

Naomi Bosch  
Organic Farming/Gardening  
Jennifer Schmidt  
12/11/13

## Independent Project Lab Report

### Introduction

For our final project, Caroline Vurlumis and I decided to build a hoop house. Hoop houses are a type of miniature greenhouse usually built around a base frame of bent PVC or other pipes that arc over a bed. Their most common application is in extremely cold climates, where they shelter plants from snow or frost and extend the growing season, but we were curious about the potential uses of hoop houses in a warmer climate like Claremont's as an extra boost to plant growth, and as a protective factor against cold desert nights. After some research into hoop house design and function<sup>1</sup>, we decided that a low hoop house built over half a bed of young spinach might help speed the growth of the plants after their transplanting to beds from the greenhouse. We hypothesized that we would see larger leaf width, length, number, and overall plant height in the hoop house spinach as compared to the spinach grown without a cover. Though not originally part of our plan, we also began recording the number of leaves that had been bitten by garden pests after the first week of observation because it became clear that leaf biting was also a notable factor in overall plant health, and we were interested in seeing if the cover provided any shelter from pests.

### Materials

Garden bed

Spinach seedlings

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<sup>1</sup> S, Doug. "Low Tunnel Construction: How to Build a Mini Hoop House." *Mother Earth News: The Original Guide to Living Wisely*. Mother Earth News, 21 Mar 2013. Web. 11 Dec 2013.  
<<http://www.motherearthnews.com/organic-gardening/low-tunnel-construction-mini-hoop-house.aspx>>.

PVC pipe

Tent stakes

Tape

Scissors

Plastic sheeting

Rocks

Paper and pens for recording

Measuring tape

### Methods

- 1) Pick bed for seedling planting and plant seedlings (this step was graciously handled for us by Adam Long, the farm manager).
- 2) Place tent stakes in pairs on opposite sides of the bed, spaced out evenly along the length of the bed to be covered by the hoop house.
- 3) Bend lengths of PVC pipe over the top of the bed, feeding their ends down over the top of the tent stakes to secure them.
- 4) Roll plastic sheeting out and measure a length appropriate for covering the PVC-enclosed bed area. Cut out sufficient sheeting material and drape it over the top of the PVC arches. Wrap one long end of the sheeting around a long straight length of PVC and tape the edge to the pipe every few inches to create a bar around which excess sheeting can be rolled.
- 5) Secure other three edges of the sheeting to the ground using large rocks.
- 6) Take measurements of a sampling of five spinach seedlings each from inside and outside the hoop house every week – we recorded all values in centimeters.

## Results

### Uncovered spinach

11/13/13

height	largest leaf width	length	leaf #	
2.5	1	2	4	
2.8	0.5	1.6	4	
2.8	0.7	2	4	
1.8	1	1.5	6	
2.75	1	2	8	
2.53	0.84	1.82	5.2	

### Covered spinach

11/13/13

height	largest leaf width	length	leaf #	
3.75	1	2	4	
3	1.25	2.25	5	
3	1.25	2	6	
2.75	1.2	2.25	5	
3	0.75	1.75	4	
3.1	1.09	2.05	4.8	

### Uncovered spinach

11/20/13

height	largest leaf width	length	leaf #	# bitten
3.75	2	2.5	7	2
3.5	1	2.5	6	3
3	1	2.5	5	3
3.5	1	2	4	2
3.5	1	2	6	0
3.45	1.2	2.3	5.6	2

### Covered spinach

11/20/13

height	largest leaf width	length	leaf #	# bitten
5.5	1.6	2.5	6	3
5.5	1.5	3	7	2
4.75	1.25	2.75	6	3
5.75	1.5	3.25	4	1
4.25	2.5	3.5	6	3
5.15	1.67	3	5.8	2.4

Uncovered spinach

11/27/13

height	largest leaf width	length	leaf #	# bitten
5.5	2.2	3	8	3
4.6	1.6	2.5	6	2
4.9	1.4	2.4	6	3
4.4	1.9	2.7	4	0
3.8	1.6	2.5	6	2
4.64	1.74	2.62	6	2

Covered spinach

11/27/13

height	largest leaf width	length	leaf #	# bitten
6	2.5	3.8	6	4
6.35	3.65	4.4	6	4
6.7	1.9	3.65	7	3
4.76	3.17	3.3	7	3
7.6	1.9	3.8	4	2
6.282	2.624	3.79	6	3.2

Uncovered spinach

12/4/13

height	largest leaf width	length	leaf #	# bitten
6	3	4	9	5
5.25	2	3	7	4
6.25	2	4	6	4
4.5	2	3	7	5
2.5	2	2.5	6	2
4.9	2.2	3.3	7	4

Covered spinach

12/4/13

height	largest leaf width	length	leaf #	# bitten
10	3.25	5.25	8	5
6.75	3	4.5	7	4
10.25	3	4.5	7	6
7.5	3	4.5	7	4
9	4	6	8	6
8.7	3.25	4.95	7.4	5

Averages of each data column are highlighted at the end of the column. See below for comparisons of each week's average values. Within the table of averages, comparative values with a difference of 1 cm or greater between them are highlighted.

*Table of Averages*

	height (cov)	height (uncov)	largest leaf width (cov)	largest leaf width (uncov)
11/13/13	3.1	2.53	1.09	0.84
11/20/13	5.15	3.45	1.67	1.74
11/27/13	6.282	4.84	2.624	1.74
12/4/13	8.7	4.9	3.25	2.2

  

	length (cov)	length (uncov)	leaf # (cov)	leaf # (uncov)
11/13/13	2.05	1.82	4.8	5.2
11/20/13	3	2.3	5.8	5.6
11/27/13	3.79	2.62	6	6
12/4/13	4.95	3.3	7.4	7

  

	# bitten (cov)	# bitten (uncov)
11/13/13	Not recorded	Not recorded
11/20/13	2.4	2
11/27/13	3.2	2
12/4/13	5	4

There were slightly noticeable differences in leaf width and length in later weeks of observation, indicating a slight advantage on the part of the spinach in the hoop house, and no appreciable observed difference in the number of leaves on any of the plants, or their susceptibility to being bitten by garden pests. The most striking and consistent difference was observed in the height of the spinach seedlings. After the first week of recorded growth, the spinach seedlings in the hoop house remained consistently ahead of the outside seedlings in terms of average height by a minimum of 1.4 centimeters. Some stunning

growth in the final week brought the average difference up to 3.8 centimeters! While our full hypothesis was not supported, as evidence of consistent average largest leaf width and length differences were scant and leaf number and pest bite number both appeared wholly unaffected by the hoop house, there *was* significant evidence to suggest that hoop house conditions positively affected the growth of spinach seedlings as measured by height.

### Discussion

This experiment tested out a basic hypothesis about the nature of plant growth in differing temperature conditions. Possible uncontrolled variables in the experiment include the fact that a strong cold spell hit during the two middle weeks of recording, which may have made the difference in temperature between the inside and outside of the hoop house more striking, and the multiple days of rain that occurred during the study period, which likely boosted the amount of water the outside seedlings got as they were not covered by the waterproof plastic sheeting of the hoop house. If given a chance to repeat this experiment, I would also want to lay down slug pellets or some similar low-impact organic pest repellent both inside and outside of the hoop house, as data about plant growth might have shown even more distinct trends if it had been less mediated by the appetites of garden pests. On the whole, I feel that our data suggest interesting future potential for more formal and long-term study of potential hoop house usage on the Organic Farm. Studies using multiple crops, less hastily built hoop houses, and supportive growth factors such as soil augmentations or pest repellents might yield even more dramatic and informative results.



Photo Appendix



Seedlings as first observed before building the hoop house on November 6<sup>th</sup> vs. seedlings as observed on the final day of recording, December 4<sup>th</sup>.



Building the hoop house.



The completed hoop house.



Data recording on November 27<sup>th</sup>.