as their grip loosens with time.

Other methods can also be used; for example:

- Steel electrical conduit is light and cheap, and stronger than PVC [may also be less toxic and more recyclable].
- Steel tubing from top rail of chain-link fencing. You need a bender to form hoops; PlantLand in Kalispell has kits and hoops. Or you can google 'hoophouse bender' for sources; they run about \$100 (see Don's Resources at the end of this document).

Audience comment: You can also use the ball of a towing hookup to bend the stuff.

Don's Afternote: Anyone building a hoophouse needs to consider the issue of "salt" buildup in the soil. If you water with hard water, the dissolved minerals accumulate in the soil as water evaporates. If you leave the hoophouse up all winter, you don't get the annual flushing of rain/snow that would remove these. Eventually, the mineral content will adversely affect soil productivity. Options include: removing film seasonally, or making hoophouse portable, so that it can be relocated periodically.

More Audience Q & A's

Q: What do you use for pea greens (sprouts)?

A: Grey Dwarf variety; you don't need a trellis if you plant thick.

Q: What soil do you use?

A: Don had good topsoil to begin with. He adds 1 - 2 pickup loads of composted weed-free horse manure annually, but he also has chickens.... He uses compost as mulch, rather than digging it in - he lets the worms do all the work.

Q: How do you water?

A: With a hose and sprinkler, but it's hard to do this in a hoophouse once the plants get going. He intends to add a drip system for this season.

Q: What do you use for walkways?

A: Straw. However, he gets volunteer grass (wheat) which is a minor weeding problem.

Q: How do you force Belgian endive?

A: The forcing of endive can begin late in the fall, and continue through the winter. It seems to take about 4 - 6 weeks to reach optimal eating size, depending upon the room temperature.

Don's Resources

References

- "Four Season Harvest", Eliot Coleman (Don's gardening bible; highly recommended) For a peek inside, see Amazon: www.amazon.com/Four-Season-Harvest-Organic-Vegetables-Garden/dp/1890132276
- "Winter Harvest Handbook", Eliot Coleman (for advanced users)
- "The Polytunnel Handbook", McKee & Gatter (written by a couple of Brits, so not "climate appropriate", but otherwise has a lot of good ideas)

- Google and Youtube: search: row covers, low tunnels, hoophouses, polytunnels. Also see Johnny's Selected Seeds (www.johnnyseeds.com). Lots of info, but pay close attention to the climate of the poster.

Sources of Supply

- Hoopers, Hwy 35, Kalispell
- Johnny's Selected Seeds (www.johnnyseeds.com): row covers, greenhouse film, accessories. Not the cheapest, but small quantities and sizes available.
- Territorial Seed (www.territorialseed.com): Same as above.
- Dripworks (www.dripworksusa.com): Drip Irrigation.
- Peaceful Valley Farm and Garden Supply (www.groworganic.com): Drip Irrigation
- Charley's Greenhouse Supply (www.charleysgreenhouse.com): Self explanatory.
- McConkey (www.mcconkeyco.com): A commercial greenhouse supplier
- CHS, Kalispell (www.chsmontana.com): Good source for 9 ga. wire for hoops. Ask for 10 lb big coils. Under \$20. Any good fencing supplier would also have it.
- Plant Land, Kalispell (www.plant-land.com): Selling homemade hoophouse kits and parts.

Other References

ESP Articles

1. [Season Extenders: Cold Frames & HotBeds \(From SavvyGardener\)](#) (printable pdf)
2. [The EssentialList: Cabbage, Coleslaw & Sauerkraut](#)
3. [The EssentialList: Fall Planting of Veggies](#)
4. [The EssentialList: Garden Hoops from Natural Materials](#)
5. [The EssentialList: Harvesting & Growing Garlic](#)
6. [The EssentialList: Potatoes: Planting, Growing & Harvesting](#)
7. [The EssentialList: Sequential Planting Through the Seasons](#)

Other websites

8. NPR article: [Old-Time Methods Yield Spring Greens All Winter, by Nancy Shute](#) (www.npr.org/2011/03/21/134664834/old-time-methods-yield-spring-greens-all-winter)
9. How to use a Wall-O-Water (www.wall-o-water.com & www.ehow.com/how_2267748_use-a-wallwater.html)
10. Univ. Oregon study by Littman, Spence. (pages.uoregon.edu/sspence2/wallowater/methodology.html)