

Benchmarking Nova Scotia Apple Farms

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March, 2009

1.0 Introduction

Orchards are a significant component of Nova Scotia agriculture. As such, information and assistance that can improve the management of apple operations in Nova Scotia is of benefit. Thus, the need exists for farmers to compare the economic performance of their farms with that of their peers, and to understand how alternative production practices relate to cost and returns results.

1.1 Purpose and Objectives

The purpose of this project is to develop a set of farm economic benchmarks for Nova Scotia apple farms. The objectives are:

- To design a standardized data collection instrument
- To conduct a farm cost and returns benchmark survey of Nova Scotia apple growers
- To analyze and interpret benchmark results from the survey.

1.2 Approach

To meet the above objectives, the following was undertaken. First, a survey instrument was designed to capture the cost, return, and agronomic information necessary to compare financial results. Second, primary data was collected from participating growers using the survey instrument. Finally, the data were collated and analyzed, and interpreted in the context of key management variables.

1.3 Organization of the Report

Section 2 below provides a description of the development of the survey instrument and the data collection procedure. Section 3 presents the results of the data collection and analysis. Section 4 places the results in context.

2.0 Data Collection

This section provides an overview of the data collection process undertaken in the study. Section 2.1 provides a review of other work relevant in designing an apple benchmarking model. Section 2.2 provides a discussion of the benchmarking template developed in the study. Section 2.3 provides a description of the data collection process.

2.1 Previous Work

The purpose of the survey instrument was to provide a common template in which growers could supply their financial information, and to provide a standard means of collecting and relating all relevant farm cost and returns information. To do so, a brief scan of cost and returns financial benchmark studies for apples in eastern Canada and the northeastern US was undertaken. The search isolated three sources relevant to this study.

2.1.1 Cornell Fruit Farm Business Summary

The scan observed an ongoing fruit farm business management in upstate New York (White *et al* 2006 and 2007). This was observed to be the only apple financial benchmark study relevant to Nova Scotia. The Fruit Farm Business Summary program was established in 1998 with the goal of helping farm managers to improve the financial management of their businesses. Under the program, data are collected from fruit farms (primarily apples, in practice) related to cash flows, costs and returns, and assets, liabilities, and farm equity.

The 2006 survey (White *et al* 2007) had a sample of 22 farms, up from 17 farms in the 2005 survey (White *et al* 2006). The format of the study is such that an overview of the sample of farms (average acreage, production, revenue, etc.) is presented. Next, average balance sheet measures are summarized for the sample, and estimates of returns against the book value of assets. Following the balance sheet, income statements are summarized as averages from the sample. The income statements are formatted on an accrual basis. Little detail is provided in terms of the assumptions made on specific cost and revenue line items in the income statement. Analyses of variable costs, fixed costs, revenues and profitability are undertaken on the income statement in terms of net farm income, return to operator's labour, management, and equity, and labour and management income.

2.1.2 Michigan Tree Fruit Business Analysis Summary

Wittenberg *et al* (2007) conducted a benchmark study of tree fruit farms in Michigan. The study used data from the 2006 crop, and had 9 farms participating. To be eligible, farms had to have at least 50% of farm sales from cherries, apples, and other tree fruits. In the study, data were collected in terms of income statements and balance sheets. The data were formatted to be fully accrual, and included all farm receipts and expenses (including those from other farm enterprises). Due to the small number of participants,

only averages could be reported. Results were presented in terms of farm profitability and returns against balance sheet measures, and interpreted relative to previous years in which the study has been conducted.

2.1.3 Canadian Horticultural Council Template

A spreadsheet cost of production analysis template developed by the Canadian Horticultural Council (CHC) to collect and compare production costs for tree fruits. The CHC template has several desirable features. It provides for a detailed relationship between production cost items and agronomic information such as yield and year of establishment. It also allows for direct analysis of expenses in establishment years and detailed analysis of newly established blocks as they are phased into production. No information from grower balance sheets is included in the CHC template, and the formatting of line items is more focused on precisely what information is to be included rather than precision in terms of accrual vs. cash-basis accounting.

2.1.3 Observations

Useful aspects of the Cornell and Michigan State studies and the CHC template were observed. The Cornell and Michigan State studies were similar in structure. Both focused on whole-farm analyses and combined income statement information with balance sheet measures to allow for analysis of fully accrual data. Since the study is ongoing, the accrual results were compared over time to provide an indicator of changes in economic conditions. The studies tended to be less precise with respect to the definition and content of specific line items, which lessen their interpretation. In addition, there was relatively little reference to agronomic details, such as fruit varieties, tree age, etc. in the analyses which limit their interpretation. Thus, the agronomic factors driving observed economic performance are not observed.

Conversely, the CHC template offered a great deal of detail on agronomic relationships and assumptions to be followed under line items. It was less precise with regard to accounting conventions and did not consider balance sheet data.

In developing the model in this study, the following approach was employed.

- First, it was determined as important that cost and returns estimates could be related to agronomic aspects such as varieties grown and yields. This aspect was more clearly exemplified in the CHC template.
- Secondly, it was determined that it be relatively easy for growers to participate in. Thus, precise formats were established for line items as per the CHC template.
- Third, the data were to be collected in February in March 2009, making time of the essence. As a consequence, a balance sheet analysis was viewed as being beyond the scope of the study.

Thus, it was determined that a generalized version of the CHC template was preferred for use in this study.

2.2 *Design of Survey Instrument*

The starting point for the survey instrument applied in this study was CHC model. First, the CHC model was generalized to establish the specific format of cost and revenue line items, based on the nature of Nova Scotia apple production. Secondly, a survey instrument was devised to collect an agronomic overview of the farm. Finally a generalized definition of cost and returns items was developed to provide a *pro forma* income statement.

Table 2.1 below presents the line items contained in the cost and returns template. In the table, growers were directed to isolate and report expense items *for the apple enterprise*. The revenue line items allow for precise identification of apple revenue, other tree fruit revenue, and other enterprise revenue. Table 2.2 provides detail on the assumptions growers were instructed to use in entering values into Table 2.1. Table 2.3 presents the architecture of supporting data collected from growers on the farm and their orchard operation.

Table 2.1 Pro Forma Income Statement Used in Data Collection

	\$ Actual
Revenue	
Apple Sales:	
Fresh	
Processing	
Juice	
Stone fruits and pears	
Other crops, livestock, and products	
Custom work, storage, rent	
Government Program Payments	
Crop Insurance indemnities received	
Grants	
Other Farm Sales	
Total	
VARIABLE CASH COSTS	
Hired Labour	
Family Unpaid Labour	
Operator Unpaid Labour and Management	
Orchard Renewal Materials (trees, stakes, etc)	
Tree Training Materials	
Cover Crops	
Fertilizer	
Nutrient Sprays	
Fungicides	
Insecticides	
Herbicides	
Other Weed Control (Mulch)	
Other Pest Controls	
Thinners	
Preharvest Drop Controls	

Bee Rentals	
Bin Repair	
Bin Rental	
Consulting Fees (Includes IPM)	
Hired custom work, storage, rent	
Machine Repair/Maintenance	
Fuel	
Crop Insurance premiums	
Transportation	
Fruit purchased for resale	
Other expenses	
Marketing and Association Fees	
Interest on Operating Capital	
TOTAL VARIABLE CASH COSTS	
FIXED CASH COSTS	
Interest on land/building/machine loans	
Interest on orchard establishment loans	
Land Rental	
Other Insurance premiums	
Taxes	
Other Overhead	
NON CASH COSTS	
Amortization-Establishment Costs	
Depreciation-Machine/Building	
TOTAL COSTS	
GROSS INCOME	
TOTAL VARIABLE COSTS	
CONTRIBUTION MARGIN	

Table 2.2 Assumptions Employed in Data Collection

<p>Yield Give average across fresh, processing, and juice apples Report proportions of each</p> <p>Orchard Renewal Materials Report replacement tree and other costs of site establishment materials Report annual value. Assume straight-line depreciation, 20 years</p> <p>Labour Include all benefits and an allowance for additional costs if applicable for housing, flight and local transportation. Attribute family unpaid labour at minimum wage Attribute owner unpaid labour and management at \$15.20/hour- based on NOC 8251 (farmers and farm managers), Annapolis and West Hants, estimated 2008</p> <p>Interest Rate on operating capital One-half of variable costs at prime plus 1</p> <p>Interest on investment Current average interest rate paid by chartered banks on guaranteed investment certificates.</p> <p>Consulting Fees By survey or consensus to possibly include soil and leaf sampling as well as full or part pest monitoring service.</p> <p>Irrigation costs Including both variable and fixed costs associated with owning and operating irrigation equipment.</p> <p>Other Overhead Decision as to what other overhead will include :</p> <p>Pricing for Insecticides, Fungicides, Herbicides Obtained from either a current price list from local supplier or by survey.</p> <p>Contribution Margin Gross income subtract total variable costs.</p>

Table 2.3 Income Statement Supporting Data

1. Acreage			
(a) in Apples		%	ac
Non Bearing			
3-5 years			
6-10 yrs			
11-15 yrs			
16-20 yrs			
20 + yrs			
(b) Pear and stone fruit			
(c) other crops/livestock			
2. Apple Yields		avg bu/ac	
3-5 yrs			
6-10 yrs			
11-15 yrs			
16-20 yrs			
20 + yrs			
3. Apple Marketings			
(a) Share by apple variety		%	
McIntosh			
Cortland			
Grav			
Nothern Spy			
Idared			
Red Del			
Honeycrisp			
Spartan			
Gala			
Gold Delicious			
Other			
(b) Fresh fruit pack out rate		%	
Fresh			
Peeler			
Juice			
4. Planting density/pruning style	Central leader	Central Axe	Spindle
% < 150 t/ac			
% 150-300t/ac			
% 300-600t/ac			
% 600-900 t/ac			
% >900			

2.3 Data Collection

The survey instrument above was administered by members of the study team directly with participating growers in a face-to-face meeting. In advance of the meetings, growers were provided with the template so they knew what was expected of them and could compile their data appropriately. The data were collected between mid-February and mid-March, 2009.

3.0 Results and Data Analysis

A total of 24 farms producing apples agreed to participate in the study and were able to submit useable data. These farms ranged in terms of size and scope; this is summarized below in Table 3.1. The median apple production in the sample was about 36,000 bushels, but with a range of almost 114,000 bushels. There was a similar range in apple acreage around a median of 80 acres. Apple contribution margin (defined as apple revenue less apple variable costs) experienced the relatively largest range (\$-56,000 to almost \$316,000) with a median of about \$20,500. Figure 3.1 provides an overview of apple varieties represented in the sample. McIntosh represents 23% of production in the sample, followed by Northern Spy, Other, Cortland, Ida Red, and Honeycrisp.

Some difficulty was observed in interpreting the fixed cost data. In particular, some producers were unable to accurately report amortization and depreciation results, or to disaggregate it from the remainder of the operation. Thus, the focus was placed on contribution margin- the return over variable costs in the apple enterprise that contributes against total fixed costs on the farm.

Given the above overview of the sample, the data were sorted and filtered to isolate factors associated with profitability. Section 3.1 sorts the results into the Top 5, Bottom 5, and Middle 14 farms based on apple contribution margin. Section 3.2 provides this fragmentation on the basis of apple contribution margin per bushel. Section 3.3 sorts the results according to apple contribution margin per acre. Section 3.4 provides additional analyses of these results.

3.1 Results Sorted According to Contribution Margin

Initially the results in the sample were pooled and ranked according to total contribution margin (total apple revenue less variable costs). These were then ranked and grouped into the top 5 farms, bottom 5 farms, and the median 14 farms, with an average taken within each category. The results are presented in Table 3.2 and 3.3 below.

The tables show that, using raw apple contribution margin as a sort criterion, farm size is an important driver of relative ranking. The top 5 farms average a contribution margin of about \$235,000, almost nine times that of the median 14. Table 3.2 shows that, compared with the median and low farms, the top 5 farms had a higher acreage, production, apple sales and higher expenses. Table 3.3 shows that the top 5 farms had significantly more orchard blocks in the prime production age classes (6-10 and 11-15 years) compared with the median and low margin farms, relatively more Honeycrisp and Northern Spy apples, and relatively less McIntosh. Yields were mostly higher for the larger farms.

3.2 Results Fragmented According to Contribution Margin Per Bushel

The sample was also fragmented according to contribution margin per bushel. The results are presented in Tables 3.4 and 3.5. The contribution margins for the top 5 farms

Table 3.1 Overview of Study Sample

Parameters	Median	Minimum	Maximum	Range
Apple Production, bu/farm	35,662	3,774	117,608	113,834
Apple Acreage, acres/farm	79	10	279	269
Apple Contribution Margin, \$/farm	20,514	-56,184	315,750	371,934

Figure 3.1 Apple Production Represented in Sample by Variety

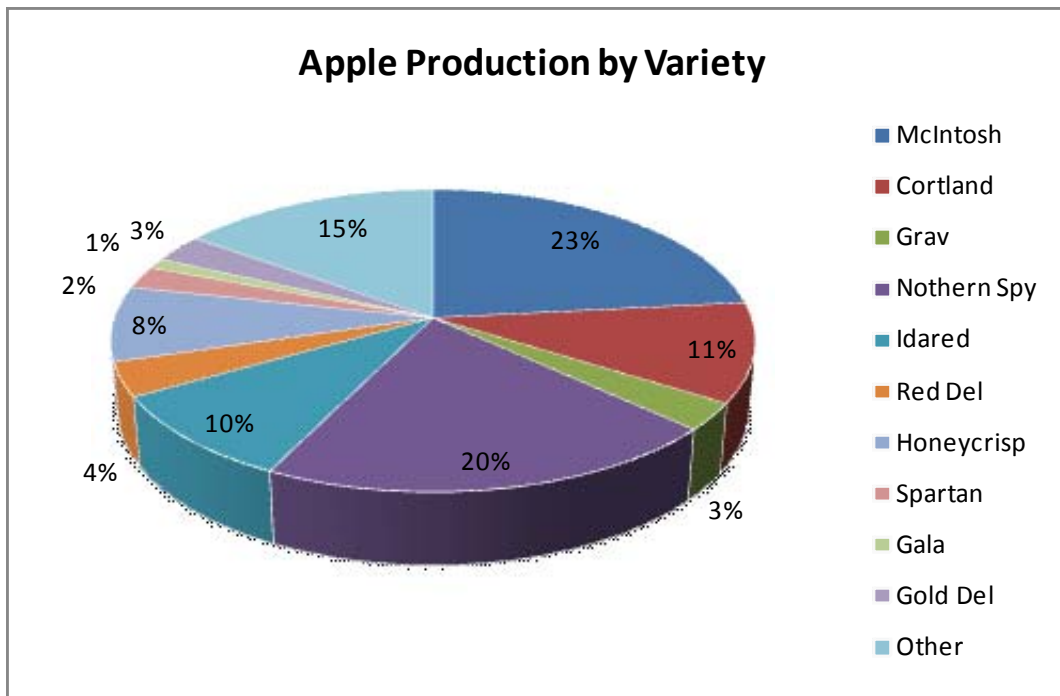


Table 3.2 Sample Ranking Sorted on Total Apple Contribution Margin

	\$/Farm			\$/Bushel		
	<i>Top 5</i>	<i>Median 14</i>	<i>Bottom 5</i>	<i>Top 5</i>	<i>Median 14</i>	<i>Bottom 5</i>
Revenue						
Apple Revenue	786,112	244,411	131,198	\$9.49	\$6.81	\$5.28
Fresh Apple	539,748	169,434	79,027	\$6.51	\$4.72	\$3.18
Processing Apple	188,934	51,414	26,430	\$2.28	\$1.43	\$1.06
Apple Juice	57,430	23,563	25,742	\$0.69	\$0.66	\$1.04
Variable Costs				\$0.00	\$0.00	\$0.00
Hired Labour	187,892	97,273	63,705	\$2.27	\$2.71	\$2.56
Family Unpaid Labour	306	3,600	5,217	\$0.00	\$0.10	\$0.21
Unpaid Labour & Mgmt	18,818	15,739	26,661	\$0.23	\$0.44	\$1.07
Orchard Renewal Materials	34,009	15,835	5,713	\$0.41	\$0.44	\$0.23
Tree Training Materials	8,311	752	100	\$0.10	\$0.02	\$0.00
Cover Crops	21	176	61	\$0.00	\$0.00	\$0.00
Fertilizer	9,632	3,346	2,064	\$0.12	\$0.09	\$0.08
Nutrient Sprays	2,343	1,686	659	\$0.03	\$0.05	\$0.03
Fungicides	39,869	15,924	10,364	\$0.48	\$0.44	\$0.42
Insecticides	20,301	8,879	7,630	\$0.25	\$0.25	\$0.31
Herbicides	4,964	1,527	1,373	\$0.06	\$0.04	\$0.06
Other Weed Control (Mulch)	1,087	1,883	130	\$0.01	\$0.05	\$0.01
Other Pest Controls	1,227	163	78	\$0.01	\$0.00	\$0.00
Thinners	9,677	2,919	1,875	\$0.12	\$0.08	\$0.08
Preharvest Drop Controls	4,736	941	650	\$0.06	\$0.03	\$0.03
Bee Rentals	1,950	507	26	\$0.02	\$0.01	\$0.00
Bin Repair	7,372	3,044	620	\$0.09	\$0.08	\$0.02
Bin Rental	7,088	4,978	469	\$0.09	\$0.14	\$0.02
Consulting Fees (Incl. IPM)	5,477	1,887	1,518	\$0.07	\$0.05	\$0.06
Custom work, storage, rent	5,015	4,408	3,435	\$0.06	\$0.12	\$0.14
Repair/Maintenance	28,062	8,164	6,886	\$0.34	\$0.23	\$0.28
Fuel	18,182	7,584	12,167	\$0.22	\$0.21	\$0.49
Crop Insurance premiums	8,678	2,001	1,677	\$0.10	\$0.06	\$0.07
Transportation	3,130	3,851	3,775	\$0.04	\$0.11	\$0.15
Fruit purchased for resale	101,690	409	800	\$1.23	\$0.01	\$0.03
Other expenses	6,725	5,781	6,022	\$0.08	\$0.16	\$0.24
Marketing/Association Fees	3,011	2,205	979	\$0.04	\$0.06	\$0.04
Interest on Operating Capital	11,638	1,798	2,561	\$0.14	\$0.05	\$0.10
Total Variable Cash Costs	551,211	217,262	167,213	\$6.65	\$6.06	\$6.73
Contribution Margin	234,901	27,149	-36,015	\$2.83	\$0.76	-\$1.45

**Table 3.3 Supporting Data, Sample Ranking
Based on Contribution Margin (\$/farm)**

Parameters	Top 5	Median 14	Bottom 5
Apple Area (acres/farm)	170	63	67
Apple Revenue (\$/farm)	786,112	244,411	131,198
Apple Variable Costs (\$/farm)	551,211	217,262	167,213
Apple Contribution Margin (\$/farm)	234,901	27,149	-36,015
Apple Contribution Margin (\$/bu)	2.83	0.76	-1.45
Apple Contribution Margin (\$/acre)	1,381	431	-541
Area			
Non Bearing Apples (% ac)	7.7%	7.2%	2.1%
3-5 Year Apples (% ac)	10.1%	4.7%	5.7%
6-10 Year Apples (% ac)	18.3%	8.9%	12.1%
11-15 Year Apples (% ac)	18.7%	16.7%	7.9%
16-20 Year Apples (% ac)	5.8%	16.0%	4.0%
20 + Year Apples (% ac)	39.3%	46.5%	68.2%
Yield			
Apple Production (bu/farm)	82,858	35,879	24,837
Average Yield (bu/ac)	487	570	373
3-5 Year Apples (bu/ac)	314	239	81
6-10 Year Apples (bu/ac)	661	465	397
11-15 Year Apples (bu/ac)	611	592	485
16-20 Year Apples (bu/ac)	507	622	362
20 + Year Apples (bu/ac)	485	686	393
Varieties			
McIntosh (%)	18.7%	26.1%	27.4%
Cortland (%)	8.0%	12.3%	12.5%
Grav (%)	2.3%	3.1%	4.3%
Northern Spy (%)	26.3%	16.2%	17.9%
Ida Red (%)	6.7%	12.1%	7.8%
Red Del (%)	2.9%	4.7%	2.1%
Honeycrisp (%)	13.6%	5.2%	1.0%
Spartan (%)	1.3%	3.1%	3.1%
Gala (%)	2.0%	0.4%	0.8%
Gold Del (%)	1.5%	4.7%	1.1%
Other (%)	16.6%	12.1%	21.8%

Table 3.4 Sample Ranking Sorted on Contribution Margin, \$/bushel

	\$/Farm			\$/Bushel		
	<i>Top 5</i>	<i>Median 14</i>	<i>Bottom 5</i>	<i>Top 5</i>	<i>Median 14</i>	<i>Bottom 5</i>
Revenue						
Apple Revenue	623,157	331,863	49,287	\$9.80	\$6.73	\$7.49
Fresh Apple	398,627	234,449	38,107	\$6.27	\$4.76	\$5.79
Processing Apple	174,285	63,609	6,931	\$2.74	\$1.29	\$1.05
Apple Juice	50,245	33,805	4,249	\$0.79	\$0.69	\$0.65
Variable Costs				\$0.00	\$0.00	\$0.00
Hired Labour	162,248	120,147	25,302	\$2.55	\$2.44	\$3.85
Family Unpaid Labour	306	3,537	5,395	\$0.00	\$0.07	\$0.82
Unpaid Labour & Mgmt	18,818	19,941	14,896	\$0.30	\$0.40	\$2.26
Orchard Renewal Materials	21,346	20,078	6,496	\$0.34	\$0.41	\$0.99
Tree Training Materials	8,311	752	100	\$0.13	\$0.02	\$0.02
Cover Crops	21	154	121	\$0.00	\$0.00	\$0.02
Fertilizer	6,289	4,884	1,100	\$0.10	\$0.10	\$0.17
Nutrient Sprays	86	2,512	601	\$0.00	\$0.05	\$0.09
Fungicides	32,531	20,466	4,985	\$0.51	\$0.42	\$0.76
Insecticides	17,283	11,685	2,792	\$0.27	\$0.24	\$0.42
Herbicides	4,085	2,140	538	\$0.06	\$0.04	\$0.08
Other Weed Control (Mulch)	1,087	1,883	130	\$0.02	\$0.04	\$0.02
Other Pest Controls	1,185	199	20	\$0.02	\$0.00	\$0.00
Thinners	5,273	4,798	1,019	\$0.08	\$0.10	\$0.15
Preharvest Drop Controls	2,230	2,068	0	\$0.04	\$0.04	\$0.00
Bee Rentals	1,040	841	0	\$0.02	\$0.02	\$0.00
Bin Repair	4,880	3,857	837	\$0.08	\$0.08	\$0.13
Bin Rental	8,459	4,528	359	\$0.13	\$0.09	\$0.05
Consulting Fees (Incl. IPM)	4,511	2,419	994	\$0.07	\$0.05	\$0.15
Custom work, storage, rent	5,015	4,810	2,311	\$0.08	\$0.10	\$0.35
Repair/Maintenance	19,262	12,723	2,921	\$0.30	\$0.26	\$0.44
Fuel	16,208	10,891	4,882	\$0.25	\$0.22	\$0.74
Crop Insurance premiums	8,678	2,475	351	\$0.14	\$0.05	\$0.05
Transportation	4,218	4,271	1,513	\$0.07	\$0.09	\$0.23
Fruit purchased for resale	52,360	17,899	1,159	\$0.82	\$0.36	\$0.18
Other expenses	6,725	6,537	3,905	\$0.11	\$0.13	\$0.59
Marketing/Association Fees	2,193	2,669	496	\$0.03	\$0.05	\$0.08
Interest on Operating Capital	10,846	2,908	245	\$0.17	\$0.06	\$0.04
<i>Total Variable Cash Costs</i>	<i>425,495</i>	<i>292,070</i>	<i>83,466</i>	<i>\$6.69</i>	<i>\$5.93</i>	<i>\$12.69</i>
Contribution Margin	197,662	39,793	-34,179	\$3.11	\$0.81	-\$5.19

**Table 3.5 Supporting Data, Sample Ranking
Based on Contribution Margin (\$/bushel)**

Parameters	Top 5	Median 14	Bottom 5
Apple Area (acres/farm)	134	92	20
Apple Revenue (\$/farm)	623,157	331,863	49,287
Apple Variable Costs (\$/farm)	425,495	292,070	83,466
Apple Contribution Margin (\$/farm)	197,662	39,793	-34,179
Apple Contribution Margin (\$/bu)	3.11	0.81	-5.19
Apple Contribution Margin (\$/acre)	1,470	431	-1,707
Area			
Non Bearing Apples (% ac)	5.6%	7.0%	7.2%
3-5 Year Apples (% ac)	11.3%	4.4%	13.6%
6-10 Year Apples (% ac)	19.2%	9.9%	18.4%
11-15 Year Apples (% ac)	23.7%	11.9%	19.8%
16-20 Year Apples (% ac)	6.7%	11.5%	9.2%
20 + Year Apples (% ac)	33.5%	55.3%	31.8%
Yield			
Apple Production (bu/farm)	63,582	49,284	6,579
Average Yield (bu/ac)	473	534	329
3-5 Year Apples (bu/ac)	289	257	141
6-10 Year Apples (bu/ac)	600	561	363
11-15 Year Apples (bu/ac)	611	583	522
16-20 Year Apples (bu/ac)	459	629	322
20 + Year Apples (bu/ac)	447	589	344
Varieties			
McIntosh (%)	22.0%	23.7%	27.8%
Cortland (%)	7.2%	12.1%	12.3%
Grav (%)	2.0%	3.3%	3.0%
Northern Spy (%)	29.5%	16.4%	15.2%
Ida Red (%)	7.4%	10.5%	7.1%
Red Del (%)	2.9%	4.0%	3.3%
Honeycrisp (%)	17.2%	3.9%	5.6%
Spartan (%)	1.0%	2.9%	5.6%
Gala (%)	0.8%	1.1%	2.9%
Gold Del (%)	1.0%	4.0%	1.0%
Other (%)	8.9%	17.9%	16.1%

were just under \$198,000, compared with about \$40,000 for the median and a contribution margin loss of about \$34,000 for the low 5 farms. Based on contribution margin per bushel, size does not appear to be as large a determinant, with average acreage about 134 acres for the top 5 farms, compared with 92 acres for the median farms and 20 acres for the low 5 farms.

Tables 3.4 and 3.5 also reveal that agronomic conditions differ markedly across the contribution margin per bushel groups. From Table 3.5 it can be seen that, while the high and low group have similar proportions of trees age 20 years or more (34% vs. 32%), the yield obtained from these trees differs markedly (447 bushels/acre vs. 344 bushels/acre). The top 5 farms had a relatively larger proportion of younger age class trees in the 6-10 and 11-15 year old range compared with the median and low farms. Also, the top 5 farms had relatively more Honeycrisp and Northern spy varieties, while the low and median farms had a higher proportion of McIntosh apples. Finally, the top farms realized a small proportion of apple revenue for juice apples compared with the median and low group, and marketed a relatively high proportion in processing. This provides some indication that the high contribution margin group was involved in further processing.

3.3 Results Fragmented According to Contribution Margin Per Acre

Tables 3.6 and 3.7 present results of a sort of results based on contribution margin per acre, with the results presented in terms of totals and \$/bushel. Under this sort, the bottom 5 farms were the same as that obtained under the based on \$/bushel; the only difference is movement between the top 4 and median group. The contribution margins for the top farms was about \$205,000 compared with about \$37,000 for the median and a contribution margin loss of about \$34,000 for the low 5 farms. The tables show that the results based on contribution margin per acre are broadly similar to that based on contribution margin per acre, although the top and median category the farms are larger than the sort based on returns per bushel.

Table 3.7 shows that agronomic differences explain much of the difference between groups in the sort. Overall yields were highest for the top group, followed by the median, and then followed by the low group. The top group had higher yields for each of the age classes observed, with the exception of the over 20 years age group. The trends relative to apple varieties were similar to those observed above.

Table 3.6 Sample Ranking Sorted on Contribution Margin in \$/acre

	\$/Farm			\$/Bushel		
	Top 5	Median 14	Bottom 5	Top 5	Median 14	Bottom 5
Revenue						
Apple Revenue	694,970	306,215	49,287	\$9.37	\$6.73	\$7.49
Fresh Apple	462,263	211,721	38,107	\$6.23	\$4.65	\$5.79
Processing Apple	178,614	62,063	6,931	\$2.41	\$1.36	\$1.05
Apple Juice	54,094	32,431	4,249	\$0.73	\$0.71	\$0.65
Variable Costs				\$0.00	\$0.00	\$0.00
Hired Labour	160,268	120,854	25,302	\$2.16	\$2.66	\$3.85
Family Unpaid Labour	306	3,537	5,395	\$0.00	\$0.08	\$0.82
Unpaid Labour & Mgmt	18,818	19,941	14,896	\$0.25	\$0.44	\$2.26
Orchard Renewal Materials	26,649	18,184	6,496	\$0.36	\$0.40	\$0.99
Tree Training Materials	8,311	752	100	\$0.11	\$0.02	\$0.02
Cover Crops	21	154	121	\$0.00	\$0.00	\$0.02
Fertilizer	9,501	3,737	1,100	\$0.13	\$0.08	\$0.17
Nutrient Sprays	2,343	1,707	601	\$0.03	\$0.04	\$0.09
Fungicides	36,781	18,948	4,985	\$0.50	\$0.42	\$0.76
Insecticides	17,848	11,484	2,792	\$0.24	\$0.25	\$0.42
Herbicides	3,740	2,263	538	\$0.05	\$0.05	\$0.08
Other Weed Control (Mulch)	497	2,094	130	\$0.01	\$0.05	\$0.02
Other Pest Controls	927	291	20	\$0.01	\$0.01	\$0.00
Thinners	9,641	3,238	1,019	\$0.13	\$0.07	\$0.15
Preharvest Drop Controls	4,736	1,173	0	\$0.06	\$0.03	\$0.00
Bee Rentals	1,830	559	0	\$0.02	\$0.01	\$0.00
Bin Repair	4,372	4,038	837	\$0.06	\$0.09	\$0.13
Bin Rental	8,459	4,528	359	\$0.11	\$0.10	\$0.05
Consulting Fees (Incl. IPM)	3,702	2,708	994	\$0.05	\$0.06	\$0.15
Custom work, storage, rent	2,015	5,881	2,311	\$0.03	\$0.13	\$0.35
Repair/Maintenance	23,062	11,366	2,921	\$0.31	\$0.25	\$0.44
Fuel	14,670	11,440	4,882	\$0.20	\$0.25	\$0.74
Crop Insurance premiums	7,590	2,863	351	\$0.10	\$0.06	\$0.05
Transportation	3,978	4,356	1,513	\$0.05	\$0.10	\$0.23
Fruit purchased for resale	101,330	410	1,159	\$1.37	\$0.01	\$0.18
Other expenses	6,725	6,537	3,905	\$0.09	\$0.14	\$0.59
Marketing/Association Fees	2,347	2,615	496	\$0.03	\$0.06	\$0.08
Interest on Operating Capital	9,143	3,516	245	\$0.12	\$0.08	\$0.04
Total Variable Cash Costs	489,609	269,172	83,466	\$6.60	\$5.91	\$12.69
Contribution Margin	205,362	37,043	-34,179	\$2.77	\$0.81	-\$5.19

**Table 3.7 Supporting Data, Sample Ranking
Based on Contribution Margin sorted on \$/acre**

Parameters	Top 5	Median 14	Bottom 5
Apple Area (acres/farm)	134	92	20
Apple Revenue (\$/farm)	694,970	306,215	49,287
Apple Variable Costs (\$/farm)	489,609	269,172	83,466
Apple Contribution Margin (\$/farm)	205,362	37,043	-34,179
Apple Contribution Margin (\$/bu)	2.77	0.81	-5.19
Apple Contribution Margin (\$/acre)	1,527	401	-1,707
Area			
Non Bearing Apples (% ac)	9.2%	5.2%	7.2%
3-5 Year Apples (% ac)	10.4%	4.9%	13.6%
6-10 Year Apples (% ac)	14.3%	12.4%	18.4%
11-15 Year Apples (% ac)	11.8%	18.1%	19.8%
16-20 Year Apples (% ac)	4.4%	12.7%	9.2%
20 + Year Apples (% ac)	50.1%	46.7%	31.8%
Yield			
Apple Production (bu/farm)	74,144	45,512	6,579
Average Yield (bu/ac)	551	493	329
3-5 Year Apples (bu/ac)	375	165	141
6-10 Year Apples (bu/ac)	855	417	363
11-15 Year Apples (bu/ac)	722	555	522
16-20 Year Apples (bu/ac)	750	560	322
20 + Year Apples (bu/ac)	545	561	344
Varieties			
McIntosh (%)	18.4%	26.0%	27.8%
Cortland (%)	8.3%	11.9%	12.3%
Grav (%)	2.9%	2.9%	3.0%
Northern Spy (%)	25.4%	17.8%	15.2%
Ida Red (%)	6.8%	11.1%	7.1%
Red Del (%)	3.5%	3.8%	3.3%
Honeycrisp (%)	10.5%	6.8%	5.6%
Spartan (%)	0.7%	3.3%	5.6%
Gala (%)	2.2%	0.4%	2.9%
Gold Del (%)	1.6%	3.9%	1.0%
Other (%)	19.7%	12.4%	16.1%

3.4 Additional Analyses

Additional observations can be drawn. First it is evident from the above that the identity of the low farms does not change much based on the fragmentation criteria. This suggests that the distribution of costs and returns across farms is not tight, as suggested by the wide range in returns noted above. Secondly, for the most part, apples are a major enterprise within farms that have others. This is illustrated in Table 3.8 below. Based on total contribution margin, the top 5 farms have about 65% of total farm sales from apples, with the median slightly lower at 57%, and the low group about 80%. Based on contribution margin per bushel the apple share of farm receipts is much higher for the top farm cash receipts at 82%, with much apple receipt shares in the median and low categories. Using contribution margin per acre, the apple receipt shares are much more even across contribution margin categories.

Table 3.8 Apple Enterprise Proportion, Across Fragmentation Methods

Farms Fragmented by Total Contribution Margin			
Parameters	Top 5	Median 14	Bottom 5
Total Revenue (\$/farm)	1,211,526	449,520	165,014
Apple Revenue (\$/farm)	786,112	244,411	131,198
Portion of Apple Revenue	64.9%	54.4%	79.5%
Farms Fragmented by Contribution Margin Per Bushel			
Parameters			
Total Revenue (\$/farm)	757,862	639,732	86,085
Apple Revenue (\$/farm)	623,157	331,863	49,287
Portion of Apple Revenue	82.2%	51.9%	57.3%
Farms Fragmented by Contribution Margin Per Acre			
Parameters			
Total Revenue (\$/farm)	1,082,945	523,630	86,085
Apple Revenue (\$/farm)	694,970	306,215	49,287
Portion of Apple Revenue	64.2%	58.5%	57.3%

Tables 3.9 and 3.10 decompose the expense items above into shares of total variable costs, based on the three contribution margin sorts. The tables show that, regardless of ranking category or the sort criteria, hired labour is the largest single cost item. Interestingly, for the top 5 farms under each of the sort criteria, owners unpaid labour and management and family labour are relatively small proportions. This suggests that for the top 5 farms managers draw a salary, and that family are either not involved to the same extent as on the median and low farms, or that they are maintained as paid employees.

At the same time, total labour expense differs sharply across the categories and by sort, but increases relatively moving from high to median to low group. For example, total labour expense in the sort based on total contribution margin was 38%, 54%, and 57% of total variable costs for the top, median, and low farms, respectively. The analogous values using the contribution margin per bushel sort give total labour cost proportions of 43%, 49%, and 55% for the top, median, and low farms. Thus, while labour is the largest expense item for all farms the top farms appear to make the most efficient use of labour.

Other observations on Table 3.9 are the following:

- The top 5 farms appear to spend relatively more on tree training materials, thinners, and pre-harvest drop controls
- The top 5 farms clearly spent more on fruit for resale, suggesting a different marketing approach compared with the median and low farms
- The low 5 farms tend to spend a greater proportion of expenses on hired custom work, storage, and rent. This suggests that they may lack some of the facilities present on the top and median farms.
- The low 5 farms spend a greater proportion of expenses on fuel.

Table 3.9 Percentage Cost Breakdown

	Sorted by Total Gross Margin			Sorted by Gross Margin/bushel		
	Fraction of Total Variable Cost			Fraction of Total Variable Cost		
	<i>Top 5</i>	<i>Median 14</i>	<i>Bottom 5</i>	<i>Top 5</i>	<i>Median 14</i>	<i>Bottom 5</i>
Hired Labour	34.09%	44.77%	38.10%	38.13 %	41.14 %	30.31%
Family Unpaid Labour	0.06%	1.66%	3.12%	0.07%	1.21%	6.46%
Unpaid Labour & Management	3.41%	7.24%	15.94%	4.42%	6.83%	17.85%
Orchard Renewal Materials	6.17%	7.29%	3.42%	5.02%	6.87%	7.78%
Tree Training Materials	1.51%	0.35%	0.06%	1.95%	0.26%	0.12%
Cover Crops	0.00%	0.08%	0.04%	0.00%	0.05%	0.15%
Fertilizer	1.75%	1.54%	1.23%	1.48%	1.67%	1.32%
Nutrient Sprays	0.43%	0.78%	0.39%	0.02%	0.86%	0.72%
Fungicides	7.23%	7.33%	6.20%	7.65%	7.01%	5.97%
Insecticides	3.68%	4.09%	4.56%	4.06%	4.00%	3.35%
Herbicides	0.90%	0.70%	0.82%	0.96%	0.73%	0.64%
Other Weed Control (Mulch)	0.20%	0.87%	0.08%	0.26%	0.64%	0.16%
Other Pest Controls	0.22%	0.08%	0.05%	0.28%	0.07%	0.02%
Thinners	1.76%	1.34%	1.12%	1.24%	1.64%	1.22%
Preharvest Drop Controls	0.86%	0.43%	0.39%	0.52%	0.71%	0.00%
Bee Rentals	0.35%	0.23%	0.02%	0.24%	0.29%	0.00%
Bin Repair	1.34%	1.40%	0.37%	1.15%	1.32%	1.00%
Bin Rental	1.29%	2.29%	0.28%	1.99%	1.55%	0.43%
Consulting Fees (Includes IPM)	0.99%	0.87%	0.91%	1.06%	0.83%	1.19%
Hired custom work, storage, rent	0.91%	2.03%	2.05%	1.18%	1.65%	2.77%
Machine Repair/Maintenance	5.09%	3.76%	4.12%	4.53%	4.36%	3.50%
Fuel	3.30%	3.49%	7.28%	3.81%	3.73%	5.85%
Crop Insurance premiums	1.57%	0.92%	1.00%	2.04%	0.85%	0.42%
Transportation	0.57%	1.77%	2.26%	0.99%	1.46%	1.81%
Fruit purchased for resale	18.45%	0.19%	0.48%	12.31 %	6.13%	1.39%
Other expenses	1.22%	2.66%	3.60%	1.58%	2.24%	4.68%
Marketing and Association Fees	0.55%	1.01%	0.59%	0.52%	0.91%	0.59%
Interest on Operating Capital	2.11%	0.83%	1.53%	2.55%	1.00%	0.29%
Total	100.00%	100%	100%	100.00 %	100.00 %	100.00 %

Table 3.10 Percentage Cost Breakdown

	Sorted by Gross Margin/acre		
	Fraction of Total Variable Cost		
	Top 5	Medium 15	Bottom 5
Hired Labour	32.73%	44.90%	30.31%
Family Unpaid Labour	0.06%	1.31%	6.46%
Unpaid Labour & Management	3.84%	7.41%	17.85%
Orchard Renewal Materials	5.44%	6.76%	7.78%
Tree Training Materials	1.70%	0.28%	0.12%
Cover Crops	0.00%	0.06%	0.15%
Fertilizer	1.94%	1.39%	1.32%
Nutrient Sprays	0.48%	0.63%	0.72%
Fungicides	7.51%	7.04%	5.97%
Insecticides	3.65%	4.27%	3.35%
Herbicides	0.76%	0.84%	0.64%
Other Weed Control (Mulch)	0.10%	0.78%	0.16%
Other Pest Controls	0.19%	0.11%	0.02%
Thinners	1.97%	1.20%	1.22%
Preharvest Drop Controls	0.97%	0.44%	0.00%
Bee Rentals	0.37%	0.21%	0.00%
Bin Repair	0.89%	1.50%	1.00%
Bin Rental	1.73%	1.68%	0.43%
Consulting Fees (Includes IPM)	0.76%	1.01%	1.19%
Hired custom work, storage, rent	0.41%	2.18%	2.77%
Machine Repair/Maintenance	4.71%	4.22%	3.50%
Fuel	3.00%	4.25%	5.85%
Crop Insurance premiums	1.55%	1.06%	0.42%
Transportation	0.81%	1.62%	1.81%
Fruit purchased for resale	20.70%	0.15%	1.39%
Other expenses	1.37%	2.43%	4.68%
Marketing and Association Fees	0.48%	0.97%	0.59%
Interest on Operating Capital	1.87%	1.31%	0.29%
Total	100%	100.00%	100.00%

4.0 Conclusions

The purpose of this study was to provide a set of farm cost and returns benchmarks that Nova Scotia apple producers could use to understand the determinants of apple farm profitability.

To meet this purpose, the following was undertaken:

- A review was conducted of apple benchmark studies in Canada and the northeastern US
- A survey template was developed to assess Nova Scotia farm costs and returns
- The survey template was administered to 24 Nova Scotia apples growers
- The results were analyzed and placed in context.

The study differs from a cost of production study in that both costs and returns are considered, and the output of farms are not standardized to allow for actual observed differences between farms in product and marketing approach.

The results showed a wide range in contribution margin per farm; this range was drawn together somewhat what the results were fragmented based on contribution margin per bushel or acre. Based on the characteristics of the top 5 farms compared with the median or low farms, it is clear that scale is positively related with contribution margin. However, as evidenced more clearly in the fragmentation based on contribution margin per bushel, management factors such as ongoing investment (as indicated by the age class distribution of orchards) and product mix (as indicated by Honeycrisp and Other varieties, as opposed to McIntosh) as well as yield are clearly important.

Ultimately, labour is the clearly the largest expense item regardless of how farms are sorted. Within the labour cost component, it appears that sharp differences appear in the efficiency with which labour is used.

Overall, it appears that improvements in management have significant potential in Nova Scotia, as evidenced by the wide range in observed contribution margin. While the top five farms are quite profitable (contribution margins in the range of \$200,000), others struggle with negative contribution margins.

These results should prove useful to farmers in understanding the value of farm management practices and interpreting differences between their own farms and the category practices. Relative to the studies undertaken in New York and Michigan, this study highlights the linkage between agronomic factors and short-term returns, as indicated by contribution margin. A useful extension of this approach would be to collect balance sheet information along with a whole farm costs and an improved capture of fixed cost data. This would allow for a comparison with the data collected in New York and Michigan, a calculation of returns relative to measures of assets employed, and retain the benefit of the reference to agronomic characteristics obtained in this study.

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