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High Tunnel Production: Inputs, Labor, and Crop Productivity

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Abstract
The 30 × 12 × 96 ft (W × H × L, 2,880 ft 2) high tunnel was planted and maintained as part of a high tunnel production budget project funded by a Specialty Crop Grant through the Iowa Department of Agriculture and Land Stewardship. Six growers throughout the state participated in the project with the objectives of creating an enterprise budgeting tool that estimates the costs and revenues associated with producing specific crops in a high tunnel, either as a single crop or multi-crop system. The budgeting tool will estimate the production cost and net profit per square foot in a high tunnel from mono-culture (one crop per tunnel) or multi-cropping, successionplanted systems. This report summarizes the findings from the high tunnel at the ISU Horticulture Research Station. The plantings in this high tunnel were used to collect labor and yield data as well as demonstrate a continuous, multi-cropping production system. A publication containing the enterprise budgeting tool, using this data and data collected from the other six farms, will be available through Iowa State University Extension and Outreach in the fall of 2012.

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Introduction

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Materials and Methods

Fourteen different vegetable crops, including two herbs, were planted and grown in the high tunnel over a 7-month period, with the first planting on March 15 and the last on July 5. The tomatoes, bell peppers, and cucumbers were set out as transplants through black plastic mulch. Bibb, romaine, and green loose-head lettuce plants were set out as 7-wk-old transplants. Direct-seeded crops included bush beans, spinach, leaf lettuce, snap peas, bunching onions, basil, and cilantro. The duration each crop was in the high tunnel is shown in Figure 1.

The crops were drip irrigated. Tensiometers were used to monitor soil moisture levels and determine irrigation needs.

Input, planting, labor, and harvest records were maintained for all crops.

Results and Discussion

A succession planting of 14 different crops from March 15 through October 15 (31 weeks) resulted in 125 percent utilization of the 2,880 square-foot high tunnel. Annual input costs were approximately $380.50, which does not include the cost of water (approximately 14,000 gallons) and depreciated costs for irrigation equipment, stakes, tools, and trellises (Table 1). The estimated annual depreciation cost over eight years for the 6-yr-old high tunnel was $875.

The 31-week season required approximately 203 hours, averaging 6.5 hr/week. The highest percentage of time was spent harvesting and the least was required for pest management (Figure 2). At a $12/hour salary, the seasonal labor cost to manage the high tunnel was $2,436.

Based on the amount of space utilized, yield, and crop value, the most profitable crop produced in the high tunnel this season was grape tomatoes (Table 2). The second most profitable was the leaf lettuce mix. The least profitable was the bunching onions due to the value, length of time in the high tunnel, and time required for hand weeding. The first

planting of determinant slicing tomatoes did not produce well due to high temperatures in the high tunnel and excessive pruning.

Due to problems with the irrigation system, the project had to be discontinued on October 15. The late planting of tomatoes, green beans, lettuce mix, and romaine were still producing at that time and would have resulted in additional revenue with minimal time commitment.

Differences in locations, quantities planted, production seasons, and planting systems will yield varying results. This study revealed that a multi-cropping system that stretches the harvest season with different crops harvested from April through October would be advantageous to farmers' market vendors. However, data from mono-culture or two-crop production systems may prove more profitable. The results from the other six growers will provide additional information for developing an accurate budget tool to determine efficient production methods to fit individual market needs.

Acknowledgements

Thanks to the Iowa Department of Agriculture for funding this project and to the staff at the Horticulture Research Station for their assistance with this project.

Table 1. Annual expenses.[1]

Item	Cost
Seeds and transplants	162.38
Fertilizer	22.00
Black plastic, 360 @ $.017 per ft	6.12
T-tape irrigation line, 720 ft @ $.025 per ft	18.00
Plant labels	10.00
Soil test	48.00
Pesticides	7.50
Row cover – 1,000 ft.	100.00
Twine	6.50
Total	380.50

[1]Does not include the cost of water and depreciated costs for irrigation equipment, stakes, tools and trellises.

Table 2. Crop yield, gross revenue, percent of high tunnel space utilized and duration in the high tunnel.[1]

Crop	Yield	$ value/unit	Gross revenue	% of high tunnel occupied	Duration (wk)
Green beans (lb)	53.5	2.50	107.00	13.0	12
Cucumbers (lb)	215	1.25	268.75	10.4	12
Grape tomatoes (lb)	136.75	3.50	478.60	6.6	16
Slicing tomatoes (lb)	440	2.00	660.00	26.2	24
Bibb lettuce (hd)	65	1.50	97.50	2.8	6
Leaf lettuce mix (lb)	38	4.50	171.00	7.0	8
Green lettuce (hd)	41	1.50	61.50	2.8	8
Romaine lettuce (hd)	42	1.50	63.00	2.8	12
Spinach (lb)	17.5	4.50	78.75	8.4	10
Snap peas (lb)	49	3.50	171.50	15.6	12
Green peppers (lb)	171	1.00	171.00	10.4	14
Red peppers (lb)	62	1.50	186.00	5.5	16
Bunching onions (bunches)	40	1.25	50.00	2.1	4
Basil (lb)	2.5	15.00	37.50	5.5	8
Cilantro (lb)	2.5	15.00	37.50	5.5	4
Total			$2,639.60	124.6%	

[1]Total growing season: March 15–October 15.

	Mar	Apr	May	June	July	Aug	Sept	Oct
Wildfire leaf lettuce mix (3 plantings)								
Covair spinach (2 plantings)								
Evergreen bunching (scallion) onions								
Buttercrunch (bibb) lettuce								
Costal Star romaine lettuce (2 plantings)								
Nevada (green) lettuce								
Sugar Snap peas								
Provider green beans								
Slicing tomatoes: Polbig, Mt. Spring, BHN 826, FL 91(2 plantings)								
Sweet Mojo grape tomatoes								
Green bell peppers: Aristotle and Revolution								
King Arthur red bell peppers								
Diva cucumbers								
Santo cilantro								
Basil								

Figure 1. The growing season for crops grown in a high tunnel in Iowa.

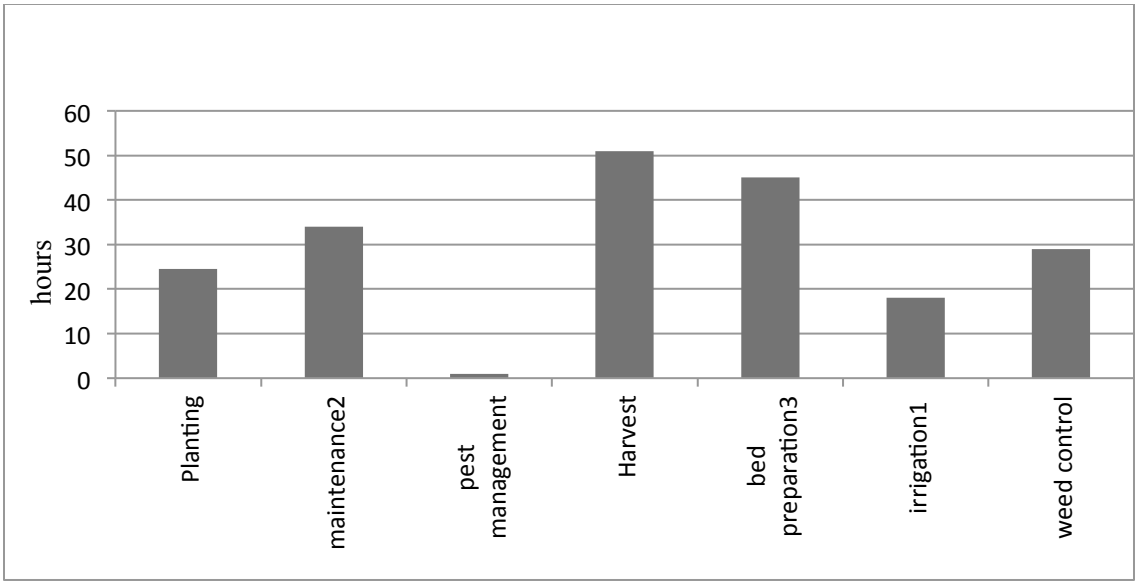

Figure 2. Labor required to manage a high tunnel for 31 weeks in Iowa.
[1]Irrigation line installation, repair, monitoring tensiometers, etc.
[2]Training, pruning, side-dress fertilization, row covers, etc.
[3]Tilling, laying, and removing plastic, fertilization, etc.