Financial and Economic Analysis of Producing Commercial Tomatoes for Fresh Market in the Georgia

By Esendugue Greg Fonsah and Joel E. Hudgins

Abstract

This study examines the financial and economic viability of producing commercial tomatoes for the fresh market in Georgia. Historical data on yields, prices received by growers, and actual production input prices were collected and used to develop an enterprise budget. Specifically, the study was aimed at analyzing profit margins and break-even conditions, and presents various operating scenarios under a risk-rated return framework. Analysis of enterprise cost and return estimates indicated that commercial tomato production is a lucrative business enterprise worth investing.The result will be useful to Georgia and the neighboring southeast and deep-south states that adopt similar agricultural production practices.

Introduction

The tomato (*Lycopersicon esculentum* Mill.) is the most widely grown vegetable in the U.S. (Kelley and Boyhan, 2006) and an important horticultural crop for the state of Georgia in particular and the southeast and deep-south states at large. Tomato production ranked 13th, 18th, and 23rd in the 2003, 2004, and 2005 Georgia Agricultural Commodity Rankings, by generating $122.2 million, $102.6 million, and $80.6 million in farm gate value during the same time periods respectively. Furthermore, Georgia is the seventh largest fresh tomato producing state nationwide (Boatright and McKissick, 2003; 2004, 2005; Fonsah, 2006).

Georgia tomato production has been rising since 1983 when reported total planted area was 2,800 acres compared to 6,500 acres in the year 2005. This reflects a 232.1 percent increase in planted area and reflects the importance of the crop to the state. In 1993, 1995, 2000, and 2001 areas planted were equal to or above 4,000 acres. From 2002 to 2005, this figure surpassed 6,000 acres. Harvesting area has also been rising at the same rate as planted area. In 1983 although 2,800 acres were planted only 2,400 acres were harvested equivalent to 86 percent (Fonsah 2006; Fonsah, et. al., 2005; Lucier and Plummer 2003a, b, c; USDA ERS, 2006).

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At the national level, the U.S. production of fresh tomatoes has equally been continually on the rise since 1978 where 156.1 million pounds were produced. By year 2002, production had increased over three times to 534.9 million pounds. Despite the three-fold increase in production, the U.S. still imports a substantial portion of its tomatoes to supplement domestic consumption which is also increasing tremendously (Fonsah, 2006; Lucier and Plummer 2003c).

The North American Free Trade Agreement (NAFTA) has boosted trade between the U.S., Canada, and Mexico. Consequently, Canada is now our number one trading partner for fruits and vegetables. In 2002, tomato export value to Canada was worth $111.7 million equivalent to 83 percent of total United States tomato export value whereas $11.6 million was recorded for export to Mexico equivalent to 8.6 percent during the same time period. The U.S. also exports a small quantity of tomatoes to the United Kingdom, the Netherlands, and Japan (Lucier and Plummer 2003b; Fonsah 2006; Fonsah, et. al., 2005).

Due to the continuous growth and importance of the tomatoes industry to a state's economy and farm sector, university extension efforts need to focus on delivering information and decision aids that will help the tomato farmers in developing production, marketing and financial plans and decisions. This study provides an in-depth discussion of the development of one such important decision aid that defines parameters or guidelines aimed at facilitating the drafting or implementation of farm operations. It is further designed to provide financial and economic information that would serve as a guide to fresh commercial tomato growers and extension agents in Georgia as well as neighboring southeast and Deep South states.

Material and Method

The importance and rapid growth of the fresh tomato industry in the past decades created the impetus and the need for an economic and financial analysis. Growing tomato is a complex operation. To be successful, the growers must consider several factors such as soil requirement and site preparation, cover crops and minimum tillage, windbreaks, transplanting, plant spacing, varieties, staking, and pruning. Growers using plastic mulch must decide the type of plastic, bed height and width, fertilizer management under plastic, planting, and type of irrigation. All these considerations are part of the cost of production and have an impact on profitability (Kelly, 2006; Fonsah, et al., 2005a).

It is therefore important that all cost components be assessed, evaluated, and analyzed to determine the viability of the industry. In order to gather all the necessary information, we visited several farms and conducted interviews with growers. Primary data for such inputs as lime, fertilizers, plastic mulch, fumigation, insecticides, and fungicides were obtained. Furthermore, we visited vendors of agricultural inputs to collect prices of chemicals and equipment. Historical data on yields and grower prices were obtained from Georgia Agricultural Statistics Service (GASS) and the National Agricultural Statistic Service (NASS). The cost estimate in this study reflects a combination of the current agricultural practices in Georgia and recommendations from UGA specialists. In the enterprise budget, we assumed 7.5 percent interest rate for total pre-harvesting variable costs and 8 percent for fixed costs respectively. The prices used for calculating cost of drip irrigation and total fixed machinery did not include quantity discounts. A risk-rated cost and returns analysis under five different yields and prices of fresh commercial tomatoes was adopted from a pepper enterprise budget (Fonsah, et al., 2005).

The tomatoes production in this study assumed the use of plastic mulch and drip irrigation which is almost the universal practice of growers in Georgia, the neighboring south-east, and deep-south states respectively. Plastic mulch is used to promote earliness, reduce weed pressure, and to conserve moisture and fertilizer. The recommended plastic mulch was 20 to 24 inches wider than the bed width to provide enough material for tucking under the soil for anchorage. The standard bed heights in our study ranged from 4 to 8 inches and top widths of beds range from 28 to 36 inches. The number of plants used was 4,000 per acre. Normally the recommended distance is 5 feet between rows with an in-row spacing of 18 to 24 inches (Kelley, 2006; Kelley and Boyhan, 2006).

Results and Discussions

Variable Costs

The variable or operating costs vary with the adopted cultural practices. Common variable cost components include seed,

fertilizer, chemicals, fuel, and labor. Variable costs were further broken down into pre-harvest, harvesting, and marketing operations to enable us to analyze the costs at different stages of the production process (Fonsah, et al,. 2004; Fonsah, et. al,. 2005b).

The estimated total pre-harvest variable cost was $4,163.33 per acre. The cost of fertilizer was $605.01 per acre, which accounts for almost 14.5 percent of the total pre-harvest variable cost. Other important cost components included purchases of plants, plastic mulch, fumigation, insecticide, fungicide, and transplant and labor amounting to $340.00, $288.00, $570.00, $512.40, $239.80, and $550.00 per acre, respectively (Table 1).

Harvesting and Marketing Costs

Total harvesting and marketing costs were estimated at $6,840.00 per acre. This figure included picking and hauling, grading and packing, container, and marketing. The calculation was based on an average yield of 1,800 boxes per acre. Aggregating the estimates for pre-harvest, harvesting and marketing costs, the estimated total variable cost was $11,003.33 (Table 2).

Fixed Costs

Fixed costs included items such as equipment ownership (depreciation, interest, insurance, and taxes), management, and general overhead costs. Most of these costs are incurred even if little production takes place and these costs should be considered when planning production costs. Total fixed cost was estimated at $896.97. This amount was the sum of machinery, irrigation, and overhead and management costs of $205.36, $67.11, and $624.50 respectively (Table 3).

Land can be treated as fixed cost and land lease is a variable cost. However, land cost per acre varies significantly from county to county, from region to region and whether it is irrigated or non-irrigated. As a result of the variability, we purposely excluded it in this study but acknowledge that it is a cost that growers must consider in their planning process. Overhead and management expenses were estimated to be about 15 percent of all pre harvest variable expenses. The amount was used as payment for management and farm costs, such as utilities, pick up trucks, farm shop, equipment, and fees, which cannot be allocated to any one specific enterprise. Total budgeted cost per acre $11,900.30 per acre. This amount was derived by adding total variable (pre-harvest variable and harvesting and marketing costs) and total fixed costs respectively (Table 3).

Break-Even Analysis

The break-even analysis shows different categories of cost or price per unit. After dividing pre-harvest variable cost by the expected yield, the break-even pre-harvest variable cost was $2.31 per acre, while the break-even harvest and marketing cost of $3.80 was obtained by dividing total harvesting and marketing cost by the expected yield. Furthermore, the break-even fixed cost was $0.50 while the break-even yield was 1,587 cartons per acre. The break-even price of $6.61 was obtained by dividing total cost per acre by the expected yield (Table 4).

Risk Rated Net Sensitivity Returns

Since prices and yields fluctuate frequently from year to year, it is important to estimate the "riskiness" and "sensitivity to such fluctuations" of producing fresh commercial tomatoes. The University of Georgia Agricultural and Applied Economics Department uses a standard five-scenario format involving different yield and price structures in developing risk-rated enterprise budgets. Fresh commercial tomato growers are expected to attain or exceed the ***median*** values half the time while they are expected to reach or exceed the optimistic values once in a six year-period. The optimistic and best prices were 12 percent and 21 percent increase of the median price respectively. The ***pessimistic*** values were the below average price and yield conditions, and are expected to be realized once every six years. The ***best*** and ***worst*** scenarios are based on extreme price and yield conditions that are expected to occur "once a lifetime." The pessimistic and worst prices were equivalent to 15 and 36 percent reduction of the median values respectively. These price and yield values were obtained from historical data and GASS (Table 5).

In a best case scenario involving a $9.50 price for a 25 pound carton and an expected yield of 1,800 cartons per acre, expected risk-rated returns was $5,200.00 and the calculated net budgeted return per acre was $5,200.00 with 99 percent chance of profit. Maintaining the same yield level, but assuming that expected price decreased to $7.50 per carton, the expected return was

$1,600, the net return was $1,600 per acre and the chances of making profit was 79 percent. With a further price decrease to $6.50 and an expected yield of 1,800 cartons, the net return expected would be -$200 with 46 percent chances of profitability (Table 5).

Drip Irrigation Cost Per Acre

Plastic mulch is installed alongside drip irrigation. It is economically unfeasible to invest in an irrigation system for just an acre of fresh tomato production. The reason is because installation costs will be unreasonably high and the system will not be fully utilized. As a result, we decided to simplify our computation by basing our calculation on 40 acres, which is the (minimum) economic size of operations that would justify the installation of such an irrigation system. The total annual fixed cost of drip irrigation based on 40 acres was $2,685. Then we divided that amount by 40 acres to obtain $67.13 per acre. An interest rate of eight percent was used in the calculations. The fixed cost component included material (pipe and fittings, storage tanks, pump, and motor) purchases, depreciation, interest, taxes, and insurance. The cost of operating the irrigation system was $220.83 per acre which included electricity, repairs, and maintenance (Table 6).

Annual Fixed Cost

A similar procedure used to calculate cost of drip irrigation was adopted for fixed cost. Since investing in heavy equipment like tractor, plow, disk, bedder, transplanter, cultivator, and sprayer just for an acre of fresh commercial tomato cultivation is economically inefficient, we therefore based our fixed cost calculation on 40 acres. We then divided the total annual fixed cost of $3,315 by the number of acres to obtain an annual fixed cost of $82.88 per acre. Factors such as the percentage of time the equipment was used for tomato cultivation, salvage value, life-span of the equipment, depreciation, interest, taxes, and insurance were taken into consideration in the calculations (Table 7).

Conclusion

Fresh commercial tomato is an important vegetable crop in the state of Georgia. This article has outlined the development of a risk-rated enterprise budgeting tool which farmers can use as a decision aid in making production, marketing, and financial decisions in their tomato farm operations. This analysis has shown that commercial tomato production is a lucrative and profitable enterprise for Georgia growers. Although successful commercial tomato production is always challenging and difficult, our study showed that it remains an economically feasible business enterprise worth considering as an investment opportunity for Georgia vegetable growers in particular and U.S. farmers at large. The result of the study will be beneficial not only to Georgia, but also the neighboring southeast and deep-south states that have similar characteristics and agricultural practices.

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Table 1. Pre-harvest variable costs per acre of producing commercial tomatoes for fresh market in Georgia using plastic mulch and drip irrigation, 2006

Items	Unit of application	Quantity of application (units/year)	Price per application ($/unit per year)	Total cost (US$/acre/ year)
Plants	thou	4.00	85.00	340.00
Lime & gypsum	ton	1.50	56.67	85.01
Fertilizer granular 1/	ton	1.00	350.00	350.00
Fertilizer liquid	ton	1.00	170.00	170.00
Mulch, plastic black 2/	roll 4000'	1.80	160.00	288.00
Fumigation	acre	200.00	2.85	570.00
Insecticide 3/	appl.	21.00	24.40	512.40
Fungicide	appl.	4.40	54.50	239.80
Herbicide	acre	1.90	31.34	59.55
Stakes	thou	4.00	40.00	160.00
String	acre	30.00	1.55	46.50
Labor ,mach operation	hr	5.00	7.00	35.00
Labor, production transplant	hr	100.00	5.50	550.00
Crop Insurance	acre	1.00	140.00	140.00
Consultant	acre	1.00	70.00	70.00
Cleanup(plastic&stakes)	acre	1.00	150.00	150.00
Machinery	acre	1.00	25.76	25.76
Drip Irrigation	acre	1.00	220.83	220.83
Land rent	acre	1.00	0.00	0.00
Interest on Operation Capital	$	4012.84	0.075	150.48
PreHarvest Variable Costs 4/				**4163.33**

1/ Fertilizer amount and application rates should be based on soil test recommendations.
2/ Metalized plastic for fall planting costs $210 per roll or $378 for 1.8 roll per acre.
3/ Fall planting include injectable insecticides and fertigation.
4/ Due to rounding error, totals may not add up.

Table 2. Harvesting and marketing costs per acre of producing commercial tomatoes for fresh market in Georgia, 2006

	Unit	Quantity of application (per year)	Price per application ($/unit per year)	Total cost (US$/ acre per year)
Picking and hauling	ctn.	1800	1.25	2,250.00
Grading and packing	ctn.	1800	0.85	1,530.00
Container	ctn.	1800	0.85	1,530.00
Marketing	ctn.	1800	0.85	1,530.00
Total harvest and marketing costs per acre				**6,840.00**
Total variable and marketing costs per acre				**11,003.33**

Table 3. Fixed costs per acre of producing commercial tomatoes for fresh market in Georgia, 2006

	Unit of application	Quantity of application (per year)	Price per application ($/unit per year)	Total cost (US$/ acre per year)
Machinery	acre	1.00	205.36	205.36
Irrigation	acre	1.00	67.11	67.11
Land	acre	1.00	0.00	0.00
Overhead and management	$	4,163.32	0.15	624.50
Total fixed costs ($)				**896.97**
Total budgeted cost per acre ($)				**11,900.30**

Table 4. Break-even analysis of producing commercial tomatoes for fresh market in Georgia, 2006

B/E Pre-harvest variable cost per carton ($)	2.31
B/E Harvest & marketing cost per carton ($)	3.80
B/E Fixed costs per carton ($)	0.50
B/E price per carton ($)	6.61
B/E Yield (cartons)	1,587

Table 5. Risk-rated sensitivity analysis per acre for producing commercial tomato for fresh market in Georgia, 2006

	Worst 1/ yield/acre (1400 ctn)	Pessimistic yield/acre (1600 ctn)	Median yield/acre (1800 ctn)	Optimistic yield/acre (2000 ctn)	Best yield /acre (2200 ctn)		
	1400	1600	1800	2000	2200		
Expected Price 2/	Expected return/acre (7% of the time) 3/	Expected return/acre (16% of the time) 3/	Expected return/acre (51% of the time) 3/	Expected return/acre (32% of the time) 3/	Expected return /acre (6% of the time) 3/	Net return based on 1800 ctn /acre 4/	Chances of profit based on 1800 ctn/acre (%) 5/
$ 5.50	$-4,748	$-2,916	$-2,000	$-1,084	$ 747	$-2,000	14
$ 6.50	$-3,019	$-1,140	$ -200	$ 739	$ 2,619	$ -200	46
$ 7.50	$-1,320	$ 627	$ 1,600	$ 2,573	$ 4,519	$ 1,600	79
$ 8.50	$ 354	$ 2,384	$ 3,400	$ 4,415	$ 6,446	$ 3,400	95
$ 9.50	$ 2,004	$ 4,134	$ 5,200	$ 6,265	$ 8,396	$ 5,200	99

1/. Yield is expressed in the number of 25 lbs cartons or boxes/acre.
2/. Risk-rated sensitivity prices i.e. the lowest value is worst price while the highest value is best price.
3/. Expect return/acre is the minimum risk-rated amount which a grower is expected to earn or more base on the percentage chances shown in each column.
4/. Refers to the actual net return or amount based on the medium yield of 1,800 cartons/acre and the various expected price/carton equivalent to 25 lbs.
5/. Percentage chances of obtaining profit with the expect yield of 1,800 cartons/acre given expected risk-rated prices.

Table 6. Estimated cost per acre of drip irrigation for producing commercial tomatoes for fresh market in Georgia based on 40 acres with 6 ft. spacing and a 15 horse-power electric motor, 2006

	Investment	Years life	Depreciation (per year)	Interest (per year)	Taxes and insurance (per year)
Pipe and fittings	6000.00	20	300.00	225.00	45.00
Storage tanks	660.00	20	33.00	25.00	5.00
Well	6500.00	25	260.00	244.00	49.00
Pump and motor	3500.00	12	292.00	131.00	26.00
Filter and auto	200.00	10	20.00	8.00	2.00
Injection system	750.00	10	75.00	26.00	6.00
Tubing	5800.00	1	00.00	218.00	44.00
Installation	8000.00	20	400.00	300.00	60.00
Total investment 1/	**30660.00**		**1305.00**	**1150.00**	**230.00**
Total annual fixed costs 1/		**2,685.00**			
Total annual fixed costs per acre 1/	**S 67.13**				
Operating costs					
Motor size (HP)			15.00		
Repairs			831.00		20.78
Annual pumping hours			2250.00		
Electricity					
Demand (standby charge) per year					
Rate $ per KWH			0.08		
Annual energy cost			2194.20		
Annual energy cost per acre					54.86
Tubing					145.20
Operating cost per acre per year 1/					**S 220.83**

1/. Totals may not add up due to rounding errors.

Table 7. Investment and estimated annual total fixed machinery cost of producing commercial tomatoes for fresh market in Georgia using 40 acres as base and 8% interest rate, 2006

Item	This crop	New cost (US$)	Salvage value	Years life	Depre-ciation (per year)	Interest (per year)	Tax and insurance (per year)	FC/Ac.
Tractors	15%	70000	14000	15	560.00	473.00	88.00	28.00
Plow	20%	8000	1600	10	128.00	72.00	13.00	5.00
Disk	20%	12000	2400	10	192.00	108.00	20.00	8.00
Appl. herb	10%	2500	500	10	20.00	11.00	2.00	1.00
Bedder	100%	4500	900	10	360.00	203.00	38.00	15.00
Transplanter	100%	3200	640	10	256.00	144.00	27.00	11.00
Cultivator	0%	3500	700	10	0.00	0.00	0.00	0.00
Sprayer	30%	15000	3000	10	360.00	203.00	38.00	15.00
Total		**118700**	**23740**		**1876.00**	**1213.00**	**226.00**	**83.00**
Total annual fixed costs		**3,315.00**						
Total annual fixed costs per acre ($) 1/		**82.88**						

1/. Totals may not add up due to rounding errors.