

## The Homestead Greenhouse – From Cold Frame to High Tunnel

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Friday, October 8<sup>th</sup>, 10:00am

Greenhouse - Heat + Ventilation. Best Use: Starting seeds.

Hoop House – large structure, but no heat. Roll-up sides. Best Use: Growing Vegetables/Fruits in the ground.

Cold Frame – Small greenhouse, not usually heat or ventilation. Best Use: Hardening off seedlings.

Low Tunnel – a mini hoop house. Low Tech. Best Use: Winter protection, microclimate, pest control

### Greenhouse Basics

- Sunlight heats the air, air volume determines the rate of temperature change
- Northern Hemisphere: Sun angle to the South.
- Latitude north from the Equator determines the angle of the sun.
- Rated light transparency is based on an angle perpendicular to the sun.

	Miami, Florida	Front Royal, VA	Montpelier, VT
10 hours of sunlight:	December 21 (10.5 hrs)	January 24 <sup>th</sup> (35°)	February 4th
11 hours of sunlight:	February 1 <sup>st</sup>	February 20 <sup>th</sup>	February 25th
March 1 <sup>st</sup> Hours + Angle	11.75 hours, 55 degrees	11.5 hours, 42 degrees	11.25 hours, 36 degrees
June 21 <sup>st</sup> Hours + Angle	13.75 hours, 86 degrees	15 hours, 74 degrees	15.5 hours, 68 degrees

- Angle will be shallow in the South, and steeper in the North. For the middle of the country, 35 to 45 degrees is a good compromise.
- Site a greenhouse to face South or slightly South-East.
- ABSOLUTELY NO SHADOWS!!! from trees or buildings. Full, complete sun from February 1 until May 15. Sunlight on November 5<sup>th</sup> is equivalent angle – no shadows on that area.
- Virtually no sunlight through North wall. Insulate!!! Or put against building.
- The R-Value of a greenhouse is practically zero. Heat loss during the night is significant. For much of the country, Thermal mass alone will not get you to the the ideal germination temperature for warm-season seedlings.
- Heating the rootzone to 75 degrees will require either an electric heat pad or a combustible fuel and a lot of BTU's. Thermostats are essential.
- Ventilation: Heat rises! Winds come from the West (usually). Intake shutter on West, fan on the East side.
- Natural ventilation works but requires management.
- A greenhouse is inherently an intensively managed space.

### The Homestead Greenhouse – Starting seeds in spring

- February 1<sup>st</sup> – start cool season crops like cabbage, broccoli. Heat to 50 to 65, vent to 75 to 85. Get plants to a stage where they can be hardened off in a cold frame or directly outside in a sheltered area.
- March 15<sup>th</sup> – Start warm season crops like tomatoes, peppers. Heat to 70 to 75, vent to 80 to 85. Harden off around the time of the last frost.

### Keys to Success:

1. Daily routine – twice daily management for seedlings.
2. Temperature management. Thermostatically-controlled heating and ventilation is best, otherwise management is intense.
3. Timing of seed-sowing. Too early is worse than too late.
4. Quality potting soil.
5. Most crops will need fertilizer once a week, at diluted rates. More challenging to do organically, since organic fertilizers are not as concentrated.
6. Water – goal is an evenly moist seedbed, not too soggy or too dry. Check in morning and at noon. Try to avoid watering at night. Fans help with reducing humidity. “Damping off” is a constant threat.
7. Goal is to optimize the growing environment to produce a healthy, young, vigorous plant that is 6 to 8 weeks old that it ready to be hardened off a week or two before the correct time to plant into the ground.

### **Hoophouses – Climate modification to extend the growing season**

- Climate modification – 3 to 5 degrees warmer, with no added heating system.
- Adverse weather mitigation – protect from rain, hail, wind, snow, etc.
- Large volume creates a big temperature buffer – slow changes.
- Usually passive ventilation, using roll-up sides or big doors.
- Highest and Best use on the Homestead: Extending the season for winter crops!
- Eliot Coleman - “The Winter Harvest Handbook” - phenomenal!
- Also can use for warm-season crops like tomatoes, peppers, cucumbers to reduce rain (and thus disease) damage, and get an extra week of growth in spring.

### Keys for Success:

1. Planning the beds and human/equipment access to maximize the space.
2. Snow load in winter? Size your metal frame accordingly. Snow is heavy.
3. With drip irrigation, salinity can build up over time. May need to uncover every 4 years to allow rain to flush out the salts.
4. Temperature management in the spring and winter – often manually done, need to manage.
5. Develop a pest control plan for aphids, thrips, and spider mites.

### **Cold Frames – Low-tech, Low-cost tools for hardening off seedlings**

- Unheated, with low-tech ventilation – just prop a door open!
- Simple is key – cheap and easily constructed.
- NOT “Solar Plant Cookers” - they need active management!
- “Hardening Off” tender transplants by gradually exposing to increasing light, increasing wind, decreasing temperatures, and decreasing humidity.
- Even with a greenhouse, you still have to “Harden Off” seedlings!

### Keys for Success:

1. Located on your homestead where you will be able to check on the plants 2 to 3 times a day.
2. Not suited to homesteaders who are extremely busy.

### **Low-Tunnels – Create a winter garden wonderland!**

- Super cheap, low tech hoops covered in plastic that provide small but significant protection from the cold and wind of deep winter.
- Easily moved, non-permanent, low commitment.

- Extend the harvest of cold-hardy crops like spinach, kale, collards, etc.
- Spring/Summer use for insect protection using Re-May row fabric or sun protection using shade cloth.

#### **Scenario A – You want to start 100% of your own seeds**

- Option #1 - Greenhouse 8'x12', powered vent and propane heater. \$4,000 to \$5,000
- Option #2 – Heat pads inside your house, on plastic table with drip tray. Also need a cold frame. Put seeds outside in cold frame every day, put on heat pads at night.

#### **Scenario B – You buy most of your seedlings from a nursery business**

- A cold-frame is still handy, and you can try your hand at some of the easier seeds and get an idea for what is involved. A cold-frame also gives you flexibility of when to plant.

#### **Scenario C – You want to garden year-round**

- Option #1 – Low-tunnels over each bed. \$200.
- Option #2 – Hoop House, 30x90. That's a lot of spinach! \$3,000
- Option #3 – Heated greenhouse, length and intensity of sunlight biggest limit. \$5,000 + \$500/month heat bill

#### **Common Problems:**

1. **Starting seeds too early.** Not much grows before February 1<sup>st</sup>. Start 6 to 8 weeks before you intend to plant outside – for Tomatoes in Virginia, this is March 15<sup>th</sup>! Starting earlier does not guarantee an earlier harvest.
2. **Overwatering seedlings.** Damping off and Botrytis mold kill the seedlings. Reduce watering frequency, and try sowing seeds into individual pots, since it spreads from seedling to seedling but a gap of an inch will stop it.
3. **Environmental stress** causes dead leaves and bud abortion. Temperature should never exceed 95 degrees, or drop below 40. High heat on cold-loving plants like Broccoli can cause premature bolting, and cold temperatures on heat-loving plants can cause stunting.
4. Yellow, stunted, weak plants due to **lack of fertilizer.** Start weekly fertilizing when plants are 10 days old. Organic fertilizer is much less concentrated, so double up on it.
5. **Leggy, weak, stretched plants.** Light inside your house, even under growlights, is not sufficient to grow a sturdy seedling. It is hard to “harden off” a leggy seedling.
6. **Insect problems.** Watch for aphids on peppers, eggplant, cucumbers especially. Occasionally other plants.
7. **No self-control:** you start too many seeds and transplant everything that comes up. Have a plan and stick with it, discard all weak or diseased plants.
8. **No plan and no gardening notes.** You can't repeat successes or avoid mistakes if you don't write down what you did, when you did it.
9. **Pie in the sky dreams** – I have a greenhouse, I want to grow tomatoes in January in Michigan – the \$1,000 tomato.
10. **“I have never grown a garden in my life, but now that I have a greenhouse, I am unstoppable. I have advanced to a higher plane of homesteading consciousness.”** If you can't garden well with purchased transplants, your success will not improve with an expensive greenhouse. A greenhouse is just one piece of your overall homestead plan. Learn to use ALL the tools at your disposal. One of the best strategies is to outsource your weak areas. If it makes sense to purchase high-quality seedlings locally, then by all means do it!

## **Gardening during the end of the world – do you need a greenhouse?**

- What if the grid went down, fossil fuels run out, and there is a breakdown of the economic system? What would you do to garden successfully? Greenhouses were mostly the domain of the wealthy until about the 1950's – very few homesteads had greenhouses before then!
- 1. Focus on direct-seeded and storage crops. Beans, Corn, Potatoes, Cabbage, etc. Not as much reliance on peppers, tomatoes, lettuce.
- 2. Plant at the proper time. No more “Gambling” on early plantings.
- 3. No ideology – do what makes sense.
- 4. Focus on getting good at gardening and farming without the clutter of fancy tools and gadgets – just the basics of good plant management. Then see what tools really are essential to your farm.
- 5. Much more management of the garden on a daily or even hourly basis – you wouldn't need automation because you would be “in tune” with the crops. (But automation is great!)
- 6. Develop systems and methods of doing things efficiently now, so that your life is easier. Our ancestors worked hard, but they also worked smart and designed their farms to be efficient.
- 7. Learn to grow year-round as much as possible. Less to can because you are producing something every week. Smaller garden space because more harvests from the same space.
- 8. Diversity – 50 different kinds of tomatoes vs 50 different crops... Trying to insulate yourself from the effects of diseases, insects, and weather, and that comes from growing different species, not just varieties.

Questions?

**Booth** – we have handouts of this talk as well as a bunch of other handouts. Happy to talk and discuss things in more detail, or troubleshoot problems you are having. We also have some berry bushes for sale, and this model cold frame will be set up for you to look at it more closely.

Thank you very much!     Happy Gardening!