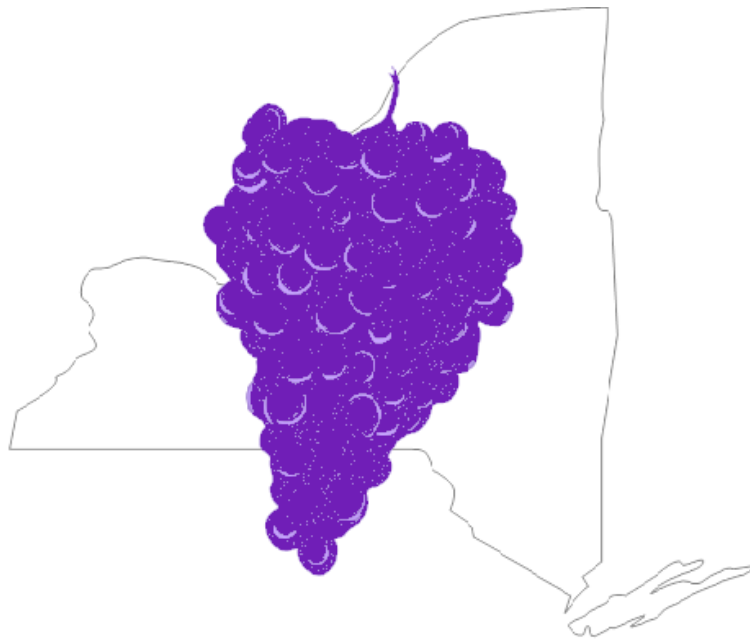


COST OF ESTABLISHMENT AND PRODUCTION OF V. VINIFERA GRAPES IN THE FINGER LAKES REGION OF NEW YORK - 2019



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Introduction

Over the years the amount of wine produced in New York State has been steadily increasing, resulting in a fairly large economic impact. As of 2017 the total economic impact the wine industry had on NYS was estimated to be \$13,764,343,000¹ per year. However, many of these benefits are felt by second and third party stakeholders. The direct economic output of the wine industry was \$5,528,619,600 in 2017. This resulted in an estimated 62,450 jobs paying out an estimated total of \$2,379,712,400 in wages.

The Finger Lakes region of NYS is one of the larger wine producing regions of the state. As of 2017 there were 9,393 total acres of the vineyards in the area producing roughly 54,600 tons of grapes. The region is mostly known for Sparkling, Riesling, Pinot Noir, and Ice Wines. In recent years there has been increased interest in the Finger Lakes, as well as in other parts of New York State and the eastern United States, in planting *Vitis vinifera* grapes for premium wine production. Acreage of red varieties such as Pinot Noir, Cabernet Sauvignon, Merlot, and Cabernet Franc all increased in the most recent orchard and vineyard survey compiled by the New York Agricultural Statistics Service in 2011. Acreage of Riesling has increased by 56 percent from 2006, while acreage of Chardonnay stayed about the same. Overall, *vinifera* acreage increased by 30 percent (to 2,047 acres) in the Finger Lakes region in this five year period, led by Riesling, with a total acreage of 849 acres. *Vinifera* grape varieties accounted for 22 percent of grape acreage in the Finger Lakes in 2011.

Wine consumption in the United States has increased almost 100% since 2000, resulting in 966 million gallons of wine being consumed in 2018. There has been an increase in consumer demand for quality wines, including interspecific French American hybrid and *V. vinifera* cultivars as well as from designated appellations. New York is gaining stature as a producer of high quality wines that command premium prices. The Finger Lakes region has benefited from a surge of sales and interest nationally in Riesling varietal wines over the past ten years. Over the past five years we have been able to see, on average, the prices of the four main varieties of *V. vinifera* grapes grown in the Finger Lakes (Riesling, Chardonnay, Cabernet Franc, and Pinot Noir) increase in tandem with an increase in Finger Lakes wine nationwide. While the prices growers are receiving are rising, and are significantly higher than those found in the 2014 study, so costs related to growing *V. vinifera* crops in the region have also increased significantly.

Growers who are considering planting additional *V. vinifera* vineyards need to carefully weigh the cost of planting and establishing a vineyard, as well the annual cost of operation of a mature vineyard, against the expected yields and prices to determine whether the investment of \$43,443 per acre or more required to bring a *V. vinifera* vineyard into production will result in a profitable return on investment. This requires a re-assessment of which varieties to plant and which sites would support profitable *V. vinifera* production. Varieties to plant have to be considered

¹ Economic Impact of Wine Industry 2017 Data, New York – The National Association of American Wineries – Wine America

relative to cold hardiness, as the Finger Lakes has experienced severe winter injury to *vinifera* about once every decade.

This question is complicated by the long-run nature of the investment (payback periods are in excess of ten years and can be even much longer), as well as the risk from a worldwide over -- supply of wine grapes from significant plantings in “new world” competitors such as Australia, New Zealand, Chile, and a significant increase in Chinese grown grapes over the past decade. Although the New York industry is somewhat insulated by the small scale of its market structure in the premium wine sector, with most wineries selling over 50 percent of their wine through direct sales in the tasting room, wineries cannot expect to be completely unaffected if global supply outstrips demand in the future. Given the limited area planted, a small increase in planted acreage can have a relatively large impact on supply when the new acreage begins bearing. During the 2007 harvest, for example, there was a surplus in Cabernet Franc grapes that put downward pressure on prices in the region. This emphasizes the importance of selection of varieties, which is driven both by the marketing plan, and to a certain extent by the relative cold hardiness of *vinifera* varieties.

The objective of this study is to determine the cost of producing *V. vinifera* grapes in the Finger Lakes region in a commercial size operation. Estimates of the total investment in land, machinery, vineyard establishment and development costs, and annual operating costs were developed. These estimates may be used by growers and potential investors to compute and analyze the costs and profit potential for their own situations. The estimates are not necessarily representative of average costs for grape production in the Finger Lakes, but rather are typical costs for well-managed vineyards using recommended practices. The yield estimates used for estimation of typical returns assume better sites (well-drained, productive soils with appropriate slopes for air drainage). We also assume that the vineyard practices employed would result in premium quality grapes. Practices such as leaf pulling and cluster thinning of certain varieties, and limit yields contribute to higher quality wine. Poorer sites and/or failure to follow optimal management practices can have a significant negative impact on the earnings estimates presented in this publication. Operations such as special tillage practices (hilling up and take away) once again had their value demonstrated with the winter injury that was widespread in 2004.

Methods

The methods used to construct cost estimates were a combination of 1) interviews with a panel comprised of grower representatives, 2) economic engineering using recommended practices, and 3) interviewing local stakeholders of the Finger Lakes wine industry. In August of 2019, we met with a panel of four growers and vineyard managers. The growers reviewed the data prepared for the most recent estimates of the costs of establishing and growing *V. vinifera* grapes. Consensus estimates were developed for land prices, labor requirements and wage rates for the various operations in a *V. vinifera* vineyard and for a typical machinery complementary for a full time commercial vineyard. The panel reviewed the machinery and labor time estimates of the 2013 study, and made recommendations for changes.

The panel also provided estimates, based on their own experience in their vineyards, of the time required to perform various vineyard operations, such as tillage, spraying, mowing, etc., and hand operations such as pruning, tying & removal, suckering, and cluster & shoot thinning.

Land

The study assumes land was purchased at \$10,370 per acre. This is an increase of 72% since the previous 2013 study was published. This value takes into account the possibility of having to prepare land that is not ready to be used for agricultural purposes. \$10,000 was decided as a base price per acre after consulting with Farm Credit East and discussing average sales price of agricultural land suited for *V. Vinifera* vineyards since 2017. Originally, a range from \$8,000 to \$15,000 was considered. However, if one were to theoretically buy 54 acres in the Finger Lakes region it is unreasonable to assume all of the land would be immediately ready to be utilized as a vineyard. Some land will need to be prepared, cultivated, and cleared, thus, we used a value on the lower end of the range.

The size of the vineyard was decided in consultation with the grower panel. The specified size was 54 acres, with 50 acres planted to grapes. The other 4 acres are occupied by roads, headlands, and a shop. The 50-acre vineyard is large enough to use vineyard machinery and equipment efficiently, but small enough to be operated by one working manager with one other full-time worker. Some hand labor operations would be done by hired part-time labor or by migrant labor crews.

We are estimating that 34 of the 54 acres being purchased are immediately ready to be used for agricultural purposes. The remaining 20 acres we are assuming need on average \$1,000 of basic preparation (clearing woodland, cross ripping, etc.) before any advanced preparation (like drainage installation) can be implemented. To calculate the \$10,370 the following equation was used:

$$\frac{((34 \text{ acres} * \$10,000) + (20 \text{ acres} * (\$10,000 \text{ land price} + \$1,000 \text{ land prep}))}{54 \text{ total acres}}$$

This equation brings us to the average land price of \$10,370. If you are assuming all of the land being purchased is ready for agricultural use please use \$10,000 as the average price per acre.

Vineyard Layout

The vineyard was assumed to be planted on a 9' X 6' spacing (row by vine) resulting in a planting density of 807 vines per acre. There were 11 rows to an acre and rows were 440 feet long. Vine cost was estimated to average \$4.25 per plant. Each year it was assumed that two percent of the vines had to be replanted due to damages caused by diseases or environmental factors. The initial planting was done using contracted GPS planting. The fee for GPS planting the vines were \$1.10 per vine, with a total of 40,000 vines being planted.

Varieties

The 50-acre vineyard was planted to the following four *V. vinifera* varieties: Pinot Noir, Cabernet Franc, Chardonnay, and Riesling. These four varieties were selected because they are well suited for the cool climate of the Finger Lakes region and demonstrated their ability to produce premium wine.

Tile Drainage

It was assumed that tile drainage was installed in the middle of every third row or 27 feet apart. The tile drainage system consisted of 4" lateral pipes running down the middle of every second row, and these lateral pipes were connected to a 6" mainline pipe that ran along the width of the vineyard.

Trellis System

It was assumed that the vines were trained using the vertically shoot positioned (VSP) training system. The trellis system was made up of two pairs of catch wires and two fruiting wires (for a total of six wires), a 8' X 5" wooden line posts at every fourth vine, four catch wire clips per line post, and a 8' X 5" wooden end post and anchor support post at the end of each row.

Herbicides and Fertilizer/Soil Program

The sample herbicide program was developed in consultation with the advisory panel of four growers. For details of the sample herbicide program, see Table A1 in the Appendix. Glyphosate spot sprays should be made using some kind of shielded sprayer to avoid contact with green tissues. The study assumes the use of an Enviromist sprayer for this purpose because of the larger acreage. The sample fertilizer/soil program was developed by Hans Walter-Peterson, Viticulture Extension Specialist, Finger Lakes Grape Program. See Table A2 for details.

Wage Rates

Wage rates used represented the consensus of the grower panel. The rates assumed were \$23.00 per hour for skilled labor (i.e. \$17.69 per hour, plus fringe benefits). Fringe benefits consist of workers compensation, social security, medical insurance, and other benefits. For unskilled labor, the rate was \$17.50 per hour (including fringe benefits). Piece rate wage rates were used for pruning the vines in years 3-22 using the rate of \$0.56 per vine. The piece rates for tying were specified at \$0.28 per vine. The pruning and tying piece rates have a base rate of \$0.45 and \$0.23 respectively.

An additional 13% contracting fee and 10% unemployment benefits cost were added resulting in \$0.56 and \$0.28 for the piece rate wages.

Harvesting & Hauling

Grapes were custom machine harvested in the fourth year and beyond. The machine harvesting rate is assumed at \$95 per ton, with an additional \$30 per ton expenses for transporting the grapes.

Machinery and Building Costs

The investment costs and annual costs for equipment and buildings are summarized in Table A3 located in the Appendix. All machinery is assumed to be purchased as new. One may be able to cut total costs by buying certain equipment used. The machinery investment required totals \$307,970 which represents an average investment of \$6,159 per acre of vineyard. The investment for a shop is estimated at \$82,500, or \$1,650 per acre. The shop was 1,500 ft², and the construction cost was estimated at \$55.00 per ft² which includes basic amenities such as water and electricity, cemented floors, and insulated walls.

Machinery depreciation and interest were charged on the basis of prices for new equipment with the minor exceptions for a used pickup truck. Diesel fuel at \$3.09 per gallon was budgeted for machine operations. Gasoline was charged at \$2.89 per gallon (for unleaded). These were representative of prices in Central New York as of August 2019. Hourly machinery variable costs (repairs, fuel, and lube) are shown in Table A4. Hourly machinery variable costs were estimated according to American Society of Agricultural Engineers 2000 Standards.

The total annual costs for depreciation and interest amount to \$32,649 for machinery and \$4,209 for buildings, or \$653 and \$84 annual costs per acre, respectively. Machinery investment would be much greater if a mechanical grape harvester was necessary.

Overhead

Annual insurance expense was estimated at 1 percent of the initial investment in buildings and machinery. Office supplies, phone, etc. were estimated at \$3,000 per year. School and property taxes were \$25 per \$1,000 of assessed value of the initial land investment.

Management Charge

A management fee of five percent of gross receipts was assessed for the vineyard. This represents the opportunity cost for the vineyard owner to manage the operation. All labor requirements were assessed as cash costs. Therefore, in situations where the owner or manager is performing vineyard tasks and managing the operation, actual cash outlays would be lower than are represented in these cost estimates.

Cost of Capital

A three percent interest charged on capital investment and operating capital was used. This rate represents a real rate based on a five percent nominal rate of interest and an expected rate of inflation of roughly two percent.

Yields

Yields were specified as the long-term average attainable on suitable sites (near the lake, sloping, good air drainage, somewhat well-drained with soil depth at least medium). These yields assume better than average management practices that are consistent with the attainment of premium quality *V. vinifera* wines. These management practices include shoot thinning and cluster removal that often decrease yields, but improve wine quality. Table 1 summarizes the yield assumptions.

Table 1: Yield Assumption

Variety	Year 3		Year 4+	
Pinot Noir	1	tons/acre	2.6	tons/acre
Cabernet Franc	1	tons/acre	3.3	tons/acre
Chardonnay	1	tons/acre	4	tons/acre
Riesling	1	tons/acre	4	tons/acre

Results

Grape Prices

Prices for the previous six years ending in 2019 are shown in Table 2. These averages do not take into account quality and/or quantity of grapes purchased by each processor. Since larger processors often pay less, the weighted average price is often lower than the average reported in Table 2. However, the prices in Table 2 are a reasonable indicator of price trends for the four varieties. The panel of grape growers and vineyard managers took these prices into account when specifying the prices shown in the last row of Table 2, which are the prices used in the profitability analysis reported in this bulletin. The prices specified by the panel reflect special quality practices that are used for premium wine production.

Table 2: Average Price Listings for Selected *V. Vinifera* Grapes in the Finger Lakes Region, 2014-2019, Dollars per Ton.

Year	Pinot Noir	Cabernet Franc	Chardonnay	Riesling
2014	\$ 1,744	\$ 1,338	\$ 1,285	\$ 1,492
2015	\$ 1,767	\$ 1,408	\$ 1,305	\$ 1,545
2016	\$ 1,817	\$ 1,573	\$ 1,377	\$ 1,627
2017	\$ 1,870	\$ 1,609	\$ 1,386	\$ 1,577
2018	\$ 1,840	\$ 1,573	\$ 1,382	\$ 1,541
2019	\$ 1,816	\$ 1,492	\$ 1,377	\$ 1,505
Mean	\$ 1,808	\$ 1,500	\$ 1,347	\$ 1,556
Prices Used	\$ 1,900	\$ 1,600	\$1,350	\$ 1,600

Source: Finger Lakes Grape Price List, 2014-2019

Pesticide Program Spray Costs

Table 3.1 indicates the recommended spray program and costs for years one, two and three (establishment). Table 3.2 indicates the recommended spray program and costs for years years 4-22 (operation). In year three, eight sprays are recommended. Beginning in year four, the spray programs are assumed to be approximately the same from year to year, with the necessity on average for twelve sprays during the growing season. Spray material costs were estimated on average at \$422.44 per acre. Fungicide applications may vary slightly among *vinifera* cultivars due to the differences in disease susceptibility. For example, Pinot Noir, Chardonnay, and Riesling are more susceptible to Botrytis bunch rot. Of course, spray programs will have to be adjusted slightly from year to year to accommodate variable weather and/or pest pressure. Pesticide application costs for labor and machinery, as well as herbicides, are presented in Tables 6 and Table 8.

Table 3.3 shows the cost break down of the chemicals used, as well as other potential substitutes or additions, in the example spray programs and lists the market price for the chemicals as well as the per unit price of each chemical.

Table 3.1: Sample Spray Program for *V. Vinifera* Grapes for Years 1 -3, Finger Lakes NY, 2019

Year	Material	Target organisms	Rate/acre	Price	\$/acre	
Year 1	Spray 1-3					
	Mancozeb 75DF	Downy mildew, botrytis, anthracnose	3 lbs.	\$8.33 lb.	\$25.00	
	Sulfur	Powdery mildew	4 lbs.	\$1.29 lb.	\$5.17	
	Surfactant	Lowers the surface tension of the spray	4 oz.	\$0.33 oz	\$1.31	
	Total per spray					
Total for year (3 sprays)					\$94.42	
Year 2	Sprays 1-4					
	Mancozeb 75DF	Downy mildew, botrytis, anthracnose	3 lbs.	\$8.33 lb.	\$25.00	
	Sulfur	Powdery mildew	4 lbs.	\$1.29 lb.	\$5.17	
	Surfactant	Lowers the surface tension of the spray	4 oz.	\$0.33 gal.	\$1.31	
	Total per spray					\$31.47
Total for year (4 sprays)					\$125.90	
Year 3	Spray 1-2					
	Mancozeb 75DF	Downy mildew, botrytis, anthracnose	3 lbs.	\$8.33 lb.	\$25.00	
	Sulfur	Powdery mildew	4 lbs.	\$1.29 lb..	\$5.17	
	Surfactant	Lowers the surface tension of the spray	4 oz.	\$0.33 gal.	\$1.31	
	Total per spray					\$31.47
	Total per year (2 sprays)					\$62.95
	Sprays 3-4					
	Revus Top	Powdery mildew, downy mildew	7 oz.	\$2.59 oz	\$18.11	
	Sulfur	Powdery mildew	4 lbs.	\$1.29 lb	\$5.17	
	Surfactant	Lowers the surface tension of the spray	4 oz.	\$0.33 oz	\$1.31	
Total per spray					\$24.59	
Total per year (2 sprays)					\$49.18	
Sprays 5-8						
Captan 80WP	Botrytis, anthracnose, brown rot	2.5 lbs.	\$0.40 lb	\$1.00		
Sulfur	Powdery mildew	5 lbs.	\$1.29 lb	\$6.46		
Surfactant	Lowers the surface tension of the spray	4 oz.	\$0.33 oz	\$1.31		
Total per spray					\$8.77	
Total per year (3 sprays)					\$26.39	
Total for year 3 (8 sprays)					\$138.42	

Table 3.2: Sample Spray Program for *V. Vinifera* Grapes for Years 4 - 22, Finger Lakes NY, 2019

Spray	Chemical	Target organisms	Measure	Unit/Acre	Cost	Spray Cost
1	Pencozeb	Downy mildew, black rot	3	lb	\$ 9.00	\$ 14.17
	Sulfur	Black spot, powdery mildew	4	lbs.	\$ 5.17	
2	Pencozeb	Downy mildew, black rot	3	lb	\$ 9.00	\$ 14.17
	Sulfur	Black spot, powdery mildew	4	lbs.	\$ 5.17	
3	Microthiol	Powdery mildew	4	lb	\$ 5.17	\$ 17.53
	Quintec	Powdery mildew	3	oz	\$ 9.63	
	Pristine	Powdery mildew, downy mildew, ripe rot, botrytis	12	oz	\$ 2.73	
4	Microthiol	Powdery mildew	4	lb	\$ 5.17	\$ 54.02
	Revus	Powdery mildew, downy mildew	8	oz	\$ 20.70	
	Cueva	Downy mildew, black rot	0.8	gal	\$ 28.16	
5	Pristine	Botrytis, downy mildew, powdery mildew	8	oz	\$ 1.82	\$ 1.82
6	Assail	Japanese Beetles	5	oz	\$ 19.69	\$ 33.85
	Pencozeb	Downy mildew, black rot	3	lb	\$ 9.00	
	Microthiol	Powdery mildew	4	lb	\$ 5.17	
7	Microthiol	Powdery mildew	4	lb	\$ 5.17	\$ 49.33
	Quintec	Powdery mildew	3	oz	\$ 9.63	
	Cueva	Downy mildew, black rot	0.8	gal	\$ 28.16	
	Rampart	Powdery mildew, downy mildew	48	oz	\$ 6.38	
8	Vivando	Powdery mildew	15	oz	\$ 26.72	\$ 94.19
	Cueva	Downy mildew, black rot	0.4	gal	\$ 14.08	
	Ranman	Downy mildew, powdery mildew	2.5	oz	\$ 19.16	
	Elevate	Botrytis	1	lb	\$ 34.24	
9	Vanguard	Botrytis	8	oz	\$ 27.20	\$ 59.20
	Sevin	Grape berry moth	2	qt	\$ 30.40	
	Captan 40	Botrytis, anthracnose	4	oz	\$ 1.60	

Spray	Chemical	Target organisms	Measure	Unit/Acre	Cost	Spray Cost
10	Rovral	Botrytis	2	pt	\$ 29.47	\$ 45.26
	Sulfur	Black spot, powdery mildew	4	lbs.	\$ 5.17	
	Rampart	Downy mildew, powdery mildew	2.5	qt	\$ 10.63	
11	Captan 40	Botrytis, anthracnose	4	oz	\$ 1.60	\$ 38.90
	Mustang Max	Fruit flies	3	oz	\$ 8.18	
	Pristine	Powdery mildew, downy mildew, ripe rot, botrytis	8	oz	\$ 1.82	
	Zampro	Downy mildew	10	oz	\$ 27.30	
					Total Cost	\$422.44

Table 3.3 Sample Cost Key of Chemicals Use in Spray Programs for V. Vinifera Grapes, Finger Lakes NY, 2019

Chemical	Amount	Cost	Unit	Cost per 1 Unit
Assail	4	\$ 252.00	lb	\$ 3.94 oz
Captan 80WP	6.25	\$ 39.95	lb	\$ 0.40 oz
Cueva	2.5	\$ 88.00	gal	\$ 35.20 gal
Elevate	2	\$ 68.48	lb	\$ 34.24 lb
Mancozeb 75DF	12	\$ 99.99	lb	\$ 8.33 lb
Microthiol	30	\$ 38.75	lb	\$ 1.29 lb
Mustang Max	1	\$ 349.07	gal	\$ 2.73 oz
Pencozeb	30	\$ 90.00	lb	\$ 3.00 lb
Pristine	7.5	\$ 27.30	lb	\$ 0.23 oz
Quintec	30	\$ 96.30	oz	\$ 3.21 oz
Rampart	2.5	\$ 42.50	gal	\$ 0.13 liquid oz
Ranman	1	\$ 980.74	gal	\$ 7.66 oz
Revus	1	\$ 331.17	gal	\$ 2.59 liquid oz
Rovral	2.5	\$ 294.68	gal	\$ 117.87 gal
Sevin	2.5	\$ 152.00	gal	\$ 60.80 gal
Sulfur	30	\$ 38.75	lb	\$ 1.29 lb
Surfactant	16	\$ 41.92	gal	\$ 0.33 liquid oz
Vanguard	50	\$ 170.00	oz	\$ 3.40 oz
Vivando	1	\$ 228.00	gal	\$ 1.78 liquid oz
Zampro	140	\$ 382.20	oz	\$ 2.73 oz

Drainage Construction Costs

Table 4 contains an estimate of drainage construction costs. These costs are transferred to the site preparation section of the establishment and development costs (see Table 6). Costs will vary greatly from site to site depending on the soil conditions and preferences of the vineyard manager. Growers should consult with their county's Soil & Water District staff to determine the proper amount of drainage a particular site requires. This study assumed that tile drainage was placed in the middle of every third row or 27 feet apart. Costs were estimated to total \$5,940 per acre.

Table 4: Tile Drainage Costs per acre for *V. Vinifera* Grapes,
Finger Lakes Region, NY, 2019

Item	Quantity (ft)	Price \$/ft	Total Cost per acre
Main line: 6" pipe	29	\$ 2.50	\$ 72.50
Laterals: 4" pipe	2,723	\$ 1.70	\$ 4,629
Installation	2,752	\$ 0.45	\$ 1,238
Total Drainage Construction per acre			\$ 5,940

Trellis Construction Costs

The trellis was designed for Vertically Shoot Positioned (VSP) vines. It was made up of two pairs of moveable catch wires and two fixed fruiting wires (a total of six wires). Wooden line posts were used for every fourth vine, and four catch wire clips were used on each post to hold the catch wires in place. Wooden anchor posts were used to support each end post. Rows were 440 feet long and there were 11 rows to an acre and 73 vines per row.

Table 5 contains an estimate of trellis constructions costs. The total cost for materials is estimated at \$4,801 per acre. These costs are transferred to Table 6 in the first year of establishment and development. Labor and machinery costs for trellis establishment are also shown in Table 6. The total cost of trellis construction for materials, labor, and machinery is \$7,721 per acre.

Table 5: Trellis Construction Costs per acre for *V. Vinifera* Grapes, Finger Lakes Region, NY, 2019

VSP Trellis Construction Materials per Acre	Quantity	Price	Total per acre
Wood end posts (8 ft X 5" diameter)	22 posts	\$14.14 post	\$311
Wood anchor kit	22 posts	\$10.00 post	\$220
Line Post (8 ft, 5" diameter, every 4th plant)	200 stakes	\$17.71 stake	\$3,542
12.5 gauge HT foliage & cordon wire (\$110 roll of 4000 ft)	26,889 ft	\$0.025 ft	\$672
Catchwire clips (4 per line post)	400 clips	\$0.05 clip	\$40
Staples, lbs.	3 lbs.	\$1.99 lb.	\$6
Crimping sleeves (for joining wire ends)	50 crimps	\$0.19 crimp	\$10
Total Trellis Construction materials			\$4,801

Establishment and Development Costs

The costs for labor machinery and materials for site preparation and in years one through three constitute the establishment and development (E&D) variable costs in Table 6. First year costs, including site preparation, trellis construction, and planting, are substantial, amount to \$18,054 per acre. A planting density of 800 vines (6' x 9') (vine by row) was assumed. The largest cost in the first year is for trellis construction, for a total of \$6,487. In year two, variable costs are a relatively modest at \$1,230 per acre with less labor required than for mature vines. In the third year, a spray program of eight sprays is recommended, and hand harvesting is required to protect the young vines. Total variable costs for the third year are estimated at \$2,109 per acre. Note that the usage of pickup truck is estimated at 10,000 miles for a 50-acre farm per year, which is \$71 per acre (including gas and maintenances costs).

The total costs (variable and fixed) for the entire E&D period (years 1-3) are summarized in Table 7. The totals from Table 6 for each of the three years are brought into the row labeled 'annual variable costs'. Hand harvesting costs are added for the third year only. Fixed costs (capital recovery for machinery and equipment and buildings, property taxes, office supplies, land charge, insurance, and management) are added. Interest, at a real rate of two percent, is added to the cumulative costs. Credit is given for the revenue from the estimated one ton of grapes per acre harvested in year three. The price of grapes in year three is the average price of the four varieties produced. The total cumulative cost for the E&D period is \$28,117 per acre. Amortized at a two percent real rate of interest for the estimated years of life from year four through 22, the annual cost for capital recovery (interest and depreciation) is \$1,764 per acre. This amount was charged as a fixed cost labeled 'vineyard capital recovery' in Table 10, which summarizes the costs and returns for a mature vineyard. Cash costs for establishment, including labor, are \$21,393 per acre for site preparation and the first three years.

Table 6: *V. Vinifera* Grape Establishment and Development Costs, Finger Lakes Region, New York, 2019

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Site Preparation – Year 0							
Drainage (see table 5 for details)	Custom						\$5,940
Lime (2 tons/acre)	Custom					\$100.00	\$100
Herbicide application	Custom				\$10.50	\$22.46	\$33
Stone removal & land maint.	Unskilled	10	10	\$175.00	\$149.67		\$325
Soil Sampling	Skilled	0.2		\$4.60		\$4.00	\$9
Fall fertilization	Skilled	0.6	0.5	\$13.80	\$7.72	\$100.00	\$122
Plowing	Custom						\$50
Discing (2X)	Custom						\$46
Pickup truck (10,000 miles for 50 ac/year)	n/a	n/a	n/a		\$70.86		\$71
Total		10.8	10.5	\$193.40	\$167.89	\$226.46	\$6,695
First Year							
Floating/dragging	Skilled	1	1	\$23.00	\$13.77		\$37
GPS vine Planting (\$4.25/vine)	Custom			\$852.00		\$3,428.33	\$4,280
Fertilization (banded)	Skilled	0.6	0.5	\$13.80	\$7.72	\$9.74	\$31
Hilling up	Skilled	1.5	1.2	\$34.50	\$23.00		\$58
Hilling up	Unskilled	1.5		\$26.25			\$26
Chem. weed control -trellis	Skilled	1.25	1.25	\$28.75	\$18.47	\$27.03	\$74
Trellis construction (see table 6 for details)	Skilled	60	16	\$1,380.00	\$306.71	\$4,801	\$6,487
Spot herbicide-hand application	Skilled	1		\$23.00		\$41.49	\$64
Cultivation (2X)	Skilled	1.2	1.2	\$27.60	\$23.00		\$51
Spray 1	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Spray 2	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Spray 3	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Seed cover crop	Skilled	0.6	0.5	\$13.80	\$7.72	\$11.25	\$33
Pickup truck (10,000 miles for 50 ac/year)	n/a	n/a	n/a		\$70.86		\$71
Total		80.65	22.55	\$2,450.30	\$496.42	\$8,413.04	\$11,360
Total for first year and site preparation							\$18,054

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
<u>Second Year</u>							
Pruning & brush removal	Skilled	3		\$69.00			\$69
Tying & renewal	Unskilled	2		\$35.00		\$4.50	\$41
Vine Replacement	Skilled	2	2	\$46.00	\$43.53	\$68.57	\$158
Spring Fertilization	Skilled	0.6	0.5	\$13.80	\$7.72	\$9.74	\$31
Chem. weed control-trellis	Skilled	1.25	1.25	\$28.75	\$19.83	\$71.97	\$121
Suckering	Unskilled	2.5		\$43.75			\$44
Cluster removal	Unskilled	2.5		\$43.75			\$44
Take away (de-hilling)	Skilled	3	2.5	\$69.00	\$47.92		\$117
Hand hoe	Unskilled	4		\$70.00			\$70
Spot herbicide treatment	Skilled	0.4	0.3	\$9.20	\$4.43	\$14.46	\$28
Spot herbicide treatment	Skilled	0.4	0.3	\$9.20	\$4.43	\$14.46	\$28
Hilling up	Skilled	3	1.5	\$69.00	\$28.75		\$98
Spray 1	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Spray 2	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Spray 3	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Spray 4	Skilled	0.4	0.3	\$9.20	\$8.39	\$31.47	\$49
Mowing (4X)	Skilled	2.6	2	\$59.80	\$37.52		\$97
Rogueing	Unskilled	1		\$17.50			\$18
Pickup truck (10,000 miles for 50 ac/year)	n/a	n/a	n/a		\$70.86		\$71
Total for Second Year		29.85	11.55	\$620.55	\$227.72	\$310.69	\$1,230

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Third Year							
Pruning and brush pulling (\$0.45/vine)	Custom	piece rate		\$451.73			\$452
Tying & renewal (\$0.23/vine)	Custom	piece rate		\$225.87		\$5.60	\$231
Brush chopping (1X)	Skilled	1.2	1	\$27.60	\$21.32		\$49
Vine replacement	Skilled	2	2	\$46.00	\$43.53	\$68.57	\$158
Chem. weed control- trellis	Skilled	2.6	2	\$59.80	\$29.54	\$71.97	\$161
Suckering	Unskilled	4		\$70.00			\$70
Cluster removal	Unskilled	4		\$70.00			\$70
Take away (de-hilling)	Skilled	3	2.5	\$69.00	\$47.92		\$117
Hand hoe	Unskilled	4		\$70.00			\$70
Bird control	Skilled	3		\$69.00			\$69
Spot herbicide treatment	Skilled	0.4	0.3	\$9.20	\$4.43	\$14.46	\$28
Spot herbicide treatment	Skilled	0.4	0.3	\$9.20	\$4.43	\$14.46	\$28
Spray 1	Skilled	0.6	0.5	\$13.80	\$13.99	\$31.47	\$59
Spray 2	Skilled	0.6	0.5	\$13.80	\$13.99	\$31.47	\$59
Spray 3	Skilled	0.6	0.5	\$13.80	\$13.99	\$24.59	\$52
Spray 4	Skilled	0.6	0.5	\$13.80	\$13.99	\$24.59	\$52
Spray 5	Skilled	0.6	0.5	\$13.80	\$13.99	\$8.77	\$37
Spray 6	Skilled	0.6	0.5	\$13.80	\$13.99	\$8.77	\$37
Spray 7	Skilled	0.6	0.5	\$13.80	\$13.99	\$8.77	\$37
Spray 8	Skilled	0.6	0.5	\$13.80	\$13.99	\$8.77	\$37
Mowing (4X)	Skilled	2.6	2	\$59.80	\$37.52		\$97
Hilling up	Skilled	1.7	1.5	\$39.10	\$28.75		\$68
Pickup truck (10,000 miles for 50 ac/year)	n/a	n/a	n/a		\$70.86		\$71
Total for third year		33.7	15.6	\$1,386.70	\$400.24	\$322.25	\$2,109

Table 7: Summary of establishment and development costs by year,
V. Vinifera grapes, Finger Lakes Region, NY, 2019

Item	Year 1	Year 2	Year 3
Revenue			
Yield per acre (tons)	0	0	1
Market price (average of 4 varieties)	n/a	n/a	\$1,613
Total revenue	\$0	\$0	\$1,613
Costs			
Site preparation	\$6,695	\$0	\$0
Annual variable costs			
-Pre-harvest	\$11,360	\$1,230	\$2,109
-Harvest (hand)+hauling	\$0	\$0	\$300
Total Variable Costs & Site preparation	\$18,054	\$1,230	\$2,409
Annual fixed costs			
-Machines & equipment depreciation	\$653	\$653	\$653
-Buildings depreciation	\$84	\$84	\$84
-Property taxes	\$259	\$259	\$259
-Land opportunity cost	\$311	\$311	\$311
-Office Supplies, phone, etc.	\$60	\$60	\$60
-Insurance	\$78	\$78	\$78
Total Fixed Costs	\$1,446	\$1,446	\$1,446
Interest on cumulative costs	\$585	\$683	\$819
Total costs	\$20,085	\$3,358	\$4,674
Net returns	-\$20,085	-\$3,358	-\$3,061
Total cumulative costs	\$20,085	\$23,443	\$28,117
Amortization of vineyard (in 22 years)			\$1,764
Cash costs of vineyard establishment (3 years)			\$21,393

Costs and Returns for a Mature Vineyard

Annual growing costs for years four through 22 are presented in Table 8. Total growing costs for a typical year in the mature vineyard are estimated to be \$3,181 per acre. The costliest operations are canopy management (\$911 per acre), spraying (11 times, for a total of \$728 per acre, including labor, machinery and materials costs) and pruning and brush removal (\$452 per acre). By year four, the well-managed vineyard will nearly have reached its full yield potential and will require approximately the same management each year for the duration of its life.

Table 9 summarizes the growing, establishment, and development costs for a *V. vinifera* vineyard. Growing costs are largest in the first year when a significant amount must be spent preparing the site, planting the vines, and constructing the trellis. Growing costs are \$3,181 per acre in years four through 22, and this number is transported to Table 10 to use in the computation of the costs and returns for the mature vineyard. The cost of crop insurance is added at an average cost of \$109 per acre, which generally starts at the fifth year of positive production (i.e. year 8). Costs for crop insurance will vary a few dollars per acre depending upon the grape variety planted.

Table 8: Growing Costs, Years Four through Twenty-two, *V. Vinifera* Grapes, Finger Lakes Region, 2019

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Operation							
Pruning + brush pulling	Custom	piece rate		\$451.73			\$452
Brush chopping	Skilled	1.2	1	\$27.60	\$21.32		\$49
Trellis maintenance	Skilled	4	1	\$92.00	\$14.97	\$30.00	\$137
Tying & renewal	Custom	piece rate		\$225.87		\$3.92	\$230
Vine replacement	Skilled	2	2	\$46.00	\$43.53	\$68.57	\$158
Chem.weed control-trellis	Skilled	2.6	2	\$59.80	\$29.54	\$27.23	\$117
Soil applic of Solubor (w. herb. Spray)	n/a					\$6.60	\$7
Spot herbicide treatment	Skilled	0.4	0.3	\$9.20	\$4.43	\$14.46	\$28
Suckering	Unskilled	4		\$70.00			\$70
Cluster removal	Unskilled	4		\$70.00			\$70
Shoot thinning	Unskilled	6		\$105.00			\$105
Take-away (de-hilling)	Skilled	3	2.5	\$69.00	\$47.92		\$117
Bird control	Skilled	3		\$69.00			\$69
Spray 1	Skilled	0.6	0.5	\$13.80	\$13.99	\$14.17	\$42
Spray 2	Skilled	0.6	0.5	\$13.80	\$13.99	\$14.17	\$42
Spray 3	Skilled	0.6	0.5	\$13.80	\$13.99	\$17.53	\$45
Spray 4	Skilled	0.6	0.5	\$13.80	\$13.99	\$54.02	\$82
Spray 5	Skilled	0.6	0.5	\$13.80	\$13.99	\$1.82	\$30
Spray 6	Skilled	0.6	0.5	\$13.80	\$13.99	\$33.85	\$62
Spray 7	Skilled	0.6	0.5	\$13.80	\$13.99	\$49.33	\$77
Spray 8	Skilled	0.6	0.5	\$13.80	\$13.99	\$94.19	\$122
Spray 9	Skilled	0.6	0.5	\$13.80	\$13.99	\$59.20	\$87
Spray 10	Skilled	0.6	0.5	\$13.80	\$13.99	\$45.26	\$73
Spray 11	Skilled	0.6	0.5	\$13.80	\$13.99	\$38.90	\$67
Mowing (4X)	Skilled	2.6	2	\$59.80	\$37.52		\$97
Lime (1 in 5 years)	Skilled	0.1	0.1	\$2.30	\$4.68	\$10.00	\$17
Pickup truck (10,000 miles for 50 ac/year)	n/a	n/a	n/a		\$70.86		\$71

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Shoot positioning/move catch wires (first path)	Unskilled	6		\$105.00			\$105
Shoot positioning/move catch wires (second path)	Unskilled	6		\$105.00			\$105
Mechanical leaf removal	Skilled	3.2	3	\$73.60	\$42.00		\$116
Summer pruning (2X)	Skilled	2.6	2.4	\$59.80	\$50.32		\$110
Petiole sampling (\$88 for every 2 years)	Skilled	0.1		\$2.30		\$3.84	\$6
Soil sampling (every 5 years)	Skilled	0.1		\$2.30		\$0.40	\$3
Hilling-up	Skilled	1.7	1.5	\$39.10	\$28.75		\$68
Fall fertilization	Skilled	0.3	0.3	\$6.90	\$4.63	\$27.50	\$39
Crop insurance							\$109
Total		59.5	23.6	\$1,903.10	\$554.38	\$614.19	\$3,181

Table 9: Summary of Growing Costs for *V. Vinifera* Vineyard, Trained to a Vertically Shoot Positioned System, Finger Lakes Region, NY, 2019

Item	Year 1	Year 2	Year 3	Year 4+
Site preparation	\$6,695			
Vines & planting	\$4,317			
Trellis materials & construction	\$6,487			\$137
Replanting & Rougeing		\$176	\$158	\$158
Dormant pruning & removal		\$69	\$452	\$452
Weed control	\$222	\$177	\$217	\$145
Fertilization	\$31	\$31		\$71
Canopy management		\$128	\$371	\$911
Disease & insect control	\$147	\$196	\$370	\$728
Take away & hilling up	\$84	\$285	\$255	\$185
Mowing		\$97	\$146	\$146
Bird Control			\$69	\$69
Pick-up (fuel, maintenances... etc)	\$71	\$71	\$71	\$71
Crop Insurance*				\$109
Total Growing Costs	\$18,054	\$1,230	\$2,109	\$3,181

*Crop Insurance generally starts at the fifth year of positive production (i.e., year 8)

Table 10 summarizes the costs and returns expected from a mature vineyard. The estimated revenue per acre varies from \$6,400 to \$4,940 depending upon variety. Total costs vary from \$7,259 to \$7,081 per acre by variety. The break-even prices and yields are shown in Table 10. A yield of 5.5 tons per acre is the break-even yield for Chardonnay, and a yield of 3.8 tons per acre would be necessary to break even with Pinot Noir. Yields at these higher levels may be inconsistent with quality requirements.

Pinot Noir shows a large loss (\$2,141) given the assumed yield and prices. At the assumed yield and prices, all varieties exhibited negative net returns. Riesling is the closest variety to breaking even at the assumed yields and prices with a loss of (\$859). To put this in perspective, it should be remembered that we assumed recommended practices throughout the model. Some growers will be able to reduce some of these costs considerably. All labor, including the owner's labor, is charged a cash wage. There is an imputed charge on all capital used.

The vineyard capital expense (establishment costs from Table 7) is written off after 22 years, which increase the fixed costs by \$1,764. In Table 13, we will discuss the scenario that vineyard holds a positive value which may be as much, or even more, than it was worth in the early years of the planting.

Table 10: Costs and Returns for a Mature *V. Vinifera* Vineyard - 1,
Finger Lakes Region, New York, 2019

Item	Pinot Noir	Cab. Franc	Chardonnay	Riesling
Receipts:				
Yield target , tons per acre	2.6	3.3	4	4
Price, \$ per ton	\$1,900	\$1,600	\$1,350	\$1,600
Total receipts	\$4,940	\$5,280	\$5,400	\$6,400
Costs:				
Variable Costs:				
Growing costs	\$3,181	\$3,181	\$3,181	\$3,181
Cluster removal (Cab. Franc and P. Noir)	\$70	\$70	\$0	\$0
Interest on operating capital	\$48	\$48	\$48	\$48
Machine Harvesting (\$95/ton)	\$247	\$314	\$380	\$380
Trucking (\$30/ton)	\$78	\$99	\$120	\$120
Total variable costs	\$3,624	\$3,712	\$3,729	\$3,729
(Optional) Bird control – sound *	\$30	\$0	\$0	\$0
Fixed Costs:				
Vineyard establishment capital recovery	\$1,764	\$1,764	\$1,764	\$1,764
Machinery and equipment capital recovery	\$653	\$653	\$653	\$653
Buildings capital recovery	\$84	\$84	\$84	\$84
Property taxes	\$259	\$259	\$259	\$259
Land opportunity cost	\$311	\$311	\$311	\$311
Office supplies, phone, etc.	\$60	\$60	\$60	\$60
Insurance	\$78	\$78	\$78	\$78
Management	\$247	\$264	\$270	\$320
Total fixed costs	\$3,457	\$3,474	\$3,480	\$3,530
Total costs	\$7,081	\$7,186	\$7,209	\$7,159
Profit or loss	-\$2,141	-\$1,906	-\$1,809	-\$859
Breakeven price (\$ /ton)	\$2,723	\$2,177	\$1,802	\$1,815
Breakeven yield (tons)	3.8	4.6	5.5	4.6

Capital Requirements

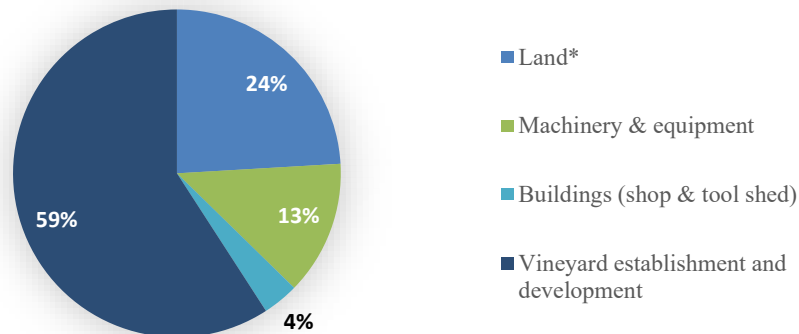
Table 11 indicates the capital investment per planted acre necessary to get into grape production in the Finger Lakes region, assuming a vineyard of 50 total planted acres with an additional four acres for roads, headlands, and a building; and reliance on either custom hand or machine harvesting of grapes. The table uses the value of new machinery and equipment and buildings. If a harvester is purchased, investment per acre for machinery would be considerably higher. Land costs assume a prime site close to the lake. Table 11 indicates that it would require \$46,527 per planted acre, for a total of \$2,512,458 for the entire 54-acre vineyard, to get the vineyard into maturity in the Finger Lakes under the assumptions indicated above. Established growers, with depreciated vineyards, machinery and equipment, and buildings, would have lower capital investment (book value) depending upon the age of their depreciable assets.

Growers with smaller acreage will typically have higher investment costs per acre. This is due to less efficient use of the machinery complement unless these smaller growers hire some vineyard operations to be done by custom operators and/or vineyard management companies, thus giving them the possibility of buying fewer items of machinery and equipment.

Table 11: Investment per Planted Acre of *V. Vinifera* Grapes, Finger Lakes Region of New York, 2019

Assets	\$/acre
Land* - specifically for planting – 50 acres	\$ 11,200
Machinery & equipment	\$ 6,159
Buildings (shop & tool shed)	\$ 1,650
Vineyard establishment and development**	\$ 27,518
Total Investment per planted acre	\$ 46,527

Chart 1: Investment per Planted Acre of *V. Vinifera* Grapes, Finger Lakes Region of New York, 2019



*Assume 54 acres purchased (including support land) for 50 planted acres

** Investment for E&D period is calculated by E&D costs in Table 7, excluding revenue, machinery, equipment and building depreciation

Sensitivity Analysis

Costs per ton of grapes and profits for Finger Lakes vineyards will vary widely due to factors such as price of land, site-specific factors, farm size, managerial ability, and labor efficiency. The cost and return estimates developed in this publication represent typical costs for well-managed vineyards producing premium quality grapes on prime sites.

The grower panel did not believe there was sufficient data to adjust costs in details for varietal differences. In reality, vigorous cultivars such as Cabernet Franc may require a greater labor input for pruning, brush removal, tying and other hand labor tasks. Differences in fungicide applications may be necessary due to the differences in disease resistance among the various varieties. For example, Pinot Noir, Chardonnay, and Riesling are more susceptible to Botrytis bunch rot, so additional spray materials may be used for Botrytis control, but these were not included in this analysis.

The total cost per ton, or breakeven price, is quite sensitive to yield as shown in Table 12. If yields are two tons per acre or less and/or with low yielding cultivars, prices around \$3,500 per ton would be required to break even. Even the highest price paid in the most recent seasons would result in unprofitable production with such a low yielding scenario.

Yields of more than four tons per acre for Cabernet Franc or more than 2.6 tons per acre for Pinot Noir; or more than five tons per acre for white *vinifera* varieties may be incompatible with the quality requirements of the market for premium wines, but this will depend greatly on the characteristics of the given growing season and the contractual agreement between grower and winery purchasing the fruit.

Table 12: Total Cost per Ton (Breakeven price) at Varying Yields,
V. Vinifera Grapes, Finger Lakes Region of New York, 2019

Pinot Noir		Cab Franc		Chardonnay		Riesling	
Yield (tons/acre)	Cost/ton*	Yield (tons/acre)	Cost/ton*	Yield (tons/acre)	Cost/ton*	Yield (tons/acre)	Cost/ton*
1.5	\$4,629	1.5	\$4,640	1.5	\$4,598	1.5	\$4,631
2.0	\$3,503	2.0	\$3,512	2.0	\$3,480	2.0	\$3,505
2.5	\$2,827	2.5	\$2,834	2.5	\$2,809	2.5	\$2,829
3.0	\$2,377	3.0	\$2,383	3.0	\$2,361	3.0	\$2,378
3.5	\$2,055	3.5	\$2,060	3.5	\$2,042	3.5	\$2,056
4.0	\$1,814	4.0	\$1,818	4.0	\$1,802	4.0	\$1,815
				4.5	\$1,616	4.5	\$1,627
				5.0	\$1,467	5.0	\$1,477

*Cost at different yield levels adjusted for harvesting and hauling at \$95/ton, trucking at \$30/ton

Discussion: Costs and Returns for a Mature Vineyard
- An established vineyard holds positive value

Table 13 indicates the estimated annual cash flow for a mature vineyard (similar to table 10), but assuming that an established vineyard is able to partially recover selected capital investments after 22 years of operation.

In this study, we do not discuss the returns of land investment, as it is mostly case-sensitive and this is not including in the vineyard's establishment capital recovery costs in table 10. Implicitly, the study thus assumes that land values increase by a rate equal to the real interest rate over the 22 years of operation. Instead, we assume that the trellis maintenance is done annually, so the trellis system has half of the value after 22 years. In addition, certain practices, such as drainage, lime application, land maintenance, herbicide application system do not need to be done when starting a new production cycle, and add value to the vineyard. The costs of these activities are therefore dropped from the annual vineyard capital recovery estimates. As a result, the capital recovery costs per acre decreases from \$1,764 (Table 10) to \$1,041 (Table 13). In Table 13, Riesling exhibits the only profitable variety at \$175 per acre. The other three varieties exhibit per-acre losses that ranges from (\$1,107) to (\$775).

Table 13: Cash and Returns for a Mature *V. Vinifera* Vineyard - 2,
Assuming that E&D costs can be partially recovered, Finger Lakes Region, New York, 2019

Item	Pinot Noir	Cab. Franc	Chardonnay	Riesling
Receipts:				
Yield target, tons per acre	2.6	3.3	4	4
Price, \$ per ton	\$1,900	\$1,600	\$1,350	\$1,600
Total receipts	\$4,940	\$5,280	\$5,400	\$6,400
Costs:				
Variable Costs:				
Growing costs	\$3,181	\$3,181	\$3,181	\$3,181
Cluster removal (Cab. Franc and P. Noir)	\$70	\$70	\$0	\$0
Interest on operating capital	\$48	\$48	\$48	\$48
Machine Harvesting (\$95/ton)	\$247	\$314	\$380	\$380
Trucking (\$30/ton)	\$78	\$99	\$120	\$120
Total variable costs	\$3,624	\$3,712	\$3,729	\$3,729
(Optional) Bird control - sound	\$30	\$0	\$0	\$0
Fixed Costs:				
Vineyard establishment capital recovery*	\$1,041	\$1,041	\$1,041	\$1,041
Machinery and equipment capital recovery	\$653	\$653	\$653	\$653
Buildings capital recovery	\$84	\$84	\$84	\$84
Property taxes	\$259	\$259	\$259	\$259
Land opportunity cost	\$0	\$0	\$0	\$0
Office supplies, phone, etc.	\$60	\$60	\$60	\$60
Insurance	\$78	\$78	\$78	\$78
Management	\$247	\$264	\$270	\$320
Total fixed costs	\$2,423	\$2,440	\$2,446	\$2,496
Total costs	\$6,047	\$6,151	\$6,175	\$6,225
Profit or loss	-\$1,107	-\$871	-\$775	\$175
Breakeven price (\$ /ton)	\$2,326	\$1,864	\$1,544	\$1,556
Breakeven yield (tons)	3.2	3.9	4.6	3.9

*Discounting practices generally need not to be redone or remains positive salvage value

Discussion: Projected 20 Year Cash Flows

Chart 2 shows the projected cash flows for 20 years of operations. This includes both variable and fixed costs. In year 20 it is assumed the vineyard, and all equipment associated with it, are sold off. The land is estimated to be worth \$815,785 after 20 years, and the equipment is estimated to have a salvage value of \$15,399. Estimated cash flow shows a total loss after 20 years of operation of (\$317,140). With current market conditions the vineyard's revenues do not make up the initial establishment costs even after 20 years of operations.

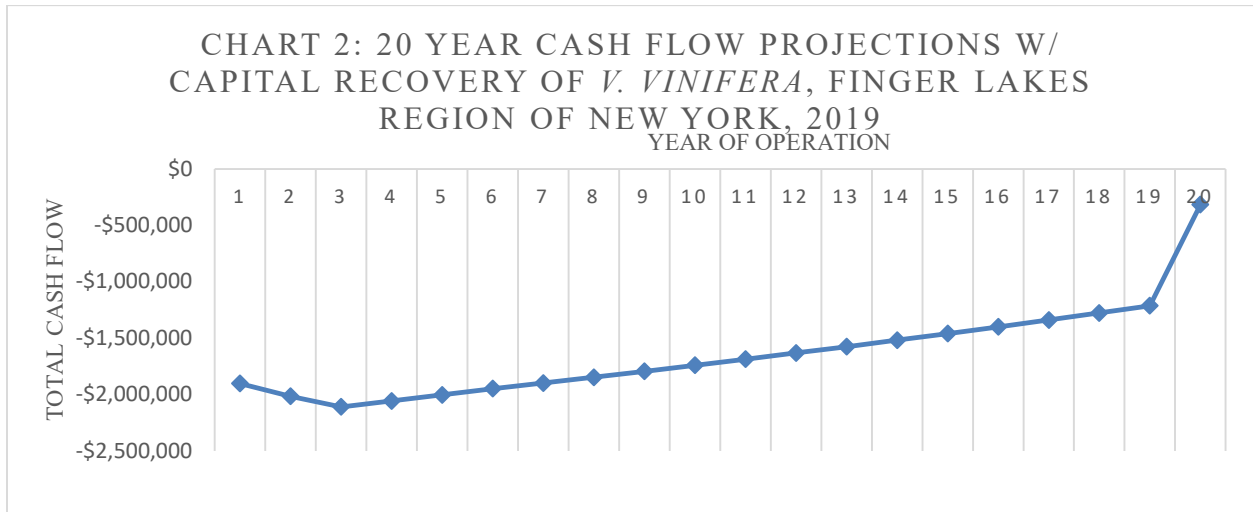
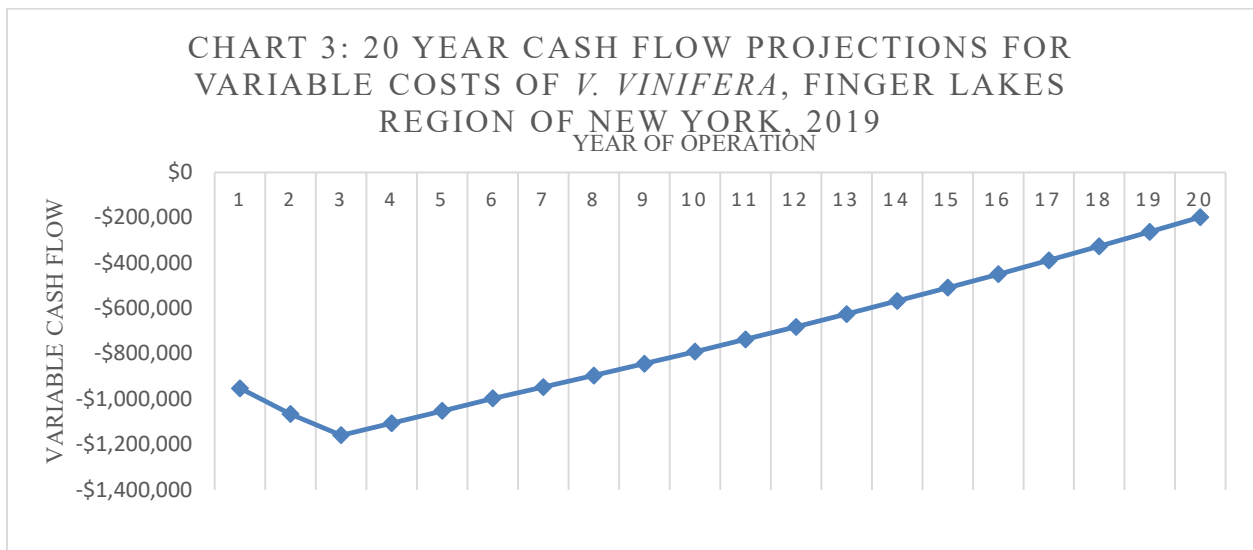


Chart 3 shows the projected cash flows for 20 years of operations in regards to variable costs. After 20 years of operations cash flows have yet to fully cover total variable costs of the establishment of the vineyard. This is mainly due to the significant upfront costs to establish the vineyard. At the end of 20 years cash flows shows a loss of (\$197,873). However, based on the projected trends the vineyard should be able to fully cover the initial variable costs within the next four years, assuming market conditions hold.



Concluding Comments

The cost and returns estimates derived in this publication indicate results for *V. vinifera* in the Finger Lakes under the assumption of prime sites, the use of recommended practices, good management, 2019 prices for inputs, and prices for grapes that reflect several quality enhancing practices such as leaf pulling, cluster removal for two varieties, and limited yields.

Potential investors should be forewarned that the current economic climate for grape growing in the Finger Lakes can change. In some years, given the thin markets for certain varieties, a surplus situation can develop when a few growers plant additional acres. The total acreage of some varieties in the Finger Lakes is quite limited. For example, in 2011 (from the most recent vineyard survey available providing specific information pertinent to the Finger Lakes region), the New York National Agricultural Statistics Service (NASS) estimated acreage of certain varieties in the Finger Lakes as follows: Cabernet Franc with 236 acres, Chardonnay with 351 acres, Pinot Noir with 194 acres, and Riesling with 849 acres. Total *vinifera* acreage in the Finger Lakes was only 2,047 acres, or about 22 percent of total grape acreage in the Finger Lakes. With such limited acreage, a few small plantings or one large planting of these varieties can lead to a large percentage increase in grapes produced, temporarily depressing the cash market. This happened with Chardonnay in the Finger Lakes in the early 1990s and Cabernet Franc in recent years.

Labor, especially with more reliance on Hispanic labor for pruning and tying, is a concern. More growers need to consider using H-2A labor to prevent the possibility of labor shortages. (Growers should be reminded that there is a long lead time involved in securing this labor). Since nearly all grapes in the Finger Lakes are harvested mechanically, the industry is not as vulnerable as the tree fruit and vegetable industries. Immigration reform would help ease growers' minds considerably, but meaningful reform is unsure at the time of writing this publication.

Nevertheless, given the growing consumption of table wine in the United States, the developing tourist trade in the Finger Lakes, and the growing reputation of Finger Lakes wine quality, the long run potential appears favorable for investors who can weather the inevitable ups and downs associated with an agricultural enterprise subject to the usual vagaries of weather and market forces.

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Special recognition is extended to Mark Pisoni (M.S., Department of Agricultural, Resource, and Managerial Economics, Cornell University, 2001). While at Cornell, working on a grant funded by the New York State Department of Agriculture and Markets' "Grow New York" Program, Mark developed an Excel program which was used to develop the 2001 - 2020 Cost of Establishment and Production of *Vinifera* Grapes in the Finger Lakes publications. Mark is now viticulturist of the Pisoni Vineyards and Winery, Gonzales, California.

Appendix

Table A1: Sample Herbicide Program for *V. Vinifera* Grapes, Finger Lakes NY, 2019

Year	Reason for Spray	Material	Rate/acre	Price	\$/acre
Year 0					
Site Preparation	Custom Herbicide	Glyphosate	4 qt	\$4.00 qt	\$16.00
		Ammonia Sulfate	1.7 lbs.	\$3.80 lb.	\$6.46
		Total per spray			
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Year 1	Chem. Weed control - Trellis	Surflan	1.5 qt	\$18.02 qt	\$27.03
	Chem. Weed control-spot	Glyphosate	2 qt	\$4.00 lb.	\$8.00
		Ammonia Sulfate	1.7 lbs.	\$3.80 lb.	\$6.46
Total per spray				\$41.49	
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Year 2 - 3	Chem. Weed control - Trellis	Prowl H20	6 qt	\$12.00 qt	\$71.97
	Spot herbicide treatment	Glyphosate	2 qt	\$4.00 qt	\$8.00
		Ammonia Sulfate	1.7 lbs.	\$3.80 lb	\$6.46
Total for all sprays				\$100.89	
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Year 4 - 20	Chem weed control - trellis	Chateau	12 fl. Oz.	\$0.68 fl. Oz	\$8.11
		Rely 280	24 fl. Oz.	\$0.80 fl. Oz	\$19.12
		Total per spray			
	Spot herbicide treatment	Glyphosate	2 qt.	\$4.00 qt	\$8.00
		Ammonia Sulfate	1.7 lbs.	\$3.80 lb	\$6.46
Total per spray				\$14.46	

Table A2: Sample Fertilizer/Soil Program for *V. Vinifera* Grapes, Finger Lakes Region, NY, 2019

Year	Material	Rate/acre	Price/Unit	\$/acre
Year 0 Site Preparation	Soil sampling 1 test/5 acres, 2 depths	0.4 acre	\$ 10.00 test	\$ 4.00
	Lime	2 tons	\$ 50.00 ton	\$ 100.00
	Fall fertilization (Muriate of potash)	300 lbs	\$ 550.00 ton	\$ 82.50
Total cost - year 0				\$ 186.50
Year 1	Fertilization 10:10:10	30 lbs	\$0.32 lb	\$ 9.74
	Mulch (if irrigation not installed - optional)	20 bales	\$ 15.00 bale	\$ 300.00
Total cost - year 1				\$ 309.74
Year 2	Spring fertilization (10:10:10)	30 lbs	\$0.32 lb	\$ 9.74
Total cost - year 2				\$ 9.74
Year 3+	Soil application Solubor	2.5 lbs	\$2.64 lb	\$ 6.60
	Muriate of potash (every 3rd year)	300 lbs	\$ 550.00 ton	\$ 27.50
	Lime (1 in 5 years)	1 ton	\$ 50.00 ton	\$ 10.00
	Petiole sampling	0.16 acre	\$ 24.00 test	\$ 3.84
	Soil sampling (every 5th year)	0.2 acre	\$ 10.00 test	\$ 2.00
Total cost - year 3+				\$ 49.94

Table A3: Machinery, equipment, and building capital recovery and interest costs, *V. Vinifera* Grapes, Finger Lakes Region, NY, 2019

<i>Machinery and Equipment</i>	Purchase Price	Years of Life	Salvage Value	Capital to be Recovered	Cost Recovery Factor	Annual Recovery	Interest on Salvage Value	Total Capital Recovery & Interest
Tractor, 62-HP, 2WD, spray cab	\$57,000	10	\$5,700	\$51,300	0.1172	\$6,014	\$171	\$6,185
Tractor, 45-HP	\$31,000	10	\$3,100	\$27,900	0.1172	\$3,271	\$93	\$3,364
Air-blast sprayer- 400 gallon	\$35,000	10	\$3,500	\$31,500	0.1172	\$3,693	\$105	\$3,798
Herbicide sprayer- 50 gallon	\$3,350	10	\$335	\$3,015	0.1172	\$353	\$10	\$363
Environmist sprayer	\$7,000	10	\$700	\$6,300	0.1172	\$739	\$21	\$760
Mower	\$4,000	7	\$571	\$3,429	0.1605	\$550	\$17	\$567
Brush chopper (6ft)	\$12,000	7	\$1,714	\$10,286	0.1605	\$1,651	\$51	\$1,702
Fertilizer Spreader	\$2,500	10	\$250	\$2,250	0.1172	\$264	\$8	\$271
Small disc (used)	\$3,000	10	\$300	\$2,700	0.1172	\$317	\$9	\$326
Grape hoe	\$18,000	10	\$1,800	\$16,200	0.1172	\$1,899	\$54	\$1,953
Post driver	\$5,400	10	\$540	\$4,860	0.1172	\$570	\$16	\$586
Vineyard Trailer	\$4,500	10	\$450	\$4,050	0.1172	\$475	\$14	\$488
Pickup truck (used)	\$34,000	10	\$3,400	\$30,600	0.1172	\$3,587	\$102	\$3,689
Auger	\$1,220	10	\$122	\$1,098	0.1172	\$129	\$4	\$132
Mechanical hedger (used)	\$18,000	10	\$1,800	\$16,200	0.1172	\$1,899	\$54	\$1,953
Mechanical Leaf remover	\$35,000	10	\$3,500	\$31,500	0.1172	\$3,693	\$105	\$3,798
ATV	\$12,000	10	\$1,200	\$10,800	0.1172	\$1,266	\$36	\$1,302
Bird control equipment (\$100/acre)	\$5,000	10	\$500	\$4,500	0.1172	\$528	\$15	\$543
Shop Equipment	\$8,000	10	\$800	\$7,200	0.1172	\$844	\$24	\$868
Electric pruning shears (\$2,500 x 3)	\$7,500	5	\$1,500	\$6,000	0.2184	\$1,310	\$45	\$1,355
Macrobin (X15)	\$4,500	10	\$450	\$4,050	0.1172	\$475	\$14	\$488
Total Machine & Equipment costs	\$307,970		\$30,283	\$265,687				\$32,649
Cost per planted acre	\$6,159							\$653
Buildings								
Shop (1,500 ft ² @ \$55 ft ²)	\$82,500	30	\$0	\$82,500	0.0510	\$4,209	\$0	\$4,209
Cost per planted acre	\$1,650							\$84

Table A4: Hourly Machinery and Equipment Variable Costs, *V. Vinifera* Grapes,
Finger Lakes Region, NY, 2019

Item	Purchase Price	Hours of life	Total Repairs	Repairs	Fuel	Lube (15% of fuel)	Total Hourly Variable Costs
Tractor, 62-HP, 2WD, spray cab	\$ 57,000	7000	100%	\$8.14	\$8.12	\$1.22	\$17.48
Tractor, 45-HP	\$ 31,000	7000	100%	\$4.43	\$8.12	\$1.22	\$13.77
Air-blast sprayer- 400 gallon	\$ 35,000	2000	60%	\$10.50			\$10.50
Herbicide sprayer- 50 gallon	\$ 3,350	2000	60%	\$1.01			\$1.01
Enviromist sprayer	\$ 7,000	2000	60%	\$2.10			\$2.10
Mower (6ft)	\$ 4,000	2500	80%	\$1.28			\$1.28
Brush Chopper	\$ 12,000	2500	80%	\$3.84			\$3.84
Fertilizer Spreader	\$ 2,500	1200	80%	\$1.67			\$1.67
Small disc (used)	\$ 3,000	2000	60%	\$0.90			\$0.90
Grape hoe	\$ 18,000	2000	60%	\$5.40			\$5.40
Post driver	\$ 5,400	2000	80%	\$2.16			\$2.16
Trailer	\$ 4,500	3000	80%	\$1.20			\$1.20
Pickup truck (used)	\$ 34,000	2500	83%	\$11.29	\$5.78	\$0.87	\$17.94
Auger	\$ 1,220	2000	80%	\$0.49			\$0.49
Mechanical hedger (used)	\$ 18,000	2000	80%	\$7.20			\$7.20
Mechanical leaf remover	\$ 35,000	2000	80%	\$14.00			\$14.00
ATV	\$ 12,000	1200	80%	\$8.00			\$8.00

Tractor Fuel Factors	Factor
Diesel	0.0438
Gasoline	0.0600