

1. Project Title: Over Wintering and Season Extension of Organic Culinary Herbs in Unheated High Tunnels (FNE03-464)

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2. Project Goals:

Demand for fresh organic herbs has recently increased, but without expensive heated greenhouses, growers in our region (zone 5) have only been able to provide 4-5 months of annual and perennial fresh cut herbs. Herbs are imported from great distances (like California) where the climate is much milder and herbs are grown economically year-round. This project will use unheated plastic covered hoop houses (high tunnels) to provide low-cost winter housing for tender perennial herbs and to extend both ends of the growing season for other perennial and annual herbs. Extending the growing season with unheated high tunnels may allow for the production of many herbs for an additional 3-4 months.

3. Farm Profile

We are a diverse farm that raises a mixture of crops and meat. With free range poultry we raise, process and direct-market 600 broiler chickens, 150 ducks and geese and 50 turkeys. We also raise 1000 layers (for eggs and replacement hens) on pasture. We pasture pigs for meat and aiding in our production of high quality compost for field and greenhouse use. We have 8 sows and a boar for certified organic piglets and pork production. In addition we also have a small beef herd. We have a seasonally heated greenhouse for propagation and two high tunnels for season extension and over wintering some crops. We intensively cultivate about an acre and a half of vegetable, herbs, berries, and flowers. These are sold fresh, dried, and as valued added products on farm and at a local farmers market. All our crops, poultry and pork are certified organic. All fieldwork is done with our team of draft horses and ponies. Karma is on the farm full time and Michael additionally works half time for the Cornell University Department of Plant Breeding. We own 100 acres of open land, pasture, and woods. This includes approximately 20 acres of pasture, an acre of cultivated land, and 75+ acres of managed woodland.

4. Cooperators

Brian Caldwell, Farm Education Coordinator-NOFA-NY: Brian helped contact other farmers involved in season extension early in the Project

Peter Johnson- Pete's Greens: Pete has provided me with information and advice on Greenhouse design, planting methods, and internal bed layout.

Organic Growers: I have visited or been in phone or email contact with five other farmers in New Hampshire, Pennsylvania, Maine, and Vermont on season extension. Several of

these growers contacted me when they heard I was working on methods to over winter Rosemary.

Molly Shaw- Cornell Cooperative Extension Agent for the Southern Tier (new technical advisor)- She took over for Tyrone Hall.

Tyrone Hall - Cornell Cooperative Extension: Tyrone left Cooperative Extension in 2004 but helped with getting pictures and information on our farm website.

5. Project Activities:

Additional research into herb season extension techniques: We continued our research into what has already been done in unheated crop protection and season extension techniques. We obtained publications from growers in Maine, Kentucky, Pennsylvania, and Kansas on what they have done (see appendix). We also spoke to many growers and spent time in the library and on the internet looking for relevant information.

Design and build unheated high tunnels: We designed and built two unheated high tunnels (images of tunnels are at www.kingbirdfarm.com/Kingbird_Images.html).

Perennial Greenhouse: This is a 30' by 96' permanent unheated greenhouse with 2 layers of greenhouse plastic and blower for inflation. It has 2" metal bows in a gothic shape and sheds snow. Extensive drainage and leveling was done to the site. The ends have two 4' by 8' doors and 2 louvers above the doors at each end. There are 4' roll up sides. All this is for ventilation. The house was completed in late fall 2003 but the perennial herbs were planted in mid summer so as to become established. About half the house is in herbs with the other half in greens and vegetables.

Annual high tunnel: This is a 12' by 96' seasonal high tunnel with one layer of plastic and roll up sides (3.5') and ends. Because of the late starting of the project this was not erected until July 2003. We used it for basil, cilantro, dill, arugula, several types of annual herbs, salad greens, and melons. The plastic was removed in early December when high winds and snow were threatening the structure and all growing was finished. The plastic was reapplied in April.

Over wintering rosemary: We purchased rosemary (variety Arp-Zone 7 hardiness) plugs in the spring 2003 and potted them on twice before planting them in the perennial greenhouse in early August 2003. Five beds of this new greenhouse are in rosemary. In December 2003 two beds were covered with straw, one was covered with just row cover, and two were covered with row cover and straw. We set up a datalogger to collect temperature data.

Over wintering other tender perennial herbs: In addition to rosemary we planted several other perennial herbs- both tender and non tender. This included tarragon, purple sage, lavender, several thymes and mints, and just a few plants of most of the standard culinary herbs we successfully grow outside.

Extending the season for Annual herbs: With the use of the annual high tunnel and extra space in the Perennial Herb greenhouse we planted annual herbs for earlier and latter harvest. These included basil, cilantro, dill, marjoram, arugala, and parsley.

6. Results

Overwintering Rosemary

In December of 2003 we applied our different winterizing treatments to five beds (5' by 11' each) of rosemary in the perennial greenhouse. The results were that an average of only 5 percent of the plants with mulch alone survived. With mulch and row cover 55 to 80% of the plants survived. On row cover alone 55% of the plants survived. With mulch and row cover we had a high rate of die back of individual plants even though the actual plant survived. We had purposely planted the rosemary plants very close together (12" apart) in 2003 assuming we would have some die off the first year. The eventual spacing of about 24" apart ending up working very well. The plants all filled in any available space. For the 2004/05 winter we used a single layer of Agribon 19 rowcover on wire hoops on all rows and had 95% survival on these more mature plants. From the use of a data logger we determined that the straw ended up keeping the plants too cold and the ground around them eventually froze and also caused excessive molding. The ground never froze where only row cover was used.

Another benefit of not using mulch, in addition to high winter survivability, was that the plants starts growing and producing marketable bunches earlier. We were able to have fresh rosemary for our first markets in early April. This was from the plants with only a row cover. We left row covers on until the threat of frost was over and replaced them in the fall when frosts became common.

We also were able to take cuttings in January and February from the rosemary to start additional plants for sale starting in the spring.

Over wintering other perennials

We also had 1-2 beds (11' by 5' each) of several other herbs. Each of these beds was at least 4' from the edge of the greenhouse to avoid any cold edge effect:

- 2 beds of French Tarragon (Zone 4 hardiness) first year (2003) we used straw mulch with good results, but it was slower to come up in the spring. Now we just use row cover and it starts coming up in March with a first harvest in April. We can cut off these beds heavily until the heat of August when they slow down too much. These beds are also very useful as mother plants.
- 3 beds of Purple Sage (Zone 6 hardiness) —first year we mulched two beds with straw and covered one with a row cover. A few plants under the straw died, but the row covered bed did excellent. The plants under straw molded and were slower to start growing in the spring. We now use only row cover with great results. Sage can be harvested throughout the winter and new growth begins in March with the first good harvest in April. These beds are incredibly productive even when other sage plantings around the farm aren't. They tend to have a lot of leaf hoppers but

don't show the damage nearly as much as other sages.

- 3 beds of Pineapple Mint (Zone 6 hardiness) —first year we straw mulched all these beds because they die back to the ground anyway. This worked well but delayed the spring growth. We now use only row cover with great results. These beds grow vigorously and is the first mint I can harvest in spring (April).
- 1 bed of Oregano Thyme (Zone 4 hardiness) —The first year we straw mulched this bed with good success although it was slow to grow in the spring. Now we just use a single layer of row cover. This thyme is slow to grow in the spring but is ready to harvest in late April.
- 1 bed of Lemon Thyme (Zone 4 hardiness) —The first year we straw mulched this bed with excellent success and it helped get the new plants through the winter without drying out. Now we just use a row cover as the plants are large and well established. This thyme is very slow to grow in the spring, but produces well once it gets going.

We also had smaller sections of other herbs in beds directly along the long sides of the greenhouse.

- East Side Edge Bed—This bed is planted to Lady Lavender (Zone 6 hardiness) and Hidcote Lavender (Zone 4 hardiness). These plants have established well even though this is the moist side of the house. We use only a row cover to protect the plants and reduce mold. The lavenders bloom twice a year in the house, once in June and once in September. We have not made a fair comparison yet between the two varieties.
- West Side Edge Bed—This bed is planted to a variety of hardy (Zone 4-5 hardiness) perennial herbs and is not covered or mulched. They include Winter thyme, Garden sage, Greek oregano, Lemon balm, Anise hyssop, Spear mint, Apple mint, Orange mint, and catnip. Some of the mints get a jump on the season by being in the house, but they tend to get moldy and hopper burn. The catnip thrives in the house and we get a multitude of cuttings during the season. We will probably remove most of these plants except a few just for mother plants for early season transplant. Except for the catnip, they don't do any better in the house than outside and they get bad hopper burn.

Temperature data:

We used a four channel downloadable datalogger to record temperature every 6 minutes in 4 locations: outside, inside the perennial greenhouse, under the row cover at 12" above the ground, and 3" below ground under the row cover. Since the project was going to only last for a few years we wanted to make sure that we had weather conditions that really tested our system.

Although doing a complicated data analysis of all the weather data is beyond our scope we did find several things. We had a very cold period from 1/9/04 -1/15/04 with it reaching below -10 F every night. We also had shorter cold periods with temperatures in the double negative digits from 1/24/04-1/26/04 and 2/15/04- 2/16/04. Our lowest recorded outside temperature was -22.3 f but inside it was 3.2 F, under the row cover it was 14.98 F, and in the soil it was 33.1 F! This meant that the greenhouse alone provided a gain in temperature

of 26.4 degrees and the additional row cover provided a total gain 38.3 degrees. By looking through the temperature data it is clear that the lower the temperature the greater difference between outside and inside temperatures. We did not record temperature under the mulch but visibly saw freezing of the soil on many occasions. It is also important to note that during these very cold periods the daytime temperature of the greenhouse was able to warm up even more because of solar gain. On the day when it was -22.3 F outside it warmed up to a high for the day of 10 degrees F outside. 35 degrees F inside and 44 degrees F under the row cover. These relatively high inside temperatures prevented frozen ground from freezing prolonged cold temperatures that could injure the plants.

Extending Annual herb production:

The protected environments gave us a great place for growing early season high quality annual herbs. We direct seeded (and covered with AG-19 row cover on hoops) arugula, dill and cilantro in the first week of April for first harvests in mid May. The rest of our cilantro and dill successions were planted outside without the use of the high tunnel. We continued small plantings of arugula in areas of both the annual high tunnel and perennial greenhouse utilizing shade from other plants and the drip irrigation. Basil plugs were started in our heated propagation greenhouse in the first week of April and transplanted the third week of April for harvest in the end of May and early June. We continued to plant succession basil all summer (3 times) in the high tunnel beds in order to have a continuous supply of high quality basil all summer. Japanese beetle damage was severe and the limiting factor in most plantings.

Fall planted parsley plugs (August- October) provided small late fall harvests and early (April) harvests. We did not adequately test other annual herbs like marjoram.

Unexpected results included:

- We experienced extensive Japanese beetle damage on the basil especially in 2003 but basil growth and yield helped offset this damage. Row cover use in 2004 helped but was a pain to manage.
- We were able to harvest herbs through Christmas despite frozen and snow covered ground outside to have them freeze at our market stall. We used coolers in 2004 to prevent freezing at market.
- Having perennial herbs in a protected environment meant that not only did we have herbs earlier in the spring but that we were able to take cuttings for potted herbs. We were able to do this without starting up a heated greenhouse by sprouting the cuttings on a table in the house and potting on once our propagation house started being heated in late March. We successfully made cuttings in spring of 2005 for the sale of potted rosemary plants for the 2005 marketing season.
- There are very important positive psychological benefits of working in an unheated greenhouse when it is miserable outside. Being able to harvest fresh crops 12 months a year and plant and harvest when it is snowing, raining, cold, or otherwise miserable outside is very comforting. It also helps spread out the labor throughout

the season.

Changes included:

- The perennial greenhouse was finished later than expected. Trying to build it in the middle of the growing season without much additional help was difficult.
- We didn't move the annual tunnel because the place it was to be moved to was not ready in the early spring because it was affected by the site prep of the perennial house. We then never moved it because it seemed like it would be difficult.
- We built a larger perennial house than we originally planned because a larger house has better heat retention and less edge effect than a narrow short house. This also meant that we did not use the entire house for herbs but also grew some vegetables year round.
- We added perennial herb beds to the East of the large perennial greenhouse. We were able to utilize the same water source of the greenhouse and believe the greenhouse provided some late season frost protection.

7. Site Conditions:

The 2003 and 2004 growing season were very wet years which helped us determine the amount of drainage and site prep we needed for the perennial greenhouse. It also limited the amount of irrigation needed. Crops in the annual high tunnel and perennial greenhouse did much better than anything outside. Other farms also had trouble growing many crops outside and this meant we were able to easily sell everything we produced with less competition than may have normally been expected.

The 2005 season was very dry. We were easily able to irrigate everything in the perennial greenhouse while non irrigated perennial herbs outside did poorly.

8. Economic Findings:

Determining the exact overall economic effect of using unheated greenhouses is very difficult. The approximate cost of erecting the 30' X 96' perennial greenhouse (all site prep, frame, all hardware and lumber, plastic, electrical, etc...) was \$6000.00. We had over \$6000.00 in sales in the first year alone. Time spent weeding was 25% of what it took for outside herb beds where weed pressure was a major limiting factor. Yields and quality were much more consistent and dependable in the unheated greenhouse.

One of the most important benefits of unheated greenhouses and high tunnels is that they minimize the risk of crop failure. In 2004 our outside perennial herb beds were crop failures with most herbs only yielding 10-20 percent of normal harvest. Using these unheated structures in 2004 meant that we had herbs to sell and not only did we make money but we did not lose market share. Having plenty of herbs also helps sales of our other products at farmers market. Having a full display of fresh herbs from April to December draws people in to then buy eggs, meat, and our other products. Having crops early on also brings in customers during the first market that then stay with us throughout the year.

The bottom line to us was that growing herbs under un-heated structures took additional up front capital investment but more than paid for itself in increased sales, more product, and protection from the inherent unpredictability of weather that can cause us mental, physical, and financial hardship.

9. Assessment

We have discovered that the more things that don't have to be recreated each year the more likely they get done. Other farms have successfully moved small hoopouses each fall but we never found the time to do it and then never got to it in the spring. Also the PVC hoopouse that we designed made us very nervous when the wind really blew or early/late snow threatened. Hoops broke and plastic eventually ripped. We will probably build another permanent high tunnel that doesn't have to be moved and will hold up to snow and wind. Being able to sleep at night is very important.

As noted above one of the new ideas generated was to use the perennial greenhouse for overwintering mother plants. We will continue to see what other mother plants can be overwintered without heat and successfully used to take early spring cuttings.

10. Adoption

We will probably not continue the use of the moveable temporary hoopouse. As described above we will probably build a permanent and sturdier unheated high tunnel.

We have fully adopted the use of the perennial greenhouse for overwintering perennial herbs and extending the harvest for both annual and perennial herbs. This was very successful and we will continue to refine it and see what other herbs will work in this system.

11. Outreach

Unheated Hoopouse and General Farm Tour- Kingbird Farm, October 6, 2004

We hosted this event at our farm co-organized with Monika Roth of the Tompkins County Cooperative Extension. Over 30 people attended and we explained the current results from our NE-SARE funded grant and well as an overview of our farm

Culinary and Greenhouse Herb Production- NOFA-NY Winter Conference- Liverpool, NY January 29th, 2005

Karma presented a workshop to 45 plus attendees on small scale organic culinary herb production. She highlighted the herb season extension work we had done as result of our NE-SARE grant.

Greenhouse Season Extension Workshop, Ithaca NY February 2nd, 2005. Hosted by Molly Shaw of Tompkins County Cooperative Extension.

Karma made a presentation to 35 plus attendees on how we use high tunnels for season extension. She highlighted the herb season extension work we had done as result of our NE-SARE grant as well as the vegetables we grown in the high tunnels.

Field and Hoophouse Herb Production- NOFA Summer Conference- Amherst, MA August 20th, 2005

Karma presented a workshop to 25 plus attendees on small scale organic culinary herb production. She highlighted the herb season extension work we had done as results of our NE-SARE grant.

Farm Innovations Tour- “Diversified Organic Farming” at Kingbird Farm October 19th, 2005

We hosted this event at our farm co-organized with Molly Shaw of the Cornell Cooperative Extension. Over 45 people attended and we explained the current results from our NE-SARE funded grant and well as an overview of our farm.

Farm Tours as part of Cornell University “Sustainable Agriculture” class- Fall 2003, 2004, 2005

We hosted 2 tours (8-10 students each) each fall in 2003, 2004, 2005 of a Sustainable Agriculture class from Cornell University. We highlighted our NE-SARE funded herb season extension work as part of our diverse farm.

An article entitled “Herb Season Extension” will be printed in the March addition of the South Central Tier Vegetable News put together by Molly Shaw.

12. Report Summary

The purpose of this project was to extend the season (on both ends) for organic herb production and find an economically sound method for successfully overwintering tender perennial herbs such as rosemary. Through the use of a permanent 30’ X 96’ unheated greenhouse and a temporary moveable 12’ X 96’ unheated plastic covered hoop houses we were able to market fresh herbs from April – December. The 30’ X 96’ unheated greenhouse with two layers of plastic and with additional hooped row covers was successful in overwintering tender perennial herbs including rosemary. To our surprise we are also able to use the overwintered herb plants as mother plants from which we took cuttings for the production of potted herb plants. We fully adopted the use of an unheated perennial greenhouse for increased herb production, higher quality, and longer production season.

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Appendix: Season Extension Resources

Coleman, Elliot . 1992. The New Organic Grower’s Four Season Harvest. Chelsea Green

Publishing Company, White River Junction, Vermont

Eliot Coleman has very useful information for extending the season on many crops. This Book is widely available.

Wiediger, Paul and Alison. 2003. Walking to Spring- Using high tunnels to grow produce 52 weeks a year. Self Published.

This is a description of what one farm does using high tunnels for season extension in Kentucky. It is available ordered directly from Au Naturel Farm/3298 Fairview Church Rd/Smiths Grove, KY 42171 (wiediger@msn.com and www.aunaturelfarm.homestead.com/)

Pennsylvania State University College of Agriculture Department of Horticulture Center for Plasticulture. 2003. 2003 High Tunnel Production Manual.

This has information on all aspects of high tunnels from the twenty eight 17' X 36' high tunnels at Penn. State.

Pennsylvania State University College of Agriculture Department of Horticulture Center for Plasticulture. 2003. The Penn State High Tunnel Research and Education Facility 2003 Crop Review.

This includes results from experiments done in high tunnels in 2003 at Penn State.

Bycynski, Lynn, ed. 2003. The Hoophouse Handbook- Growing Produce and Flowers in Hoophouses and High Tunnels. Fairplain Publications, Lawrence, KS.

From the editor of Growing for Market (1-800-307-8849 or www.growingformarket.com). A great resource on using and building high tunnels.

Coleman, Elliot. 2001. The Winter-Harvest Manual-Farming the Back Side of the Calendar. Self published.

This is Elliot Colemans text that builds on the Four Season handbook and applies season extension techniques for primarily producing vegetable crops throughout the winter. This manual is available from Growing for Market (1-800-307-8849 or www.growingformarket.com).

Resources:

Harmony Essentials
1522 Lefever Ln
Spring Grove, PA 17362
(sandcmoore@juno.com)

Steve and Carol Moore commonly have biannual intensive Passive Solar Greenhouse workshops at their farm in southern PA. Steve can be contacted at Harmony Essentials/ 1522 Lefever Ln/ Spring Grove, PA 17362 or sandcmoore@juno.com)

Ed Persons
Route 171, Box 375
Mounonboro, NY 03254

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Ed designs and builds excellent economical greenhouse frames.