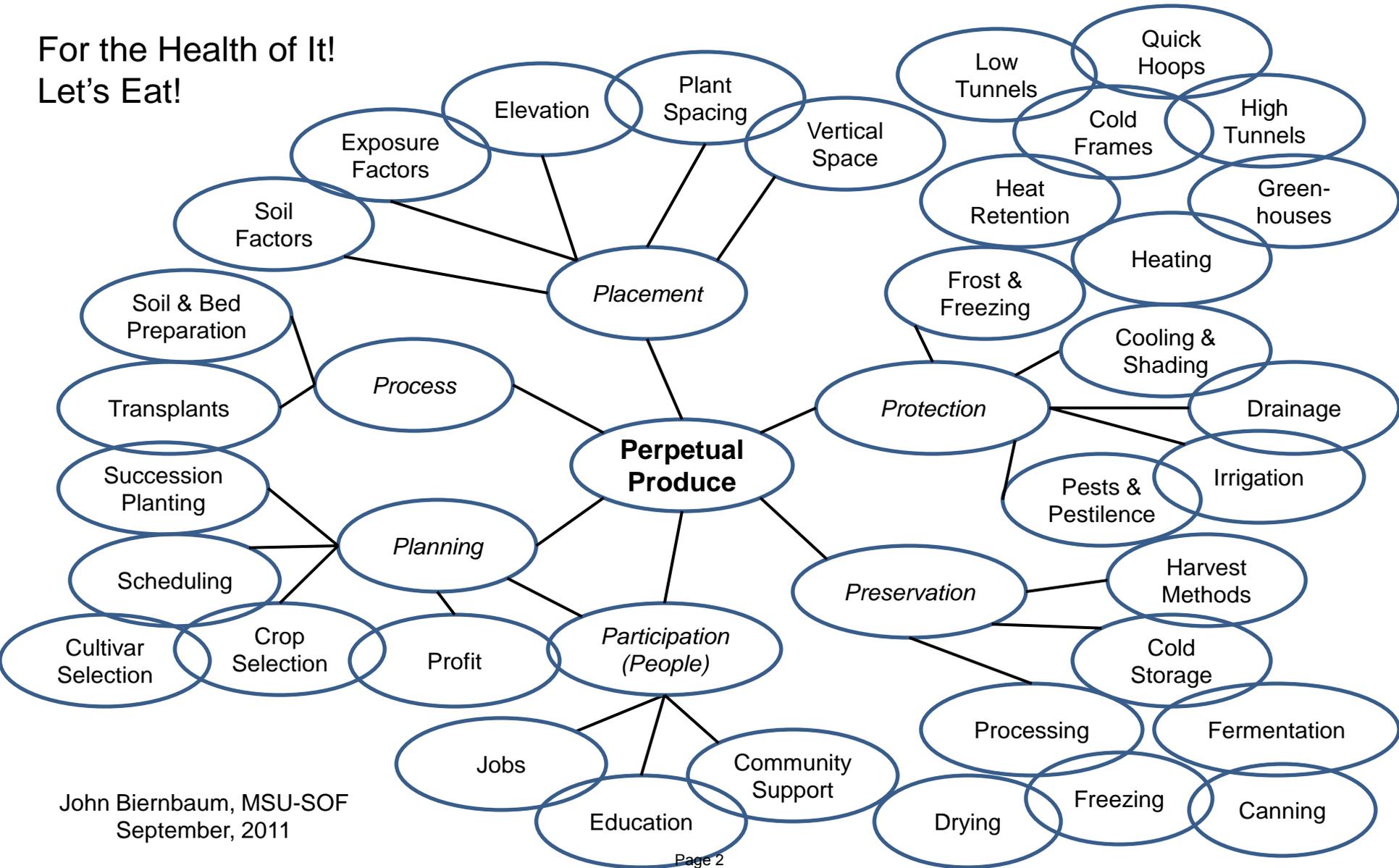


Practical Profitable Prolific Perpetual Produce

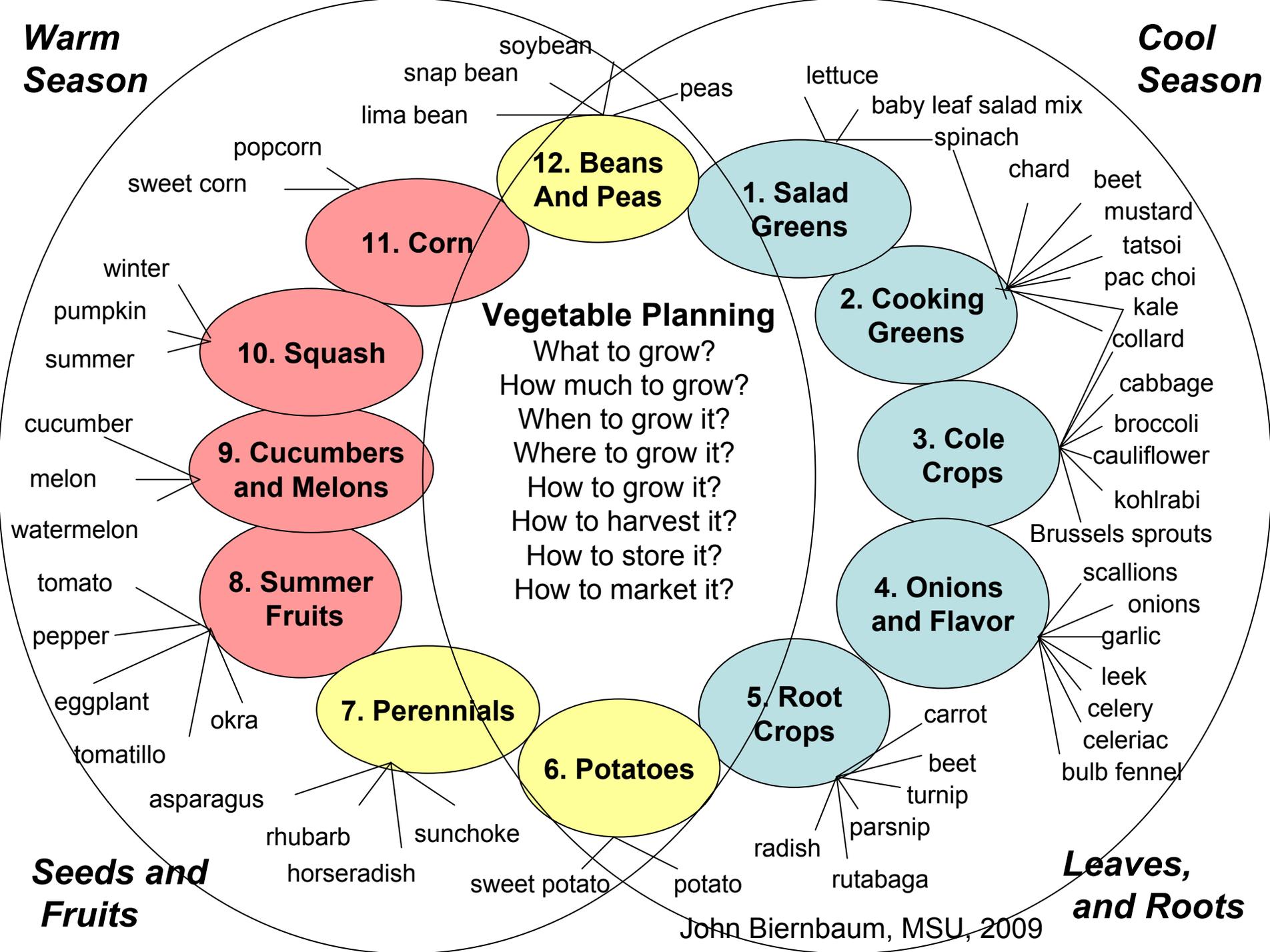
Extended Season, Four Season, Year-Round Farming

For the Health of It!
Let's Eat!



**Warm
Season**

**Cool
Season**



**Seeds and
Fruits**

**Leaves,
and Roots**

Perpetual Produce

Simple season extension for year-round farming.

Prepared by John Biernbaum
MSU Horticulture and Student Organic Farm

Whether we call it “fair food”, “good food” or “local food”, the message is the same. We are harvesting and sharing to help ourselves and our community. Whether we call it “season extension”, “year-round food” or “four season farming”, the message is the same. By using a variety of skills and procedures we can have vegetables, fruit and herbs when we want them. Picture your “garden” as a continuous source of what you want to be happy and healthy – and then let it happen. Which of the following methods are right for you?

Some perpetual produce possibilities include:

1. Planning: (What?) **Crop Selection and Diversity.**

We grow dozens of vegetables and herbs that originated from hot or cool climates around the world. Increasing the diversity of the vegetables we grow allows us to have fresh produce in both warm and cool seasons. For any crop varieties can be selected for shorter or longer maturity times.

2. Planning: (When?/time) Frost Dates; **Succession Scheduling and Planting**; Produce Size.

We can start new crops all year round. Planting dates are often referred to as 4 weeks or 2 weeks before, or a week or more after the last average frost date in the spring. Fall planting is scheduled by counting back weeks from the first average frost date. Use of low tunnels or cold frames can move the planting date forward or back by 2 to 3 weeks and high tunnels can move the planting date as much as 4 to 6 weeks.

3. Process: **Transplants** and Seed Treatments; Light Shelves; Greenhouses.

Starting transplants under lights in a home, garage or basement or in a heated greenhouse can reduce field time by 3 to 6 weeks and increase the number of succession plantings. Preparation includes having suitable growing trays/containers and root media. Depending on the transplant production area available, the transplants can be small or large.

4. Placement: **Soil Factors** – Drainage, Color and Temperature; Fertility.

Soil temperature is as important as air temperature for plant growth. Warm soil (greater than 60°F) in the spring will hasten seed germination and young plant growth. Well drained sandy soils, often referred to as “lighter” soils usually warm faster in the spring. Darker soils can also warm faster. Early or late season plant growth can be slowed or enhanced by the use of mulches.

5. Placement: (where/place) **Exposure Factors** – Light, Wind, Water, Elevation, Buildings.

In general, the more sunlight the warmer the soil and air temperature and the faster plant growth. Excess wind and water can lead to lower temperatures and slower growth. Higher elevation above sea level usually results in lower air and soil temperature and shorter growing seasons. Buildings that hold heat can lead to warmer temperatures in urban compared to rural environments..

6. Process: **Soil and Bed Preparation**; Rotations; Compost; Cover Crops.

Soils are often wet in the spring which can delay preparation of the ground. If the ground can be cultivated in the fall and beds prepared for spring planting, often several weeks can be gained. Raised beds and adding compost may hasten soil warming if the soil is poorly drained. Compost and crop rotation allows the soil to stay healthy with less resting. Cover crops that survive the winter and start growing, such as cereal

rye, can help dry out the soil. Cover crops that winter kill, like oats, can provide a surface mulch that stabilizes the soil so it can be walked on earlier in the spring.

7. Placement: **Plant Spacing** Effect on Harvest Time or Interval.

Succession planting and planning can be altered by changing the size of the produce harvested. For example, lettuce transplants can be planted closer together and either all the heads harvested early and sold as baby heads or half or some percentage of the heads can be harvested at regular time intervals so the remaining heads have more space to get larger. One planting date can have multiple or extended harvest dates.

8. Placement: Use **Vertical Space** and Three Dimensions.

We usually think of vertical growing systems as increasing the amount of plants that can be grown in a space. The harvest can also be extended by using trellises or structures that keep the crop growing vertically. Keeping the crop off the ground may reduce diseases that would otherwise shorten the production time. Increased light exposure may also hasten the harvest.

9. Protection: **Heat Retention and Reflection**; Mulches; Cold Frames, Row Covers, Low/High Tunnels.

Most of the emphasis on season extension has been on structural crop protection methods. Details of this method are provided in a separate document.

10. Protection: **Heat Transfer** or Production from Composting, Animals, Waste Heat (Roofs), Ponds, Soil.

Is there a source of “excess” or “waste” heat near the crop production site that can be used to warm the soil or the air temperature? One example is using the warm of the ground at deeper levels (40-45°F at depths below 5 to 6 feet). Horse manure was used to make “hot beds” that extended the season long before the availability of electricity. Compost can also be managed as a low grade heat source for hot beds. Roof top gardening can provide bottom warmth for the soil.

11. Protection: **Irrigation and Drainage** / Collection of Excess Water, Snow, Ice; Wind and Windbreaks.

Protection from summer heat and drought requires a plan for capturing and applying irrigation water. Under winter growing conditions it is more often not the cold that kills plants but the excess snow, ice and wet soils. Can excess of water at certain times be conserved for the dry periods?

12. Protection: **Pests and Pestilence**

Insects and four legged herbivores like rabbits and deer or disease can quickly end an extended harvest. Preventative measures need to be planned in advance and might include fencing, timers, traps and scents.

13. Preservation: **Harvest Methods**; Timing; Marketing

The harvest can be prolonged and maintained by regular and timely harvest of fruits that otherwise become mature and lead to reduced fruit set. Getting the crops out of the field at the best time of day and in a timely manner improves quality and increases the opportunity for additional planting to occur.

14. Preservation: **Cold Storage** Methods

Produce life and quality can be extended hours, days or weeks depending on the type of cold storage available. A cold room in a basement or an underground storage / root cellar can make a big difference.

15. Preservation: **Processing, Drying, Pickling**, etc

Crops can be processed for storage provided human time and resources for cooking are available.

Low Cost Small Scale Coldframe / Hightunnel Construction Options

John Biernbaum, Michigan State University Student Organic Farm (www.msuorganicfarm.com)

There are many options for building coldframes, high tunnels and greenhouses. The intent here is to provide considerations for low cost (\$1 to \$2 per square foot), simple to build designs from local materials that can be used to cover garden space and extend the growing season without heat.

Shapes: consider the working height, interior volume, ability to shed snow

A-frame: easy, sheds snow well, less working height; normal pitch or slope is 6:12 or 1:2.

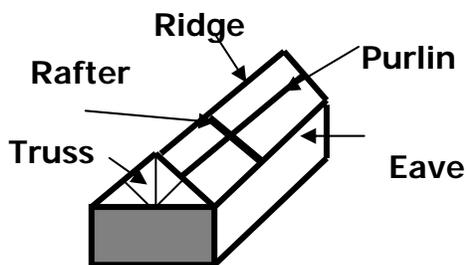
Quonset – round on top: potential to hold snow on top, may be less working height

Gothic or peaked: recommended - better than Quonset for snow removal, good working height

Roof Slope influences light penetration, snow removal, condensation runoff, venting

Key Structural Components

Post, Rafter, Ridge, Purlin, Truss or Cross Bracing, Diagonal or Wind Bracing, Ridge, Eave, End Wall



General Materials and Methods:

- Wood – lower cost, but usually more structure needed, more weight, and not as long lasting in high moisture environment. For food crops, treated wood touching soil is not desired.
- Plastic pipe – may not hold up to snow loads; PVC reported to have high environmental cost.
- Metal pipe – lasts a long time, additional strength. EMTConduit can be bent with either a pipe bender or “jig” – a form that facilitates bending. A more expensive alternative is to use 90 and 45 degree connectors for metal pipes. Options include electrical conduit and chain link fence pipe.
- Conduit is available in 10’ lengths from Home Depot or similar stores; ½” ~\$2, ¾” ~\$4, 1” ~\$6
- Chain link fence top rail comes in 10’ or 21’ sections and 1.3” diameter. Ten feet costs about \$10.

Connecting Two Pipes or wood framing to metal pipes

- Crimped or swaged ends;
- Two diameters – one fits inside the other; conduit may be loose; 1” EMT in 1.3” fence rail is good
- A smaller diameter connecting insert piece (spline) or larger diameter connecting cover piece;
- Self taping / tek screws to hold together; or drill holes and bolt together;
- Pipe straps or “C” clamps, a heavy-duty quality is preferred.
- Purlin clamps to hold the pipes at right angles – can buy from Farmtek or Grower’s Supply.

Attaching or Connecting Plastic Film – greenhouse grade, 6 mil polyethylene recommended

- Greenhouse plastic (6 mil) will last 3 to 4 years and let in more light.
- Can bury the plastic in soil at the sides of the greenhouse or coldframe – but access is difficult.
- Wood lath - two pieces forming a clamp to hold the plastic
- Wiggle wire, poly-lock or cam-lock is a more expensive metal form of holding the plastic.
- Source of plastic, vents & wirelock: www.farmtek.com or www.growerssupply.com 800-476-9715
- Source of quick hoop bender and frost fabric: www.johnnyseeds.com 877-564-6697



Mini greenhouse cold frame from 1/2" EMT and wire lock channels to hold plastic; jig to bend conduit.



Left: MSU Student Organic Farm 4' x 8' coldframe for < \$100; Right, less expensive options.



1/2" EMT 4' and 6' quick hoop bender from Johnny's Seeds and three, 60° bends with conduit bender. Takes about the same amount of time; could make a jig like the one above.



Short (8') and long (40') beds with quick hoops and Agribon frost cover.
 Long raised bed (80') with round and angled quick hoops to be covered with plastic.
 Compare peak or bow with the barn and hoophouse in the background. Both held up to snow.



12' wide, 12' long, ~ 7' tall; 10' long 1" diameter EMT conduit bent at 45° and joined at top.
 Exterior joining spline and ground posts made with 1.3" chain link fence top rail.



Make a greenhouse from conduit in one hour. Can use 4, 45° bends or 3, 60° bends on 1" conduit. Smaller size is two 10' pieces; Larger size is 2.5 10' pieces with 5' piece to make the top angle. Connected with 1.3" chain link fence top rail as a spline for the 1" EMT. Use fence rail for ground posts.



Bending, joining, and using purlin clamps to join conduit and wire lock channel to attach plastic.

Examples of Quick Hoops™

From: <http://www.johnnyseeds.com/t-ManageQuickHoops.aspx>



Reprinted by permission from Eliot Coleman's [*The Winter Harvest Handbook*](#).

...we cover them with row cover in mid-October, the same as with the onions. Overwintered lettuce and spinach will give you outdoor crops to sell up to a month earlier than the best you can do with spring transplants. It is important to choose varieties that are hardy enough to put up with the stress of overwintering.

Once real winter weather threatens (late November/early December) we add a sheet of 10-foot-wide clear plastic over the row cover to make the Quick Hoops™ tunnels more snow proof. To stiffen the structure against wind and snow load, it's important to tighten the plastic. We do that by driving a stake into the ground 4 feet from the last hoop at each end of the low tunnel and tying a rope to each end of the plastic. We then pull as tightly as we can on both ends and secure the ropes to the stakes. That makes the plastic cover taut lengthwise. We then shift the sandbags on top of the edges of the plastic to make it taut from side to side.

Using sandbags to secure the edges is much faster and much less work than burying the edges, although it's not as permanent. With sandbags, the covers can blow off in a really strong wind, but once winter arrives and everything freezes to the ground, nothing is going to move. The sandbags also allow us to cover every pair of beds side by side across a field because there is no need to find room to dig a trench and throw the soil aside as one needs to do when burying the edges.

When spring arrives, we start ventilating these structures on sunny days. We remove a few sandbags along the southern edge and insert a notched prop to hold up the edges of the plastic and fabric. Once outdoor temperatures have moderated to the point where the fabric alone is protection enough (late March) we remove the plastic layers and store them until next winter.