

Nova Scotia Wine Grape Cost of Production and Cash Flow Analysis



Nova Scotia Department of Agriculture



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I. Highlights

- The total economic cost of production associated with a 10 acre and 20 acre vineyard in a typical production year is estimated to be \$6,590/acre and \$5,733/acre, respectively.
- The total cost to establish a 10 acre and 20 acre vineyard and bring it into production over a 4 year establishment period is estimated to be \$38,146/acre and \$34,315/acre, respectively.
- Discounting the owner's net cash flows over a 30 year period, at a rate of 5.0% annually, resulted in a net present value (NPV) of -\$4,488/acre for a 10 acre vineyard with 80% debt financing, -\$6,544 with 50% debt financing, and -\$7,000/acre for a 10 acre vineyard without debt financing (100% owner's equity financed).
- The NPV analysis shows that when the owner's net cash flows for a 20 acre vineyard are discounted over a 30 year period at 5.0% annually, the NPV is \$7,335/acre with 80% debt financing of the investment, \$5,484 with 50% debt financing, and \$2,400/acre with no debt financing (100% owner's equity financed).
- The owner's net cash flows for the 20 acre vineyard using 50 and 80% debt financing and 100% owner's equity financing were the scenarios that generated a rate of return on the investment that satisfies the owner's required rate of return of 5.0% (under the model assumptions). The internal rate of return for these scenarios was 6.5, 8.2, and 5.4%, respectively.
- Sensitivity analysis illustrates the impact of various prices and yields on the NPV and IRR for a 10 acre and 20 acre vineyard without debt financing (100% equity financing).

II. Nova Scotia Grape Industry

Nova Scotia is gaining recognition in Canada and around the world for high quality wines. With this increase in awareness of Nova Scotia as a wine producing region, there is also increased interest in the production of grapes. The growth in NS's wineries has spurred a 12% annual increase in grape production from 56 tonnes produced in 1987 to 1,147 tonnes in 2013. According to the 2011 Census of Agriculture, there are 94 farms in Nova Scotia with a total of 658 acres planted with grape vines. The majority of these farms have very small grape acreages with only about 10 farms having 10 or more acres in grape production.

There is a substantial capital investment required for the establishment of a commercial vineyard and it takes many years to recover the costs associated with its establishment. The purpose of this report is to provide those interested in the production of grapes with an understanding of the costs associated with the establishment and operation of a vineyard.

III. Methodology

The establishment and production costs in this report were compiled from consultations with selected grape producers in NS, industry specialists, and NS agribusinesses. This report reflects the best management practices of growers in Nova Scotia at the present time and economic conditions. The costs in this document represent an average scenario and the expenses will vary depending on the producer and their management decisions.

The two financial considerations regarding the establishment and operation of a vineyard in Nova Scotia include 1) profitability and 2) cash flow analysis.

- 1) Profitability is addressed through an enterprise budget, or cost of production, which incorporates all costs, cash and non-cash, during an average production year (i.e. after the vineyard is established and the capital is paid for). Profitability analysis measures the ability of an enterprise to generate profits and is used to calculate the yield and/or price required to breakeven in a typical production year.
- 2) Cash flow analysis looks at the cash flowing in and out of the enterprise for a fixed amount of time and is represented in a cash flow budget. Cash flow analysis is used to determine whether an investment is desirable, in this case, the vineyard establishment. Additionally, cash flow is used in determining the Net Present Value (NPV) of an investment. The NPV is a common indicator and method in cash flow analysis for financial decision-making regarding investments. The NPV of the investment is the sum of all the expected future cash flows (net) less the initial cost of the investment. A general rule of thumb is if the $NPV > 0$, invest and if $NPV < 0$, do not invest. A second common decision-making method is calculating an investment's Internal Rate of Return (IRR). IRR is the discount rate that equates the NPV to 0, i.e. when the present value of the cash flows equals the initial investment. A general rule of thumb is if the $IRR > \text{required rate of return}$, invest and if $IRR < \text{required rate of return}$, do not invest.

IV. The Nova Scotia Vineyard Model

Most wineries in Nova Scotia are interested in producing a premium quality wine, not a bulk wine, and therefore are concerned with securing the highest quality grapes. The model farms in this analysis illustrate a 10 acre and a 20 acre grape vineyards producing an average yield of grape varieties that are currently growing and in demand by Nova Scotia wineries. These varieties include a combination of 80% hybrid vines and 20% vinifera vines. For further information on grape varieties that are suitable for production in Nova Scotia consult your regional extension specialist.

The following describes the vineyards, 10 acres and 20 acres, modeled in this report, as well as the assumptions made when estimating the budget enterprise, or *cost of production*, and the cash flow analysis associated with the model vineyards.

Vineyard Assumptions:

- Vineyard spacing: 10 vineyard rows, 500 ft in length with vines at 4 ft spacing and a row spacing of 9 ft. This will allow for approximately 1200 vines/acre at \$2/vine
- The vineyards are 80% hybrid plants and 20% vinifera plants
- The trellis system is a vertical shoot positioning system (VSP)
- Grapes are hand harvested
- The vineyards are in full production in year 5
- The vineyards return an average yield of 3 tonnes/acre
- The combination of grape varieties return an average price of \$2500/tonne
- The vineyards have a 28'x32' farm structure priced at \$35/sqft for storage of equipment and machinery
- The capital requirements (machinery, equipment, tools, bird control) in this report to support a 10 acre vineyard include:

30-40 HP Tractor (used)	\$15,000
Airblast Sprayer (500 - 1000L)	\$10,000
Herbicide Sprayer	\$3,000
Backpack Sprayer	\$200
Rotary Mower (6-8')	\$4,500
Hedger	\$10,000
Fertilizer Spreader	\$2,000
Trailers	\$2,500
Hand Equipment (pruning, weeding, max tapener)	\$500
Harvesting Equipment	\$500
Bird Netting/Walers/Cannons	\$5,000

- The capital requirements (machinery, equipment, tools, bird control) in this report to support a 20 acre vineyard include:

50 HP Tractor (used)	\$25,000
Airblast Sprayer (1000 - 2000 L)	\$15,000
Herbicide Sprayer	\$3,000
Backpack Sprayer	\$200
Rotary Mower (6-8')	\$4,500
Hedger	\$10,000
Fertilizer Spreader	\$2,000
Trailers	\$2,500
Utility Vehicle (Gator, Kubota, ATV)	\$5,000
Hand Equipment (pruning, weeding, max tapener)	\$500
Harvesting Equipment	\$1,000
Bird Netting/Walers/Cannons	\$10,000

Cost of Production Assumptions:

- The productive life of the vineyard/trellis system, is 30 years
- The useful life of the building, equipment, and bird control is 30 years, with a \$0 salvage value
- The useful life of the tractor is 15 years
- Land rent, or *ownership cost of the land*, is estimated at 4% of the estimated purchase price of the land

Cash Flow Analysis Assumptions:

- All future cash flows of money are in real dollars
- An average purchase price of land at \$5,000/acre is used
- The tractor is replaced with another used tractor in year 15
- The salvage value of the land after 30 years of producing grapes (the productive life of the vineyard) is \$5,000/acre
- Land renovation and preparation costs are based on land previously in pasture
- Farm Loan board rates (as of April 1, 2015) are used for borrowing at a cost of 3.85% for a 20 year loan
- A discount rate of 5.0% is used in the cash flow analysis as the required rate of return on investment (equity) by the owner

V. Cost of Production and Breakeven Analysis

Table 1 shows the total economic cost of production associated with the model vineyard, 10 acres and 20 acres, in a typical production year as being \$6,590/acre and \$5,733/acre, respectively. The projected revenue for the 2013 production year was \$7,500/acre based on an average yield of 3 tonnes/acre and grape price of \$2,500/tonne. The breakeven price analysis shows the price required to breakeven if yields rise or fall by 0.25 tonne/acre. The breakeven yield analysis shows the yield that is required to breakeven if prices rise or fall by \$500/tonne.

VI. Notes to Production Costs and Breakeven Analysis for a NS Vineyard

- Current growers that are 20 acres or less and don't fit the model acres in this report, can compare their own costs with the variable costs presented in above table. However, the fixed costs will vary depending on the acreage and the equipment and machinery needs of the operation.
- Current prices of grapes in Nova Scotia range from \$1,000 - \$4,000/tonne
- The economic cost of production indicates that growing grapes is a profitable commodity, with margins of \$910/acre and \$1,767/acre over total costs for the 10 and 20 acre model, respectively.
- It should be noted that the operation in this report is a sole enterprise. If there is more than one enterprise, tractor maintenance and fixed costs, for example, would be shared across the farm enterprises.

VII. Establishment Costs for a Nova Scotia Vineyard

This section presents the cash costs associated with establishing the 10 and 20 acre vineyards modeled in this report. Table 2 presents all the cash outflows over a period of 4 years required to establish a 10 acre vineyard and bring it into production. Year 1 includes the purchase of the land, building, equipment, and tractor, and the costs associated with preparing the land for planting the grapes (including tile drainage), at an estimated cost of \$17,491/acre. Year 2 includes the cash outflows expected during the planting year at a total cost of \$11,213/acre. Years 3 and 4 include the cost of cultural practices required to bring the newly established vineyard into production, at a combined cost of \$9,442/acre. The total cost to establish a 10 acre vineyard and bring it into production over the 4 year establishment period is estimated to be \$38,146/acre.

Table 3 presents all the cash outflows over a period of 4 years for establishing a 20 acre vineyard and bringing it into production. Compared to the establishment costs of a 10 acre vineyard, there are advantages to establishing a larger vineyard and scaling up the enterprise (for example, the fixed costs are spread over a larger number of acres). In particular, fixed cost and (some) machinery costs are lower on a per acre basis with the 20 acre vineyard. In addition, vineyard management efficiencies are achieved in the fourth year of establishment of the larger operation and continue over the productive life of the vineyard. Overall, the total cost to establish a 20 acre vineyard and bring it into production over the 4 year establishment period is estimated to be \$34,315/acre, a cost savings of \$3,831/acre over the cost of establishing a 10 acre vineyard.

Table 2: Per acre expense summary to establish a 10 acre vineyard

	Year 1	Year 2	Year3	Year4	Total
Variable Costs					
Labour					
Vineyard Management		2,500	2,500	2,750	
Bird/Pest Control Labour				600	
Harvesting Labour				450	
Vine Replacement, 2%			48	48	
Cover Crop	32	30			
Tying Material		220	20	20	
Pesticides/Herbicide		250	300	300	
Soil Amendments & Testing	140	140	140	140	
Building Maintenance	63	63	63	63	
Tractor Expenses (maintenance & fuel)	150	500	500	500	
Sub-total	385	3,703	3,571	4,871	12,530
Fixed Costs					
Administrative Costs (accounting, legal, membership fees)	250	250	250	250	1,000
Total Operating & Fixed Costs	635	3,953	3,821	5,121	13,530
Establishment Expenses					
Land Purchase	5,000				
Tractor & Equipment	4,820				
Building	3,136				
Pest Control				500	
Tile Drainage	3,500				
Land Preperation	400				
Vine Purchase		2,400			
Trellis Supplies					
Line Posts		2,000			
End Posts		350			
Wire		750			
Grow Tubes		240			
Anchors		320			
Steel Stakes for Vines		1,200			
Sub-total	16,856	7,260	-	500	24,616
Total Cash Outflows	\$ 17,491	\$ 11,213	\$ 3,821	\$ 5,621	\$ 38,146

Table 3: Per acre expense summary to establish a 20 acre vineyard

	Year 1	Year 2	Year3	Year4	Total
Variable Costs					
Labour					
Vineyard Management		2,500	2,500	2,500	
Bird/Pest Control Labour				600	
Harvesting Labour				450	
Vine Replacement			48	48	
Cover Crop	32	30			
Tying Material		220	20	20	
Pesticides/Herbicide		250	300	300	
Soil Amendments & Testing	140	140	140	140	
Building Maintenance	31	31	31	31	
Tractor Expenses (maintenance & fuel)	150	500	500	500	
Sub-total	353	3,671	3,539	4,589	12,152
Fixed Costs					
Administrative Costs (accounting, legal, membership fees)	125	125	125	125	500
Total Operating Costs	478	3,796	3,664	4,714	12,652
Establishment Expenses					
Land Purchase	5,000				
Tractor & Equipment	3,435				
Building	1,568				
Pest Control				500	
Tile Drainage	3,500				
Land Preperation	400				
Vine Purchase		2,400			
Trellis Supplies					
Line Posts		2,000			
End Posts		350			
Wire		750			
Grow Tubes		240			
Anchors		320			
Steel Stakes for Vines		1,200			
Sub-total	13,903	7,260	-	500	21,663
Total Cash Outflows	\$ 14,381	\$ 11,056	\$ 3,664	\$ 5,214	\$ 34,315

VIII. Notes to Establishment Cost of a NS Vineyard

- The establishment costs in this report include all start-up costs. In many cases, a new grape grower may already own land or a tractor, for example. These costs are a benchmark only and each unique situation should be evaluated individually.
- Vineyard management labour will vary greatly from site to site and may or may not include owner's labour
- Pesticides/herbicides costs can vary from \$0-\$600/acre
- Land purchase price can vary from \$1500-2000/acre in Cumberland County to over \$10,000/acre in the Annapolis Valley for suitable vineyard land
- Line posts can be steel or wood, depending on the grape variety
- Grow tubes can vary from \$0-600, depending on management practices and grape variety
- Pest control capital is purchased in Year 4 when the vines begin to produce a crop
- The tractor will need to be replaced after 15 years (this is included in the investment analysis)
- Grape growers should contact a program specialist to inquire whether there are programs available to offset establishment costs (or expansion costs), e.g. tile drainage programs.

IX. Cash Flow Analysis: Net Present Value & Internal Rate of Return

Cash flow analysis can be used to evaluate any investment, for example, a new piece of machinery/technology. In this report, cash flow analysis is used to evaluate the investment needed to start up an entire vineyard by calculating the producer's net present value (NPV) and internal rate of return (IRR) as decision-making tools.

The following tables present summary results of the cash flow analysis for the 10 and 20 acre vineyards modelled in this report¹. Three financing options were considered for the establishment (investment) of each model; 80% debt financing, 50% debt financing and 0% debt financing (or 100% equity financing). The NPV and the associated IRR were calculated, as well as break-even yield and break-even price for the investments. For the 10 acre vineyard model, the NPV is negative under each financing option and the IRR is less than the required rate of return of 5%. Therefore, it can be concluded that the 10 acre vineyard model, under the assumptions in this report, is not an economically viable investment.

¹ For detailed cash flow tables, contact the author of the report.

However, the results are significantly different for the 20 acre vineyard model in this report. Under each financing option, the NPV is greater than 0 and the IRR is greater than the owner's required rate of return. Therefore, these results suggest that the investment of the 20 acre vineyard modelled in this report would be a viable financial investment.

Table 4: Cash flow analysis results for the 10 acre vineyard

Summary Table: 10 Acre Model	Debt Financing		
	0%	50%	80%
Net Present Value	\$ (7,000)	\$ (6,544)	\$ (4,488)
IRR (percent)	3.7	3.2	3.2
Breakeven Yield (tonnes/acre)	3.24	3.21	3.14
Breakeven Price (\$/tonne)	\$ 2,700	\$ 2,670	\$ 2,617

Table 5: Cash flow analysis results for the 20 acre vineyard

Summary Table: 20 Acre Model	Debt Financing		
	0%	50%	80%
Net Present Value	\$ 2,400	\$ 5,484	\$ 7,335
IRR (percent)	5.4	6.5	8.2
Breakeven Yield (tonnes/acre)	2.93	2.83	2.78
Breakeven Price (\$/tonne)	\$ 2,438	\$ 2,358	\$ 2,310

The break-even yields for the 10 acre vineyard model are 3.24, 3.21, and 3.14 tonnes/acre for each of the financing options (0%, 50%, and 80% debt financing, respectively). These yields are well above the estimated industry average of 2.25 tonnes/acre for 2013. The breakeven yields for the 20 acre vineyard model appear more reasonable at 2.93, 2.83, and 2.78 tonnes/acre under each of the financing options (0%, 50%, and 80% debt financing, respectively).

The break-even price for the 10 acre vineyard model are \$2,700, \$2,670, and \$2,617 per tonne for each of the financing options (0%, 50%, and 80% debt financing, respectively). These prices are above the portfolio average of the vineyards modeled in this report and could be difficult to achieve, especially in the early years of production. The breakeven price for the 20 acre vineyard model are \$2,438, \$2,358, and \$2,310 for each of the financing options (0%, 50%, and 80% debt financing, respectively).

X. Notes to Cash Flow Analysis: NPV & IRR

- Owner's net cash flows in year 30 includes the salvage value of the land at the original purchase price (\$5,000/acre)
- Under the 50 and 80% debt financing scenario, the owner is responsible for 50 and 20% of the total costs for years 1-4, including fixed, variable, and establishment costs
- The loan is a 20 year loan with interest-only payments for the first four years deferred and added to the loan principle, payable over 16 years, with an interest rate of 3.85% (based NS Farm Loan Board rates and products as of April 1, 2015)
- Net present value is calculated on the owner's net cash flow from years 5 to 30, when the vineyard is established and in full production
- It is important to note that these are benchmark numbers only. Each potential investor must evaluate their own situation and capital investment needs

XI. Sensitivity Analysis: NPV and IRR

This section presents the results of the effects of price and yield on the NPV and IRR calculations for each vineyard model. For simplicity, only the 0% debt financing (100% owner's equity investment) is evaluated². Tables 8 & 9 illustrate the sensitivity of net present value (NPV) and internal rate of return (IRR) to changes in price and yield for the 10 acre vineyard model using 100% owner's equity financing for the investment.

Table 8: Effects of Price and Yield on NPV – 10 acres using 100% equity financing

Price (\$/tonne)	Yield (tonnes/acre)				
	2.5	2.75	3.0	3.25	3.5
\$ 2,250	\$ (29,081)	\$ (22,457)	\$ (15,832)	\$ (9,208)	\$ (2,584)
\$ 2,500	\$ (21,720)	\$ (14,360)	\$ (7,000)	\$ 360	\$ 7,721
\$ 2,750	\$ (14,360)	\$ (6,264)	\$ 1,832	\$ 9,929	\$ 18,025

² For sensitivity analysis for the 50 and 80% debt financing options, contact the author of this report

Table 9: Effects of Price and Yield on IRR – 10 acres using 100% equity financing

Price (\$/tonne)	Yield (tonnes/acre)				
	2.5	2.75	3.0	3.25	3.5
\$ 2,250	-1.5%	0.2%	1.8%	3.2%	4.5%
\$ 2,500	0.4%	2.1%	3.7%	5.1%	6.3%
\$ 2,750	2.1%	3.8%	5.3%	6.7%	7.9%

Tables 10 & 11 illustrate the sensitivity of net present value (NPV) and internal rate of return (IRR) to changes in price and yield for the 20 acre vineyard model using 100% owner's equity financing for the investment.

Table 10: Effects of Price and Yield on NPV - 20 acres using 100% equity financing

Price (\$/tonne)	Yield (tonnes/acre)				
	2.5	2.75	3.0	3.25	3.5
\$ 2,250	\$ (21,653)	\$ (14,437)	\$ (7,221)	\$ (6)	\$ 7,210
\$ 2,500	\$ (13,636)	\$ (5,618)	\$ 2,400	\$ 10,417	\$ 18,435
\$ 2,750	\$ (5,618)	\$ 3,201	\$ 12,021	\$ 20,840	\$ 29,660

Table 11: Effects of Price and Yield on IRR - 20 acres using 100% equity financing

Price (\$/tonne)	Yield (tonnes/acre)				
	2.5	2.75	3.0	3.25	3.5
\$ 2,250	-0.1%	1.9%	3.6%	5.0%	6.2%
\$ 2,500	2.1%	3.9%	5.4%	6.8%	7.9%
\$ 2,750	3.9%	5.6%	7.0%	8.3%	9.4%

XII. Notes to Sensitivity Analysis: NPV and IRR

- A positive NPV or an IRR greater than 5.0% are deemed rational, or economically viable, investment scenarios

Disclaimer:

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