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The Economics of Hoop House Fruits and Vegetables

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A hoop house is "a freestanding or gutter-connected covered structure, without heating or electrical power, using passive ventilation for air exchange and cooling, and an irrigation system for crop production." This "plasticulture" technology is promoted as having benefits, including reducing production risks associated with insect and disease control, and variable growing conditions. Hoop houses have also been said to have potential to extend the growing season to target fruit and vegetable production for niche marketing opportunities. Given the potential production advantages, many growers have been asking for economic information associated with hoop houses and whether or not this technology should be implemented in their operations.

To answer such questions, The Samuel Roberts Noble Foundation evaluated two fruit and vegetable cropping systems (System 1: spinach followed by tomato; and System 2: strawberry followed by yellow and zucchini squash) that were grown in high tunnel hoop houses in south-central Oklahoma for the 2007-2008, 2008-2009 and 2009-2010 growing seasons. The objectives were (1) to determine the expected cost of production for each crop and system, and (2) to determine the breakeven price for each crop in each system. The replicated study utilized four 1,400-square-foot, high tunnel hoop houses with each house having four 238-cubic-foot permanent raised growing beds. All fertilizer treatments were managed based on results from soil samples taken throughout the growing season, and all treatments for weeds, insects, fungi and diseases were administered as needed based on daily visual inspection. Labor requirements were also measured and recorded in hours into one of seven production categories: preplanting, planting, crop care, hoop house maintenance, harvesting, sorting and packaging, and post-crop cleanup. Enterprise budgeting techniques were used to determine expected values for cash operating expenses and fixed costs associated with depreciable assets.

Production yields averaged 648 and 1,918 pounds per house of spinach and tomato, respectively, and 518, 452 and 318 pounds per house of strawberry and yellow and zucchini squash, respectively. Growers can expect to experience less variation in spinach yield across growing seasons compared to the tomato, strawberry and squash crops. This is potentially a result of production timing and the disease/insect complex relative to plant type. Spinach is a cool-season crop that is not subjected to volatile spring temperatures or extreme heat. It is also a non-fruit producing crop, and, therefore, threatened by fewer diseases and/or insects compared to other crops in the study. Growers can also expect hoop house fruit and vegetable production to require a considerable amount of labor. The spinach/tomato system required an average of 152 hours of labor while the strawberry/squash system required an average of 114 hours of labor. Labor largely consisted of crop care and the combined activities of harvesting, sorting and packaging with an allocation of 29 percent and 42 percent, respectively, for the spinach/tomato system and 36 percent and 26 percent, respectively, for the strawberry/squash system.

Economic results indicate growers can expect operating costs to comprise approximately 40 percent of total costs while the remaining 60 percent is comprised of fixed costs associated with depreciable assets. Total costs were $3,620 and $3,461 for the spinach/tomato and strawberry/squash systems, respectively. Labor and house ownership and maintenance costs were the two largest expense categories for both systems;

31 percent and 26 percent, respectively, for the spinach/tomato system and 25 percent and 27 percent, respectively, for the strawberry/squash system.

Produce from this study was not marketed; however, breakeven prices were determined for each crop in each system, as reported in Table 1. For the scenario where all spinach and tomato produce is sold and labor is valued at $7.75/hour, growers need to receive $3.04/lb for spinach and 86 cents/lb for tomato in order for the spinach/tomato system to break even. Breakeven prices per pound are lower when labor is not valued. Results for the strawberry/squash system can be interpreted in much the same way. Readers should be mindful that water and marketing costs were not included in these calculations. Breakeven prices will be higher than those reported here when the cost of water, marketing and transportation to and from the market is included.

Breakeven prices are especially sensitive to the percentage of marketable yield sold and the value of labor, as alluded to earlier. Profit-minded growers commonly assume that 100 percent of marketable yield can be sold, but previous research shows this is not always the case. A production and marketing study conducted in rural Oklahoma reported that 52 percent, 64 percent and 68 percent of the marketable yield for field tomato, yellow squash and zucchini squash, respectively, could not be sold at market and went to waste. Due to the possibility of post-harvest waste, breakeven prices were calculated assuming that only 75 percent and 50 percent of crops were sold. Breakeven prices assuming percent yield marketed are reported in Table 2. These scenarios can also benefit growers who pursue horticultural activities for recreation/lifestyle purposes. This class of grower may choose to consume 25 percent or 50 percent of produce and/or distribute among family and friends while the remaining produce is sold at market. Spinach and strawberry crops appear to be more sensitive to the percent yield marketed scenarios compared to the tomato and squash crops. For the scenario where only 50 percent of the spinach crop is available for market and labor is valued at $7.75/hour, breakeven price increases from $3.04/lb to $6.07/lb. Under the same scenario, strawberry breakeven price increases from $5.31/lb to $10.62/lb. Growers using hoop house technology should focus on management practices to decrease post-harvest waste, as breakeven prices decrease when a greater percentage of produce is marketed.

You may be familiar with the saying "covered space is expensive space." That is one of the reasons the spinach/tomato system is recommended for profit-minded growers as compared to the strawberry/squash system – even though total costs are greater in the spinach/tomato system. Strawberry production requires more growing days in the hoop house, which equates to a larger portion of fixed costs and, ultimately, higher breakeven prices when compared to cool-season spinach. Spinach also has less production risk as yields are more stable across years. Considering individual crops, tomato and yellow and zucchini squash are suited to hoop house growing environments; however, when evaluating cropping systems to provide year-round production, spinach appears to have more benefits as a cool-season crop compared to strawberry. Growers wishing to use hoop house plasticulture technology should target warm- and cool-season crops that are economically beneficial and complement each other in a production cropping system. ■

Table 1. Breakeven prices by crop when cost calculations include and exclude the value of grower/owner labor and 100% of marketable produce is sold at market ($/lb)

	System 1			System 2	
	Spinach	Tomato	Strawberry	Yellow Squash	Zucchini Squash
100% yield; includes labor	3.04	0.86	5.31	0.79	1.11
100% yield; excludes labor	2.11	0.59	4.18	0.48	0.68

Table 2. Breakeven prices by crop when cost calculations include and exclude the value of grower/owner labor and only 75% and 50% of marketable produce is sold at market ($/lb)

	System 1			System 2	
	Spinach	Tomato	Strawberry	Yellow Squash	Zucchini Squash
75% yield; includes labor	4.05	1.15	7.08	1.06	1.48
50% yield; includes labor	6.07	1.72	10.62	1.59	2.22
75% yield; excludes labor	2.82	0.78	5.58	0.65	0.91
50% yield; excludes labor	4.22	1.17	8.37	0.97	1.37

Giacomelli, G. A. "Engineering Principles Impacting High-tunnel Environments." HortTechnology 19,1(2009):30-33.

Biermacher, J.T., S. Upson, D. Miller, and D. Pittman. "Economic Challenges of Small-scale Vegetable Production and Retailing in Rural Communities: An Example from Rural Oklahoma." Journal of Food Distribution Research 38,3(2007):1-13.