



Seed Propagation in a High Tunnel

Field Tested is a series of reports about farm tools that have been tested by Montana farmers to enhance their specialty crop production. The reports describe these farmers' findings to help others make informed decisions about their specialty crop businesses. Visit FarmLinkMontana.org to read more Field Tested reports. This project is administered by the Community Food & Agriculture Coalition with funding from the Montana Department of Agriculture Specialty Crop Block Grant Program.

COUNTY RAIL FARM | HUSON



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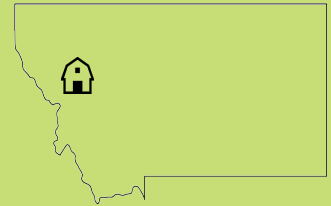
COUNTY RAIL FARM SNAPSHOT

Location: Huson, MT

Acres in Production: 2 ,
increasing to 2.5

Operator(s): Tracy Potter-Fins
& Margaret DeBona

Crops: packaged salad & arugula; wrapped cucumbers;
cherry and heirloom tomatoes; diversified vegetables



INTRODUCTION

Tracy and Margaret of County Rail Farm moved their farm to a larger location in 2016. Moving sites allowed for an increase in vegetable production, so Tracy designed a propagation house designed specifically for the purpose of producing seedlings and specialty crops. This project allowed Tracy to experiment with different propagation systems; this guide includes some of her learnings so that other farmers can adapt the system for their own purposes and potentially refine them for greater efficiency, cost savings, or general functionality.



DESIGN OF THE PROPAGATION HOUSE

The main goal of County Rail's propagation house was to germinate seedlings more efficiently and reliably, as well as grow healthier tomatoes, cucumbers, peppers, and other hot crops due to the innovative design. This process improvement was necessary so Tracy could increase the number of crops she plants in succession and the number of successions throughout the year, thereby increasing early cash flow in the spring.

In order to encourage faster propagation, Tracy intentionally designed the process to promote warmth at every step of propagation. The high tunnel is heated with propane; the soil used to start seeds is at high-tunnel temperature; a germination chamber provides humidity and warmth for sprouting seeds; a hot table provides extra warmth for seedling growth; and the water used on the seedlings is also warmed. Read more about each of these materials in the following sections.

MATERIALS PURCHASED

- Heating & Venting (fan, vents, heater)
- Propane Installation
- Tools for Installation (pliers)
- Seeding Table
- Soil Box
- Hot table
- Propagation Benches
- Germination Chamber
- Water Tank
- Water Pump

TOTAL: ~\$5,000

High-Tunnel Greenhouse

Tracy built a 25x50ft greenhouse with the Harnois tunnel kit. It has a double layer of plastic, roll up sides, a 115v propane heater, a 115v 24" fan, and a 24" venting window. Approximately half of the space in the greenhouse is used for propagation and the other half for growing crops.

TIP

Tracy found that a thermostat placed in the center of the tunnel will provide the most accuracy.

She also found that it's beneficial to hook the fan to the thermostat so it can turn on and off on its own. Separate shutoffs for fan and heater would be beneficial in case you have to do repairs on one. A lower fan can improve direct air flow across the starts in spring.



Seeding Table and Soil Box

The seeding table provides ample storage space for seedling trays and table space for seeding multiple trays at once. The soil box is located next to the table to provide easy access for filling trays. Since it's located in the greenhouse the soil is already warmed for seeding. Both the table and the box were built with simple 2x4 lumber and are coated with linseed oil for longevity.



Soil Box: L7x26"Dx33"Hx51"W,
with ½" plywood on bottom and sides to keep
soil from falling out.



Seeding Table: 56" total height;
Table: 84"Lx26"Dx33"H

Germination Chamber

The Germination Chamber is a repurposed refrigerator built with small revisions with the help of FarmHack plans (see the Additional Resources section for a link to the plans). The germination chamber can hold 16 seedling trays and includes:

- Temperature monitor/thermostat
- Plastic-coated shelving
- Analog crockpot

Tracy used plastic shelving because she found that metal shelving would rust and was too heavy duty for the application. An analog crockpot is best in order to maintain consistent temperature controls—when a digital display is turned off and on again it loses all settings. Tracy filled the crock pot with vegetable oil instead of water; this helped with too much humidity and it would keep longer, reducing the need to refill it throughout the season.

TIP

The germination chamber must be checked regularly throughout the day when trays are inside. Some crops, such as brassicas, can sprout quickly and get leggy within a few hours if left inside the chamber. For such quick-germinating crops, Tracy sometimes skips the germination chamber and uses the hot table instead.



Hot Table

The hot table keeps seedlings warm while they grow once they leave the germination chamber. The table holds eight standard 10"x20" trays and has a cable thermostat and sensor attached. It has a 48" square top and is 34" high. The top square is insulated on the bottom with floor insulation and a piece of ½" plywood. Old greenhouse plastic lines the box and is filled half way with sand and then heat cable laid on top of the sand and then covered with more sand to fill box. The sand must be wet to conduct heat.



Growing Benches

Tracy built long tables with supports and movable tops for the seedling trays to finish out this phase of growth. The movable tops have multiple uses- they can hold seedling trays inside the greenhouse, they can be moved outside for hardening off, and they can even be used for drying onions.

All together, the benches and tops can hold 176 standard seedling trays (10"x20").

Each table was built from 2x4 lumber to hold eight standard trays. The tops are 43" square with hardware cloth stapled on top and supports are 18" deep, 29" high, and 38" wide – then 8ft 2x4 set across each support a long table.



Water Tank








Tracy bought a 105-gallon water tank, painted it black and located it in a sunny corner of the greenhouse where the water can heat all day. This system was intended to lessen the temperature shock the plants experience when water is applied since it is warmer than if it were to come directly out of the ground.

When the greenhouse was at full capacity Tracy often ran out of the warm water from the tank to water all the plants. She ended up just plugging her water into the frost-free by the middle of the season. She recommends purchasing a larger tank or three of the 105-gallon tanks in order to prevent that from happening, but also notes that the seedlings did not seem to suffer after the switch back to cold water.

Results

Tracy planted early tomatoes and peppers in the greenhouse in the spring of 2017 and harvested cherry tomatoes as early as June 30th (over a month earlier than outdoor tomatoes). Because of this set up, in particular the large heated space and the germination chamber, she had better germination rates than any other year and was able to efficiently transplant crops with less labor. Tomato successions were incredibly successful because she was able to heat the greenhouse early, promoting early growth and strength. She was also able to transplant crops often direct seeded earlier, resulting in denser crop production and higher yields. Overall, the project allowed them to increase the number of crops they plant in succession, the number of successions, and the size of each succession. Additional successions meant they could rotate their fields more and create opportunities in season to incorporate organic matter rapidly – this was crucial to their new farm site where soil health was lacking.

PROPOGATION DESIGN IMPROVEMENTS RESULT IN TRIPLE THE CAPACTIY FOR COUNTY RAIL FARM

Improved Design Elements	Crop Improvement	Workflow Improvement
Soil Box		
Seeding Table Lots of storage, workspace at waist-height		
Germination Chamber Warm, humid environment for seed germination, conveniently located in the greenhouse		
Hot Table Heated soil for seedling growth		
Growing Benches		

ADDITIONAL RESOURCES

Montana Department of Agriculture Specialty Crop Block Mini-Grants: The purpose of this program is solely to enhance the competitiveness of specialty crops in Montana. Visit their website to find funding opportunities and more information: agr.mt.gov/SpecialtyCropBlockGrants

Farmhack Germination Chamber Plans: Farmhack.org/tools/sweat-box-germination-chamber

Farm Link Montana: A project of the Community Food and Agriculture Coalition to connect Montana's beginning farmers and ranchers with the tools they need to succeed: farmlinkmontana.org