2011 Cost of Producing Fresh Market Field-Grown Tomatoes in Western Washington

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS080E

Preface

The study results presented in this WSU publication serve as a general guide for producing fresh market field-grown tomatoes in western Washington in 2011. This publication can be used by new and existing tomato producers to help evaluate production decisions, determine potential returns, and prepare budgets. Specific assumptions are included in this publication, but these assumptions may not fit every situation since production costs and returns vary among farm operations, depending on the following factors:

- Farm size
- Crop yields
- Input prices
- Capital, labor, and natural resources
- Type and size of machinery
- Cultural practices
- Commodity prices
- Management skills

Cost estimations in the enterprise budget vary depending on the intended use. To avoid drawing unwarranted conclusions about any particular farm, readers must closely examine the assumptions used in this guide and then adjust the costs and/or returns as appropriate for their individual situation.

Fresh Tomato Production in Washington

Essentially every county in Washington State has some fresh market tomato production, and most fruit is sold in-state. Tomato production in western Washington is dispersed and occurs on small acreages. In 2007, there were a total of 318 acres in production on 409 farms (Table 1). In 2006, the total value of tomato production in Washington was estimated to be $1– $1.2 million (WSCPR 2010). While tomatoes are a relatively minor crop in terms of overall production and value in Washington, they are a mainstay crop for direct-market farmers statewide. Most tomatoes are currently sold through direct marketing.

Tomato varieties are either determinate (vegetative growth stops after approximately three flower trusses per stem) or indeterminate (plant growth and fruit set continue until environmental conditions are no longer favorable). Higher yielding varieties tend to be indeterminate, and they require staking and, in many cases, pruning. Earlier varieties tend to be determinate, and these varieties have shorter plant stature and may be grown without staking or pruning.

Tomatoes grow best when temperatures are between 65°F–80°F. When temperatures are above 98°F or below 40°F, pollination and fruit set are inhibited (Kinet and Peet 1997). Yield is positively correlated with sunlight, and shading reduces yield by reducing fruit size. For optimum production, tomatoes are grown from transplants and harvested by hand. Seed requirements are approximately one-half ounce per acre, and plant populations are generally 4,000–6,000 plants per acre. Seed costs are approximately $90 per oz and vary by seed variety. Seedlings are started in the greenhouse and are 6–8 weeks old when transplanted to the field.

Most tomatoes are staked and grown in raised beds with drip irrigation and black plastic mulch. Black plastic mulch controls weeds, conserves moisture, and increases soil temperature. Also, various types of protective covers are often used.

Fertilizer and regular irrigation are essential for high quality fruit production. Tomatoes generally require 75–100 lb of nitrogen/acre, 100–150 lb of phosphate/acre, and 100–150 lb of potassium/acre at planting (Oregon State University 2003). An additional 25–50 lb of nitrogen/acre is applied from first to final flowering. In Washington, irrigation needed is approximately 1–2 inches per week, depending on the temperature (Oregon State University 2003). Tomato yields vary with geographical area and number of harvests, and can range from 24,000 to 34,000 lb/acre. Harvested tomatoes can be stored at 45–50°F and 90–95% relative humidity for up to 2 weeks (USDA ARS 2004).

Study Objectives

The primary objectives of this study are: (1) to provide estimates for capital requirements and production costs of field-grown tomatoes in Washington State, (2) to provide growers with a tool for analyzing the profitability of tomato produc-

tion, and (3) to develop an Excel workbook that allows the user to estimate production costs and examine the impact of different input assumptions, yields, and price scenarios.

This publication is not intended to be a definitive guide to production practices but is helpful in estimating the physical and financial requirements of comparable plantings.

Sources of Information

The data presented in this study, including input prices, were obtained from a group of experienced tomato growers in western Washington. Their production practices and requirements for equipment, supplies, and labor are the basis for the assumptions used to develop this enterprise budget. Furthermore, the values reported here represent what these growers anticipate if no unforeseen production failures occur. However, crop loss should be anticipated periodically. Given that many factors affect production costs and returns, individual growers can use the Excel Workbook provided to estimate their own costs and returns.

Budget Assumptions

1. This budget is based on a 1.25-acre block of field-grown tomatoes on a 20-acre mixed vegetables farm, where 0.25 acre is not being used for any direct tomato production. This leaves a total production area of 1 acre. Table 2 shows the tomato block specifications for this scenario.
2. The growing season goes from February to September, and the harvest season is from August to September. Tomatoes are sold through direct marketing (e.g., farmers markets, CSA, and the like).
3. Tomato yield is 30,360 pounds per acre, based on 0.23 lb of tomatoes per plant, harvested 3 times a week for 8 weeks, which equals approximately 5.52 lb per plant per season. Estimated return to the grower is $2 per pound.
4. The farm uses a drip irrigation system with a total installation cost of $30,000 or $1,500 per acre.
5. Agricultural plastic mulch (black 1 mil) is used, at a cost of approximately $440 per acre. A bed-shaping mulch layer combination machine is used to prepare and shape the bed and to lay the mulch. Mulch laying takes about 8 hours of labor. The plastic mulch is removed by hand, which takes approximately 11 hours of labor per acre.
6. The total value of bare agricultural land is $10,000 per acre, with property taxes of $200 per acre.
7. The interest rate on investment is 5%.

Summary of Results

The estimated annual costs and returns for the production of a 1-acre field of tomatoes in Washington State are shown in Table 3. Production costs are split into variable costs and fixed costs. Variable costs are the costs of field operations, harvest and packing, labor, materials, and machinery maintenance and repairs. Fixed costs (which are incurred whether tomatoes are grown or not) include depreciation, interest, taxes, and insurance. Based on the given assumptions, the total estimated cost of production for 1 acre of tomatoes is approximately $25,983. Table 4 shows the net returns for different price and yield scenarios.

The fixed costs (shown in Table 2) are based on underlying cost data shown in Tables 5 through 7. Table 5 presents the detailed machinery and equipment requirements for a 20-acre mixed vegetables farm. Interest costs for a 1-acre tomato enterprise are given in Table 6, and the depreciation costs are given in Table 7.

Interest costs of production represent the required return on investments. These costs can be actual interest payments on loans used to finance farm operations and physical capital investments, or they can be opportunity costs, or a combination of the two.

WSU enterprise budgets are economic budgets (not financial/cash budgets), and to fully understand them, it is important to understand the concept of *opportunity cost*. Opportunity cost is defined as the revenue foregone by not investing in the next best alternative carrying a similar financial risk. For example, if a producer invests $50,000 of equity capital in equipment, he or she gives up the alternative of investing that money in the stock market, or paying off an outstanding loan. Thus, if the producer is to realize an "economic" profit, the $50,000 equipment investment must earn a return that is higher than the producer would earn from the next best alternative. If the next best alternative happens to be paying off an outstanding loan that carries an annual interest rate of 6%, economic profits are not realized until a net return greater than $3,000 is realized by the equipment investment. Thus, the tomato enterprise budget reflects an interest cost on owned or borrowed capital.

The same is true in calculating the opportunity costs of an operator's labor and owned land. In calculating labor costs, an operator's labor is valued at the amount he or she could earn if they were hired someplace else to do the same work, or at the amount it would cost to hire someone to do the work the operator currently does himself/herself. Likewise, in calculating the opportunity cost of a producer's owned land, this land would be valued at the amount a producer could earn if he or she rented it out instead of keeping it for his or her own use.

Depreciation costs (shown in Table 6) include the annual replacement cost of machinery and equipment, which is the amount a producer would pay to replace machinery and equipment per year, on average. Although using replacement prices may overstate the costs growers are experiencing in the present, these prices do indicate the earnings that would be needed to replace depreciated assets in the future. Recent price increases for machinery and equipment mean that the cost of replacing older machinery and equipment will be substantially higher than what depreciation costs would indicate. However, when looking at the long-term viability of an enterprise, it is important to consider its ability to replace older depreciated assets on an actual replacement-cost basis.

Excel Workbook

An Excel spreadsheet version of the sample tomato enterprise budget (Table 3) and associated data underlying its production cost calculations (Tables 5–7), as well as plastic mulch calculators (Appendix 1 and 2) are available on the WSU School of Economic Science's Extension website at http://extecon.wsu.edu/pages/Enterprise_Budgets.[1] Growers can modify certain values in this Excel Workbook and thus use it to evaluate their own production costs and returns.

References

Hinman, H. 2002. Understanding and Using WSU Crop Enterprise Budgets. http://extecon.wsu.edu/pages/Enterprise_Budgets.

Kinet, J. M., and M. M. Peet. 1997. Tomato. In: The Physiology of Vegetable Crops. H. C. Wien (ed.). CABI Publishing, New York, NY.

Oregon State University. 2003. Fresh Market Tomato *Lycopersicon esculentum*. http://nwrec.hort.oregonstate.edu/tomato.html.

USDA ARS. 2004. The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks. Agriculture Handbook Number 66. http://www.ba.ars.usda.gov/hb66/contents.html.

USDA ERS. 2010. U.S. Tomato Statistics, Table067. http://usda01.library.cornell.edu/usda/ers/92010/Table067.xls.

WSCPR. 2010. Compendium of Washington Agriculture. Tomato. http://69.93.14.225/wscpr/LibraryDocs/Tomato2010.pdf.

[1] This website provides access to enterprise budgets of various crops in Washington. Hinman (2002) is a good reference for readers wishing for more details about understanding and using WSU enterprise budgets.

Acknowledgements

This study was funded by the NIFA Specialty Crops Research Initiative, USDA SCRI-SREP Grant Award No. 2009-02484. The authors wish to thank the project team, especially Dr. Thomas L. Marsh (IMPACT Director, School of Economic Sciences, WSU), Dr. Debra A. Inglis (Extension Plant Pathologist, WSU), and the participating WSU Extension Publication reviewers for their helpful comments, as well as Chris Benedict (WSU Extension) for his help in organizing the focus group. We would also like to thank the tomato growers who generously assisted in developing this enterprise budget.

Table 1. Washington State Census of Number of Farms with Tomatoes, Area Harvested and Area Irrigated, 1978–2007

	1978	1982	1987	1992	1997	2002	2007
No. Farms	158	156	141	114	128	301	409
Area harvested (acres)	758	479	477	346	351	367	318
Acres irrigated (%)	100	100	100	87.3	96	—	—

Source: USDA ERS (2010).

Table 2. Tomato Block Specifications

Variety	Indeterminate
Block size (productive)	1 acre
In-Row Spacing	2 feet
Between-Row Spacing	5 feet
Row width	4 feet
Row length	500 feet
Density	5,500 plants
Number of Rows	22 rows

Table 3. Estimated Cost and Returns of Producing Field-Grown Tomatoes ($/acre)

Total Returns	**Unit**	**Price/unit**	**Quantity**	**Total**	**Note**	**Your Return**
Tomato	pound	$2.00	30,360	$60,720.00	Harvest 0.23 lb of tomatoes per plant 3 times a week for 8 weeks	
Variable Costs	**Unit**	**Cost/unit**	**Quantity**	**Total**	**Note**	**Your Cost**
Primary tillage	hour	$18.00	1	$18.00	Bed preparation labor	
Secondary tillage	hour	$18.00	1	$18.00	Bed preparation labor	
Land preparation						
Soil testing	acre	$35.00	1	$35.00		
Bed shaping	hour	$18.00	7	$126.00		
Plastic mulch	roll	$100.00	4.4	$440.00	Black 1 mil plastic, 5' x 2,000' roll at $100 each roll	
Plastic mulch installation	hour	$18.00	8	$144.00	Total labor cost of 2 people; using mulch layer equipment	
Tomato transplants	acre	$640.00	1	$640.00	Including cost of labor and transplants	
Planting transplants	hour	$18.00	23	$414.00		
Chemicals and Fertilizer						
Insecticides	acre	$0.00	0	$0.00		
Fungicides[1]	acre	$125.00	1	$125.00	Using copper	
Lime[1]	acre	$255.00	1	$255.00	1 ton of lime per acre plus 1 hour to spread it	
Compost	acre	$200.00	1	$200.00		
Fertilizer	acre	$1,650.00	1	$1,650.00	Includes foliar and ground fertilizer, and application	
Irrigation						
Water charge	acre	$0.00	1	$0.00		
Electric charge	acre	$0.00	1	$0.00	This cost is captured in overhead	
Labor						
Compost application	hour	$18.00	3	$54.00		
Pruning	hour	$18.00	132	$2,376.00	Pruning for basketweave method	
T-post installation	hour	$18.00	183	$3,294.00		
Staking and tying	hour	$18.00	21	$378.00		
Harvesting and packing						
Hand harvest and field packing	hour	$18.00	336	$6,048.00		
Boxes	10-lb box	$0.75	3,036	$2,277.00		
Year-end crop removal						
Stake removal	hour	$18.00	16	$288.00	Removal by hand	
Take down trellis	hour	$18.00	165	$2,970.00	Removal by hand; Total labor cost of 2 people	
Plastic mulch removal	hour	$18.00	11	$198.00	Removal by hand; Total labor cost of 2 people	
Maintenance and Repairs						
Machinery Repair	acre	$175.00	1	$175.00		
Fueling and Lubrication	acre	$75.00	1	$75.00		
Irrigation System Maintenance and Repair	acre	$100.00	1	$100.00		
Other Variable Costs						
Plastic mulch disposal	lb	$0.03	1197.90	$38.93	Disposal facility receiving charge is $65/ton or $0.0325/lb	
Overhead (5% of variable costs)	acre			$1,116.85		
Interest on Variable Costs (5%)[2]	acre			$781.79		
Total Variable Costs				**$24,235.57**		
Fixed Costs						
Depreciation						
Irrigation System	acre			$67.50		
Machinery and Equipment Annual Replacement Cost	acre			$300.00		
Interest						
Land	acre			$500.00		
Irrigation System	acre			$41.25		
Machinery and Equipment	acre			$138.60		
Other Fixed Costs						
Land and Property Tax	acre			$200.00		
Insurance Cost (on entire farm)	acre			$100.00		
Management	acre			$400.00		
Total Fixed Costs				**$1,747.35**		
Total Cost				**$25,982.92**		
Estimated Net Returns				**$34,737.08**		

[1]Includes cost of labor and cost of material
[2]Interest expense on 8 months during a year.

Table 4. Estimated Net Returns at Various Prices and Yields of Field-Grown Tomatoes

Yield (pounds per acre)	Price ($ per pound)				
	$1.00	**$1.50**	**$2.00**	**$2.50**	**$3.00**
15,000	-$9,733	-$2,233	$5,267	$12,767	$20,267
20,000	-$5,140	$4,860	$14,860	$24,860	$34,860
25,000	-$547	$11,953	$24,453	$36,953	$49,453
30,000	$4,046	$19,046	$34,046	$49,046	$64,046
35,000	$8,639	$26,139	$43,639	$61,139	$78,639
40,000	$13,233	$33,233	$53,233	$73,233	$93,233

Table 5. Physical Capital Requirements and Irrigation System for a 20-Acre Farm

Machinery/Equipment	Purchase Price*	Number of Units	Total Cost
55-Horsepower Tractor	$25,000	1	$25,000
Bed shaper and mulch layer	$2,800	1	$2,800
Pickup	$30,000	1	$30,000
Spader	$20,000	1	$20,000
Disc	$3,000	1	$3,000
Fertilizer Spreader	$3,500	1	$3,500
Rotary mower	$3,000	1	$3,000
Propagation house	$7,000	1	$7,000
Cultivation equipment	$1,500	1	$1,500
Shop Tools	$5,000	1	$5,000
Total Cost of Machinery, Equipment and Building			**$100,800**
Irrigation System—Drip Irrigation			
Total cost of materials and installation	$30,000	1	**$30,000**

*Purchase price is approximate and corresponds to new machinery, equipment, building or irrigation system.

Table 6. Interest Costs for a 1-Acre Tomato Block

	Total Purchase Price	Salvage Value	Number of Acres	Total Interest Cost	Interest Cost Per Acre
Land	$12,500	$12,500	1.25	$625	$500.00
Irrigation System	$1,500	$150	1	$41	$41.25
Machinery and Equipment	$100,800	$10,080	20	$2,772	$138.60
Interest Rate	*5.0%*				
*Salvage Value**	*10.0%*				

Notes:
Interest Cost is calculated as: (Total Purchase Price + Salvage Value)/2 x 5%.
*Salvage Value refers to the estimated value of an asset at the end of its useful life. It is calculated as: Total Purchase Price x 10%. Salvage Value does not apply to land because land is not a depreciable asset.

Table 7. Depreciation Costs for a 1-Acre Tomato Block

	Total Purchase Price	Number of Acres	Total Value Per Acre	Years of Use	Depreciation Cost Per Acre
Irrigation System	$1,500	1	$1,500.00	20	$67.50
Machinery and Equipment*					$300.00

Notes:
The depreciation cost for the irrigation system is calculated as *straight line depreciation*: Total Purchase Price – Salvage Value/Years of Use.
*An estimate of average annual replacement costs, rather than depreciation costs, is used for machinery and equipment. Replacement prices may overstate costs growers experience. However, they indicate the earnings needed to replace depreciable assets. When looking at long-term enterprise viability, it is important to consider the ability to replace depreciable assets.

By **Suzette P. Galinato**, Research Associate, IMPACT Center, School of Economic Sciences, Washington State University, Pullman, WA; **Carol A. Miles**, Associate Professor/Associate Scientist and Vegetable Extension Specialist, WSU Mount Vernon Northwestern Washington Research and Extension Center, Mt. Vernon, WA; and **Srinivasa S. Ponnaluru**, Postdoctoral Research Associate, IMPACT Center, School of Economic Sciences, Washington State University, Pullman, WA.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, sex, religion, age, color, creed, and national or ethnic origin; physical, mental, or sensory disability; marital status or sexual orientation; and status as a Vietnam-era or disabled veteran. Evidence of noncompliance may be reported through your local WSU Extension office. Trade names have been used to simplify information; no endorsement is intended. Published October 2012.

FS080E