Terra Firma Winter Greens Research Project Summary

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Terra Firma Farms has partnered with Okanagan College to research the viability of growing greens in greenhouses during the winter months using compost as a heat source. The project is funded by the Ministry of Agriculture's Growing Forward 2 program, aimed at supporting innovation for climate change mitigation. The three-year research project began in December 2015 and is entering its third and final winter.

A group of interested farmers and food security folks gathered at Terra Firma on October 5th to hear owners Rob Jay and Terra Park describe the results gathered so far.


Photos: Preparing the greenhouse, with compost pile in the background (left), and the greenhouse cover (right).

The Build

Two 50' x 20' greenhouses were constructed from heavy-gauge metal piping and "10-year" poly sheeting on top of a flattened area of bark mulch, to provide some heat as it decomposes and to help with moisture control. One greenhouse has one layer of poly sheeting, while the other greenhouse has a double layer of poly sheeting. The single layer lets in more sun, while the double layer is inflated with air to retain more heat. A sliding door was installed in each greenhouse for ventilation purposes.

Within each greenhouse, 3' x 6' planter boxes were built of cedar wood and arranged in 4 rows of 6 boxes each. The planter boxes were filled with sterilized soil to decrease variability within the study. Irrigation is done manually within each greenhouse, and the planter boxes saved from excess watering.

A closed loop water system was created using tubing buried in the planter boxes and throughout a nearby compost pile. The decomposition of the compost heats the water in the tubes. The heated water is pumped through the planter boxes, thus heating the soil, providing additional heat to the solar capacity of the greenhouses.

For the 2015/16 winter growing season, Rob built a round compost pile of bark mulch. A rain event during that winter oversaturated the compost pile and caused freezing throughout the pile, breaking the tubing.

For the 2016/17 winter growing season, a new compost pile was built that is approximately 120' long x 10' wide and is composed of 50% bark mulch and 50% fresh horse manure, with an exterior layer of bark mulch for insulation. Integrated through the pile is the closed system of 5000' of tubing that connects with the tubing in the greenhouse planter boxes. The water running through this system can reach temperatures of 120F.

The 2017/18 winter growing season will continue to use this compost pile as long as produces heat. A secondary pile will be built to switch over to when needed.

Remay, a light white cloth, is also used on top of the planter boxes to provide additional insulation. The remay is suspended above the crops with poly arches, or hoops, attached to the sides of the planters.

Seven varieties of salad greens were started inside Terra and Rob's home in September, under growing lights. The varieties included three types of lettuce (pearl, refugio and tango), bates kale, flamingo chard, red devil beet and salinova. Terra spoke highly of the salinova, which is sold exclusively from Johnny's Seeds in the USA at $33USD for 1000 pelleted seeds. Johnny's salinova comes in eight varieties, makes a nice salad mix, are not heavy feeders, grow well at all temperatures but are prone to pests in summer. She usually gets two cuttings/plants in their 7-8 week life, so she plants every 7-10 days for a constant crop.

The Challenges

Snow Clearing - The single layered greenhouse collects frost, which is difficult to get off without damaging the poly sheeting. Rob and Terra found that it was best to keep some snow along the base of the sides of the greenhouses to add stability to the structures and to guide sloughing snow off of the structures.

Compost pile - It takes a summer to really get the pile cooking and able to provide enough heat, but Rob felt that building the compost pile even one month prior could be adequate. It is best to have two compost piles going at once in order to troubleshoot. The compost can be used to amend soil once it is finished creating heat. Rob thought that it would be best to use steel pipes through the compost pile for increased heat conduction, but was unsure of the viability of this idea. Discussion was held around putting the greenhouse on top of the compost, but the methane produced from decomposition of the pile would require ventilation. Bark mulch can not be sourced from the local lumber mill for certified organic farming purposes as it is considered

“industrial waste” due to oil contaminants. Rob and Terra use lime as a ph buffering agent due to the acidity of the mulch, which is inexpensive.

Pests - During the 2016/17 winter there was a lot of damage to the plants due to voles, resulting in a lost crop.

The Yield

Researchers from Okanagan College set the growing plan and take samples for analysis in conjunction with the recorded growing conditions. Terra Firma is more interested in looking at the marketable yield of this project, to inform future business decisions.

Year One - double layered greenhouse had 5% better yield - 100 lbs. (sells for $8-9/lb)
Year Two - double layered greenhouse had 40% better yield - 125 lbs.

Terra reported that she could achieve higher yields with better optimization of the space within the greenhouses in addition to using the varieties of seeds that performed well. She found that the winter yield was inferior to the summer yields which also have a shorter turnover between plantings.

The Financials

Each greenhouse cost approximately $7000 from *Professional Growers*. Additional materials for the project cost over $4000 for the planter boxes, soil, row covering, row cover hoops, seeds and water tubing.

The Results

Rob and Terra liked the idea of having an early crop aided by compost-heated greenhouses, but were unsure of the financial viability of this operation on the scale they are operating. They felt that this type of system would be more viable for a bigger operations utilizing 20’ of space between greenhouses for snow clearing, minimizing damage to the greenhouses. Different locations offer different light levels and different levels of heat can be generated with different types of compost piles. They felt that it would be much easier to turn a profit on this system in a low snow year as the work involved with snow clearing was the most onerous part. The size of the compost pile would need to scaled to the size of the operation to allow for enough heat generation.

Without a large financial benefit from this winter operation, Rob and Terra are not interested in continuing the project past the study period. They felt that this project locked them into being home during the only time that their farm could potentially allow them a break. They did feel that using heated greenhouses is valuable in February as a season extender that would provide them with more products to sell at early season farmers markets, thus maintaining their customer base.