Cost of Establishment and Production of Concord Grapes in the Lake Erie Region of New York - 2020

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Introduction

New York State is home to the largest Concord grape industry in the Eastern United States and is the second largest producer of Concord grapes in the country. The Lake Erie Grape Belt is home to more than 800 vineyards covering 32,000 acres of grape producing land stretching from Buffalo, NY to Erie, Pennsylvania (Governor, 2018). These farms produce roughly 150,000 tons of Concord grapes each year with the majority being used for grape juice (Montalbano, 2018). The Concord grape industry provides approximately 2,000 jobs and accounts for around $340 million in economic impact each year (Montalbano, 2018).

The Lake Erie Concord Grape Belt is the oldest in the world. The Concord grape is native to North America and first propagated in western New York in the 1870's (Concord). Propagators found the climate, geography, and soils around Lake Erie to be very suitable for growing high yielding, as well as high quality, Concord grapes. In recent years Concord producers have seen larger than average yields. The typical Concord vineyard can be expected to have yields of roughly six tons per acre. In 2015 and 2016, due to both the cyclical growing pattern of Concord grapes and suitable weather conditions, many growers saw yields upwards of 8 to 10 tons per acre (Montalbano, 2018).

The economics surrounding Concord grape production have varied widely over the past few years. Between 2015 and 2016 grape prices fell to a modern low of around $130 per ton (Martin, 2019). However, since then the price has been steadily increasing. In the fall of 2019 the sales price for one ton of Concord grapes was roughly $240-$250, almost doubling in a five year time span. For the 2020 harvest year the price range for Concord is $250 - $320 per ton. The average is expected to be $280 per ton. One of the main reasons for the price increase is the same reason for the low prices found in 2015/2016, grape supply (Martin, 2019). Since 2015/2016 Concord grape acreage has fallen roughly 10% in the Lake Erie region, and as much as 20% in other places such as Washington and Michigan (Martin, 2019). The decrease is overall supply has allowed prices to increase over the past few years to levels where efficient growers may realize significant economic profits. However, even with the cost of Concord grapes increase almost two-fold in a 5-6 time span many growers may still just be breaking-even, while many others may be operating at a loss.

Growers who are considering planting Concord grapes need to carefully weigh the cost of planting and establishing a vineyard, as well as the annual cost of production of a mature vineyard against the expected yields and sales price to determine whether their investment to bring a Concord grape vineyard to maturity will result in economically profitable returns. This requires an assessment of the initial establishment costs, yearly operation costs, and multi-year projections estimating when the vineyard may become economically profitable. Higher prices that often motivate plantings are often gone before vineyards reach full production.

This question is complicated by the long-run nature of the investment (payback periods are in excess of ten years and can be much longer), as well as the risk of an oversupply of Concord grapes found both in the Lake Erie Concord Grape Belt and around the world. Secondly, there are other risks involved in the market of Concord grapes. The majority of growers in the Lake Erie region rely on one or two main buyers, both cooperative business structures, specializing in grape juice production. If grape juice demand were to substantially decline prices growers receive for Concord grapes may decline as well. These are just two of the potential threats to investing in a Concord vineyard. Other threats may include pest infestation, climate change, unexpected sever weather instances, etc. While it is impossible to plan for all potential threats it is important for those considering investing in a new Concord vineyard to understand these risks exist.

The objective of this study was to determine the cost of establishing and producing Concord grapes in the Lake Erie region with a commercial size operation. The models were based off of the 2020 publication *Cost of Establishment and Production of V. Vinifera Grapes in the Finger Lakes Region of New York – 2019*, analyzing the costs of establishing a *V. Vinifera* vineyard in the Finger Lakes. New estimates mirroring the market conditions of the total investment in land, machinery, vineyard establishment and development costs, and annual operating costs were developed specifically for Concord grapes. These estimates can guide 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 Lake Erie area, 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 assumed that vineyard practices were used which would result consistently high yields. Poorer sites and/or failure to follow optimal management practices can have a significant negative impact on the earnings estimates presented in this publication.

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 Erie region Concord industry. In October of 2019, we spoke with multiple Concord vineyard managers, as well as extension agents, who reviewed the data prepared for the first estimates of the costs of establishing and growing Concord grapes. Consensus estimates were developed for land prices, labor requirements and wage rates for the various operations of a Concord vineyard and for a typical machinery complementary for a full time commercial vineyard.

The stakeholders 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[1]

The study assumes land was purchased at $3,100 per acre. In 2015 study was published analyzing the cost and establishment of Cold Hardy grapes in the Chautauqua County, the neighboring county to Erie county, where a large number of grape producers are located as well. Agricultural land prices are relatively similar in both counties. It is important to note the price of $3,100 is an increase of 55% since the Cold Hardy grapy study in 2015 was published. This value takes into account the possibility of having to prepare land that is not ready to be used for agricultural purposes. $3,100 was decided as a base price per acre after consulting with Farm Credit East and discussing average sales price of agricultural land suited for grape production.

The specified size was 154 acres, with 150 acres planted to Concord grapes. The size of the modelled vineyard reflects the large vineyards specializing in Concord grape production in the Erie region. The large size of the vineyard allows for growers to use large scale machinery efficiently, allowing for the producers to potentially minimize labor hours by using more mechanized production and harvesting methods. That being said, some production methods will need to be done my hand and may be carried out by the growers themselves or by hired full/part-time laborer's.

Vineyard Layout

The vineyard was assumed to be planted on a 9' X 7.5' spacing (row by vine) resulting in a planting density of 645 vines per acre. There were 9 rows to an acre and rows were 440 feet long. Vine cost was estimated to average a total of $2.85 per plant. This includes the individual vine cost of $1.75 and a GPS planting cost of roughly $1.10 per vine. Each year it was assumed that three 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 96,800 vines being planted over 150 acres.

[1] Prices of land vary dramatically, especially for land used for Concord production. Land costs may be as low as $500/acre in some instances.

Varieties

The 150-acre vineyard was planted solely with Concord gapes. Concord growers particularly well in the Erie region of New York and is a staple crop for many agricultural producers in the region.

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 Top-Wire Cordon training system. The trellis system was made up of a top wire assumed to be 66-72in from the ground, a 8' X 4" wooden line posts at every fourth vine, two catch wire clips per end 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 Penn State Extension Services. 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 Kevin Martin, Extension Specialist, Lake Erie Regional 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 $0.45 per vine. The piece rates for tying were specified at $0.23 per vine. The pruning and tying piece rates have a base rate of $0.36 and $0.18 respectively. An additional 13% contracting fee and 10% unemployment benefits cost were added resulting in $0.45 and $0.23 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 $150 per ton, with an additional $8 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 $906,720 which represents an average investment of $517 per acre of planted vineyard. The investment for a shop is estimated at $82,500, or $550 per acre. The shop is 1,500 ft^2, and the construction cost ia estimated at $55.00 per ft^2 which includes basic amenities such as water and electricity, cement 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 $79,616 for machinery and $4,209 for buildings, or $517 and $27.33 annual costs per acre, respectively.

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 Concord grapes. For years one and two we assume there are now suitable grapes

for harvest, in year three we assume yields of 40% of a mature vineyard equaling 3 tons per acre, and from year 4 on we assume the vineyard is a healthy, mature vineyard producing 7.5 tons of Concord grapes per acre.

Results

Grape Prices

After speaking with some of the largest buyers and producers of Concord grapes in the Erie region of New York, and analyzing previous year's sales data, we settle on a price of $280 per ton. This price reflects higher quality Concord grape production. This is a significant increase from roughly 5-6 years ago when modern Concord prices bottomed out at roughly $130 per ton. The estimated $280 per ton may allow producers to cover their cost of production as well as potentially invest in new equipment.

Pesticide Program Spray Costs

Table 1.1 indicates the recommended spray program and costs for years one (zero sprays), two and three (establishment years). Table 1.2 indicates the recommended spray program and costs for years 4+ (mature vineyard operation). The total spray costs for Year 2 is $39.96, and the total spray cost for Year 3 is $93.17. Beginning in year four, the spray programs are assumed to be approximately the same from year to year, with the necessity on average for six sprays during the growing season. Spray material costs were estimated on average at $160.69 per acre from year 4 on. 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 1.3 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 1.1: Sample Spray Program for Concord Grapes, Years 2 & 3, Lake Erie Region, NY, 2020

Year	Spray	Chemical	Target Organisms	Measurement	Unit/Acre	Cost	Spray Cost
2	1	Mancozeb 75DF	Phomopsis	3	lbs	$ 11.87	$ 39.96
		Tebustar	Powdery Mildew	0.8	gal	$ 28.16	
	Total	Year 2					$ 53.16
3	1	Mancozeb 75DF	Phomopsis	3	lbs	$ 11.87	$ 11.87
	2	Ziram	Black rot, downy mildew	3.5	lbs	$ 19.58	$ 52.16
		Leverage 360	Grape berry moth, Japanese beetle	3	oz	$ 5.86	
		Vivando	Powdery mildew	15	oz	$ 26.72	
	3	Quintec	Powdery mildew	3	oz	$ 9.63	$ 29.21
		Ziram	Downy mildew, black rot	3.5	lbs	$ 19.58	
	Total	Year 3					$ 93.17

Table 1.2: Sample Spray Program for Concord Grapes, Mature Vineyard Year 4+, Lake Erie Region, NY, 2020

Spray	Chemical	Target organisms	Measure	Unit/Acre		Cost	Spray Cost
1	Mancozeb 75DF	Phomopsis	2	lbs.	$	7.87	$ 7.87
2	Mancozeb 75DF	Phomopsis, Black Rot	3	lbs.	$	11.80	$ 11.80
3	Mancozeb 75DF	Phomopsis, Black Rot, Downy mildew,	4	lbs.	$	15.73	$ 35.73
	Endura	Powdery mildew	4.5	oz.	$	20.00	
4	Vivando	Powdery Mildew	11	Oz	$	19.59	$ 39.18
	Ziram	Downy mildew, black rot	3.5	lbs		19.58	
5	Quintec	Powdery mildew	5.5	oz	$	16.05	$ 44.14
	Intrepid	Grape berry moth	8	Oz	$	17.81	
	Reason	Downy Mildew	4	Oz		8.68	
6	Leverage 360	Grape berry moth, Japanese beetle	3	oz.	$	5.86	$ 21.97
	Champ	Powdery Mildew, Black rot, downy mildew	3.5	lbs.	$	16.11	
						Total Cost	**$ 160.69**

Table 1.3: Cost Key of Sample Sprays for Concord Grapes, Lake Erie Region, NY, 2020

Chemical	Amount	Unit	Market Cost	Cost per 1	Unit
Cueva	2.5	gal	$ 88.00	$ 35.20	gal
Champ	20	Lbs	$ 92.07	$ 4.60	lb
Intrepid	1	gal	$ 284.89	$ 2.23	oz
Leverage 360	1	gal	$ 249.95	$ 1.95	oz
Luna Experience	1	qt	$ 188.95	$ 5.90	oz
Mancozeb 75DF	12	lb	$ 99.99	$ 8.33	lb
Mettle	30	oz	$ 115.95	$ 3.87	oz
Quintec	30	oz	$ 96.30	$ 3.21	oz
Reason	1	gal	$ 277.76	$ 2.17	oz
Surfactant	1	gal	$ 41.92	$ 0.33	liquid oz
Tebustar	2	lb	$ 34.95	$ 1.09	oz
Vivando	1	gal	$ 228.00	$ 1.78	liquid oz
Ziram	10	lb	$ 55.95	$ 5.60	lb

Drainage Construction Costs

Table 2 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 $5,146 per acre.

Table 2: Tile Drainage Costs per acre for Concord Grapes, Lake Erie Region, NY, 2020

Item	Quantity (ft)	Price $/ft	Total Cost per acre
Main line: 6" pipe	29.00	$2.25	$65.25
Laterals: 4" pipe	2,723	$0.35	$953
Installation	2,752	$1.50	$4,128
Total Drainage Construction per acre			**$5,146**

* assumptions: tile drainage in the middle of every third row (27 feet apart)

Trellis Construction Costs

Table 3 contains an estimate of trellis constructions costs. The total cost for materials is estimated at $2,646 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 $4,373 per acre.

Table 3: Sample Trellis Construction Costs per acre for Concord Grapes, Lake Erie Region, NY, 2020

Top-Wire Cordon Construction Materials per Acre	Quantity	Unit	Price	Unit	Total per acre
Wood end posts (8 ft X 4-5" diameter)	18	posts	$ 9.25	post	$ 167
Anchor Kit	18	posts	$ 9.00	post	$ 162
Line Post (8 ft, 3-4" diameter, every 4th plant)	234	posts	$ 6.75	stake	$ 1,580
12.5 gauge HT foilage & cordon wire ($143 roll of 3846 ft)	19,555	ft	$ 0.03	ft	$ 727
Crimps	36	clips	$ 0.16	clip	$ 6
Staples, lbs.	2.4	lbs.	$ 1.99	lb.	$ 5
Total Trellis Construction materials					**$ 2,646**

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 4. First year costs, including site preparation, trellis construction, and planting, are substantial, amount to $12,794 per

acre. A planting density of 645 vines (9' x 7.5') (row by vine) was assumed. The largest cost in the first year is for trellis construction, for a total of $4,373. In year two, variable costs are a relatively modest at $651 per acre with less labor required than for mature vines, and fixed costs equaling $801 per acre. In the third year total variable costs are estimated at $1,627 per acre. Note that the usage of pickup truck is estimated at 40,000 miles for a 200-acre farm per year, which is roughly $50 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 5. 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 $18,099 per acre. Cash costs for establishment, including labor, minus the estimated revenues for the relatively small yields in year three, are $14,622 per acre for site preparation and the first three years.

Table 4: Concord Grape Establishment & Development Costs, Lake Erie Region, NY, 2020

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Site Preparation							
Drainage (see table 5 for details)	Custom						$5,146
Lime (2 tons/acre)	Custom					$100.00	$100
Herbicide application	Custom				$10.50	$22.46	$33
Stone removal & land maint.	Skilled	10	10	$230.00	$183.96		$414
Soil Sampling	Skilled	0.2		$4.60		$4.00	$9
Fall fertilization	Skilled	0.6	0.5	$13.80	$14.60	$100.00	$128
Plowing	Custom						$50
Discing (2X)	Custom						$46
Pickup truck (40,000 miles for 200 ac/year)	n/a	n/a	n/a		$49.84		$50
Total Site Preparation		10.8	10.5	$248.40	$258.89	$226.46	**$5,976**
First Year							
Floating/dragging	Skilled	1	1	$23.00	$17.20		$40
Laser Planting ($1.10/vine)	Custom			$852.00		$1,129.33	$1,981
Fertilization	Skilled	0.6	0.5	$13.80	$14.60	$0.00	$28
Chem. weed control -trellis	Skilled	1.25	1.25	$28.75	$27.12	$27.03	$83
Hilling Up	Skilled	3	1.5	$69.00	$33.89		$103
Trellis construction (see table 6 for details)	Skilled	60	16	$1,380.00	$347.85	$2,646	$4,373
Spot herbicide-hand application	Skilled	1		$23.00		$41.49	$64
Cultivation (2X)	Skilled	1.2	1.2	$27.60	$27.11		$55
Seed cover crop	Skilled	0.6	0.5	$13.80	$14.60	$11.25	$40
Pickup truck (40,000 miles for 200 ac/year)	n/a	n/a	n/a		$49.84		$50
Total Year 1		79.45	21.65	$2,430.795	$532.21	$3,854.72	**$6,818**
Total for first year and site preparation							**$12,794**

(Unit: Acre)	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Second Year							
Pruning & brush removal	Skilled	3		$69.00			$69
Tying & renewal	Unskilled	2		$35.00		$4.50	$41
Spring Fertilization	Skilled	0.6	0.5	$13.80	$14.60		$28
Chem. weed control-trellis	Skilled	1.25	1.25	$28.75	$24.12	$71.97	$125
Cluster removal	Unskilled	2.5		$43.75			$44
Spot herbicide treatment	Skilled	0.4	0.3	$9.20	$6.51	$14.46	$30
Spot herbicide treatment	Skilled	0.4	0.3	$9.20	$6.51	$14.46	$30
Spray 1	Skilled	0.4	0.3	$9.20	$13.67	$39.96	$63
Mowing (4X)	Skilled	2.6	2	$59.80	$42.67		$102
rogueing	Unskilled	1		$17.50			$18
Pickup truck (40,000 miles for 200 ac/year)	n/a	n/a	n/a		$49.84		$50
Total Year 2		24.15	8.65	$347.70	$108.08	$145.35	**$651**
Third Year							
Pruning and brush pulling ($0.45/vine)	Custom	piece rate		$290.40			$290
Tying & renewal ($0.23/vine)	Custom	piece rate		$148.43		$3.60	$152
Brush chopping (1X)	Skilled	1.2	1	$27.60	$23.89		$51
Chem. weed control- trellis	Skilled	2.6	2	$59.80	$43.39	$71.97	$175
Suckering	Unskilled	4		$70.00			$70
Cluster removal	Unskilled	4		$70.00			$70
Spray 1	Skilled	0.6	0.5	$13.80	$22.78	$13.11	$54
Spray 2	Skilled	0.6	0.5	$13.80	$22.78	$25.65	$62
Spray 3	Skilled	0.6	0.5	$13.80	$22.78	$28.96	$66
Mowing (4X)	Skilled	2.6	2	$59.80	$48.79		$109
Pickup truck (40,000 miles for 200 ac/year)	n/a	n/a	n/a		$49.84		$50
Total Year 3		13.6	4.5	$810.88	$185.45	$77.57	**$1,177**

Table 5: Summary of Establishment & Development Costs by Year, Concord Grapes, Lake Erie Region, NY, 2020

Item	Year 1	Year 2	Year 3
Revenue			
Yield per acre (tons)	0	0	3
Market price	na	na	$280
Total revenue	$0	$0	$840
Costs			
Site preparation	$5,976	$0	$0
Annual variable costs			
-Preharvest	$6,818	$651	$1,177
-Harvest - Machine	$0	$0	$450
Total Variable Costs & Site preparation	$12,794	$651	$1,627
Annual fixed costs			
-Machines & equipment amortization	$517	$517	$517
-Buildings amortization	$27	$27	$27
-Property taxes	$78	$78	$78
-Land opportunity cost	$93	$93	$93
-Office Supplies, phone, etc.	$20	$20	$20
-Insurance (fire, liability)	$66	$66	$66
-Management	$0	$0	$42
Total Fixed Costs	$801	$801	$801
Interest on cumulative costs	$408	$464	$552
Total costs	$14,003	1,915	$3,021
Net returns	($14,003)	($1,915)	($2,181)
Total cumulative costs	$14,003	$15,918	$18,099
Amortization of vineyard:			$1,136
Cash costs of vineyard establishment (3 Yrs.)			$14,622

Costs and Returns for a Mature Vineyard

Table 6 summarizes the growing, establishment, and development costs for a Concord 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. Total growing costs are $1,471 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 may vary from vineyard to vineyard.

Annual growing costs for years four through 22 are presented in Table 7. Total growing costs for a typical year in the mature vineyard are estimated to be $1,471 per acre. The costliest operations are dormant vine pruning and removal ($361 per acre), canopy management ($255 per acre), and disease and insect control ($236 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 6: Summary of Growing Costs for Concord Grapes, TCW Trellis, Lake Erie Region, NY, 2020

Item	Year 1	Year 2	Year 3	Year 4+
Site preparation	$6,112			
Vines & replanting	$2,022			
Trellis materials & construction	$4,373			$140
Dormant pruning & removal		$69	$361	$361
Weed control	$242	$185	$175	$161
Fertilization	$28	$28		$126
Canopy management		$83	$326	$255
Disease & insect control		$63	$182	$236
Take away & hilling up	$103			
Mowing		$102	$160	$103
Pick-up (fuel, maintenances…etc)	$50	$50	$50	$50
Crop Insurance*				$109
Total Growing Costs	**$12,691**	**$581**	**$1,177**	**$1,471**

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

Table 7: Growing Costs of a Mature Vineyard, Year 4+, Concord Grapes, Lake Erie Region, NY, 2020

Operation	Labor Used	Labor Hours	Equipment Hours	Labor Cost	Equipment Cost	Materials Cost	Total Cost
Pruning+brush pulling	Custom	piece rate		$361.39			$361
Brush chopping	Skilled	1.2	1	$27.60	$23.89		$51
Trellis maintenance	Skilled	4	1	$92.00	$18.40	$30.00	$140
Tying & renewal	Custom	piece rate		$180.69		$3.92	$185
Chem.weed control-trellis	Skilled	2.6	2	$59.80	$43.39	$27.23	$130
Soil applic of Solubor (w. herb. Spray)	n/a					$6.60	$7
Spot herbicide treatment	Skilled	0.4	0.3	$9.20	$6.51	$14.46	$30
Spray 1	Skilled	0.25	0.15	$5.75	$6.83	$7.87	$20
Spray 2	Skilled	0.25	0.15	$5.75	$6.83	$11.80	$24
Spray 3	Skilled	0.25	0.15	$5.75	$6.83	$35.73	$48
Spray 4	Skilled	0.25	0.15	$5.75	$6.83	$39.18	$52
Spray 5	Skilled	0.25	0.15	$5.75	$6.83	$44.14	$57
Spray 6	Skilled	0.25	0.15	$5.75	$6.83	$21.97	$35
Mowing (2X)	Skilled	1.3	1	$29.90	$21.33		$51
Lime (1 in 3 years)	Skilled	0.1	0.1	$2.30	$5.02	$10.00	$17
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
Fertilization (3x)	Skilled	0.42	0.3		$8.76	$74.72	$83
Crop insurance						$109.00	$109
Pickup truck (30,000 miles for 150 ac/year)	n/a	n/a	n/a		$49.84		$50
Total Yearly Growing Costs of Mature Vineyard							**$1,471**

Table 10 summarizes the costs and returns expected from a mature vineyard. The estimated receipts per acre are $2,100 given the assumed sales price of $280 per ton and target yields of 7.5 tons per acre. Total variable costs equal $2,678 and total fixed costs equal $2,041 for a total cost per acre of $4,719. The break-even prices and yields are shown in Table 10. A breakeven target yield, assuming the sales price of $280 per ton stays constant, is 30.1 tons per acre. The breakeven target price per ton, assuming the target yield of 7.5 tons per acre stays constant, is $629 per ton.

If the model assumptions hold Concord grapes are shown to operate at an economic loss of $2,619 per acre per year. For an acre of Concord grapes to simply breakeven the target yields need to increase astronomically[2] or the sales price per ton of Concord grapes needs to more than double (2.25x). 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 $1,136. 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.

[2] This is specifically due to the increased costs of machine harvesting on a per ton basis. We estimate $150/ton for machinery harvesting which significantly increases variable costs at higher yields.

Table 8: Costs & Returns for a Mature Concord Vineyard, Lake Erie Region, NY, 2020

Item	$ Amount
Receipts:	
Yield **target**, tons per acre	7.5
Price, $ per ton	$280
Total receipts	*$2,100*
Costs:	
Variable Costs:	
Growing (incl. crop insurance @$109/Ac)	$1,471
Interest on operating capital	$24
Machine Harvesting ($150/ton)	$1,125
Trucking ($8/ton)	$60
Total variable costs	*$2,678*
Fixed Costs:	
Vineyard capital recovery	$1,136
Machinery and equipment capital recovery	$517
Buildings capital recovery	$27
Property taxes	$78
Land opportunity cost	$93
Office supplies, phone, etc.	$20
Insurance	$66
Management	$105
Total fixed costs	*$2,041*
Total costs	**$4,719**
Profit or loss	**-$2,619**
Breakeven price ($ /ton)	$629
Breakeven yield (tons)	29

Capital Requirements

Table 9 indicates the capital investment per planted acre necessary to get into grape production in the Erie region, assuming a vineyard of 150 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 $27,084 per

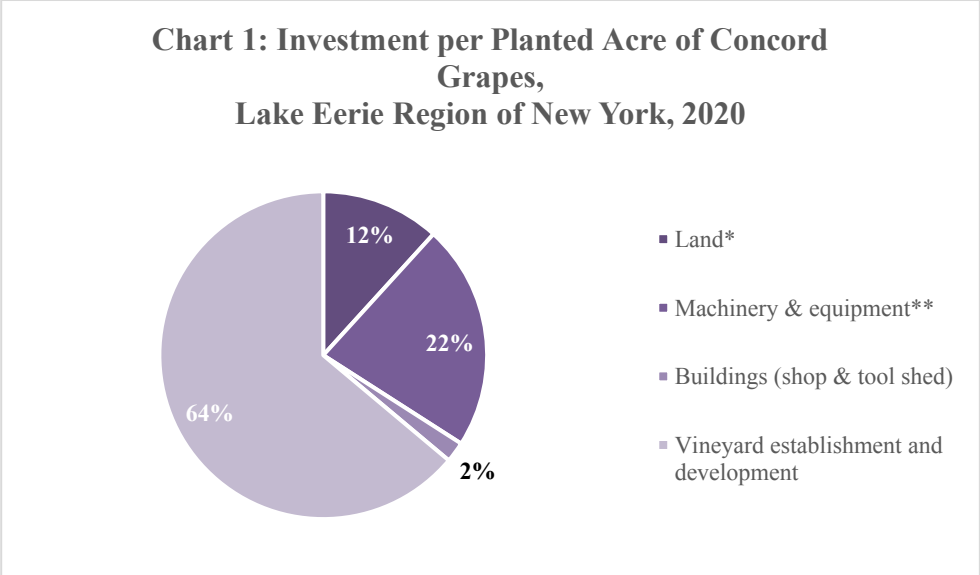
planted acre, for a total of $4,062,557.99 for the entire 150 acres of planted Concord vineyard, to get the vineyard into maturity in the Erie region under the assumptions indicated above. Established growers, with depreciated vineyards, machinery and equipment, and buildings, would have lower capital 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. It is possible 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 9: Investment Per Planted Acre of Concord Grapes, Lake Erie Region, NY, 2020

Assets	$/acre	Percentage
Land*	$3,183	11.8%
Machinery & equipment**	$6,045	22.3%
Buildings (shop & tool shed)	$550	2.0%
Vineyard establishment and development	$17,306	63.9%
Total Investment per acre	**$27,084**	**$4,062,557.99**

*Assume 154 acres purchased (including support land) for 150 planted acres
** Investment for E&D period is calculated by E&D costs in Table 5, excluding revenue, machinery, equipment and building depreciation



Sensitivity Analysis

Costs per ton of grapes and profits for Erie Concord 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.

Table 10 shows the sensitivity of the costs for producing different yields of Concord grapes. The cost per ton of Concord production varies drastically depending on potential yields. In a uniquely bad production year, for example is significant hail damage wipes out the majority of a crop, of only 1.5 tons per acre the cost per one ton of Concord production is $2,602. However, for years when the producer meets the target yield in this model of 7.5 tons per acre the cost per one ton of Concord production equals $647. This cost is still significantly higher than that of the modelled sales price per ton of Concord grapes, but it does represent an increasing returns to scale and demonstrates the importance of responsibly maximizing yields to decrease overall costs.

Table 10: Sensitivity of Cost Per Ton of Production of Concord Grapes, Lake Erie Region, NY, 2020

Blank	Yield (tons/acre)	Cost/ton*	Blank
	1.5	$2,514	
	2	$1,925	
	2.5	$1,572	
	3	$1,336	
	3.5	$1,168	
	4	$1,042	
	4.5	$943	
	5	$865	
	5.5	$801	
	6	$747	
	6.5	$702	
	7	$663	
	7.5	$629	
	8	$600	
	8.5	$574	
	9	$551	
	9.5	$530	
	10	$511	

It may not be feasible for producers to increase their Concord production significantly from year to year. It also may not be realistic to assume sales prices producers receive will either increase or decrease at the substantial levels needed to breakeven that were discussed above. Below is a sensitivity analysis table looking at what a potential increase or decrease of both prices and/or yields of +/- 10% and +/- 20% would do for the economic profit/loss of Concord production on a per acre basis. The table shows even if both the target yield and sales price per ton increase by 20% (bottom right cell) a producer should expect an economic loss of roughly $2,064 per acre.

Table 11: Profit/Loss Sensitivity Analysis of Concord Grapes, Lake Erie Region, NY, 2020

Sales $/Ton	6 tons/acre	6.75 tons/acre	7.5 tons/acre	8.25 tons/acre	9 tons/acre
$ 224	$ (3,138)	$ (3,089)	$ (3,039)	$ (2,990)	$ (2,940)
$ 252	$ (2,970)	$ (2,900)	$ (2,829)	$ (2,759)	$ (2,688)
$ 280	$ (2,802)	$ (2,711)	$ (2,619)	$ (2,528)	$ (2,436)
$ 308	$ (2,634)	$ (2,522)	$ (2,409)	$ (2,297)	$ (2,184)
$ 336	$ (2,466)	$ (2,333)	$ (2,199)	$ (2,066)	$ (1,932)

*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 12 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 $1,136 (Table 10) to $630 (Table 13). Even with this decrease in estimated capital recovery costs we see an economic loss of $2,020 per acre.

Table 12: Costs & returns for a Mature Concord Vineyard, Assuming Less Vineyard Capital Recover, Lake Erie Region, NY, 2020

Item	$ Amount
Receipts:	
Yield **target**, tons per acre	7.5
Price, $ per ton	$280
Total receipts	*$2,100*
Costs:	
Variable Costs:	
Growing (incl. crop insurance @$109/Ac)	$1,471
Interest on operating capital	$24
Machine Harvesting ($150/ton)	$1,125
Trucking ($8/ton)	$60
Total variable costs	*$2,678*
Fixed Costs:	
Vineyard capital recovery (MINUS VALUABLE LAND INPUTS)	$630
Machinery and equipment capital recovery	$517
Buildings capital recovery	$27
Property taxes	$78
Land opportunity cost	$0
Office supplies, phone, etc.	$20
Insurance	$66
Management	$105
Total fixed costs	*$1,442*
Total costs	$4,120
Profit or loss	-$2,020
Breakeven price ($ /ton)	$549
Breakeven yield (tons)	24.1

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 $695,482 after 20 years, and the equipment is estimated to have a salvage value of $22,086. Estimated cash flow shows a total loss after 20 years of operation of ($5,888,354). With current market conditions the vineyard's revenues do not make up the initial establishment costs even after selling all land and machinery upon 20 years of operations.

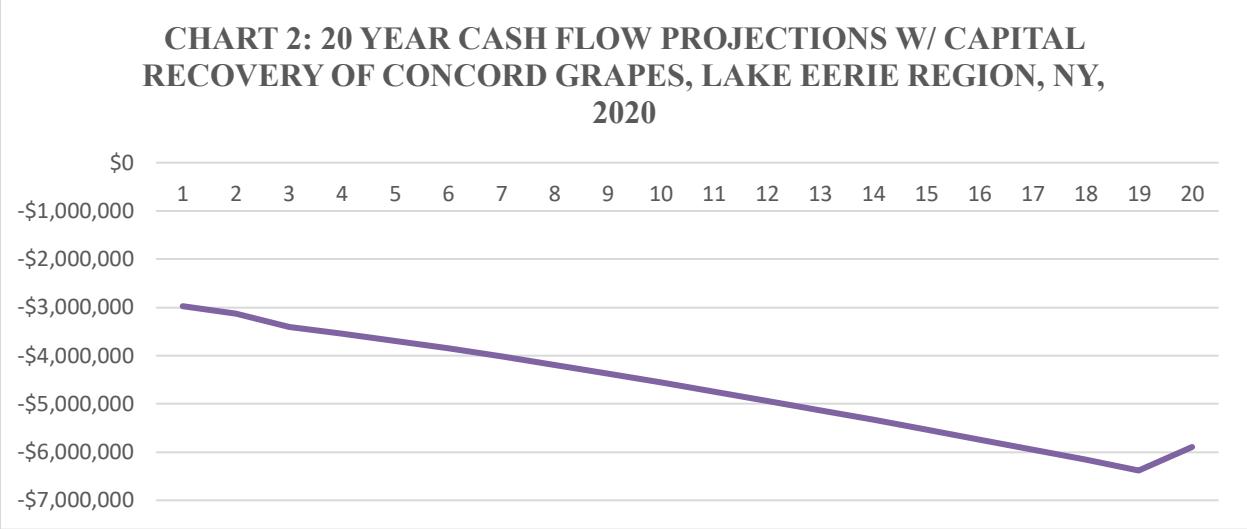
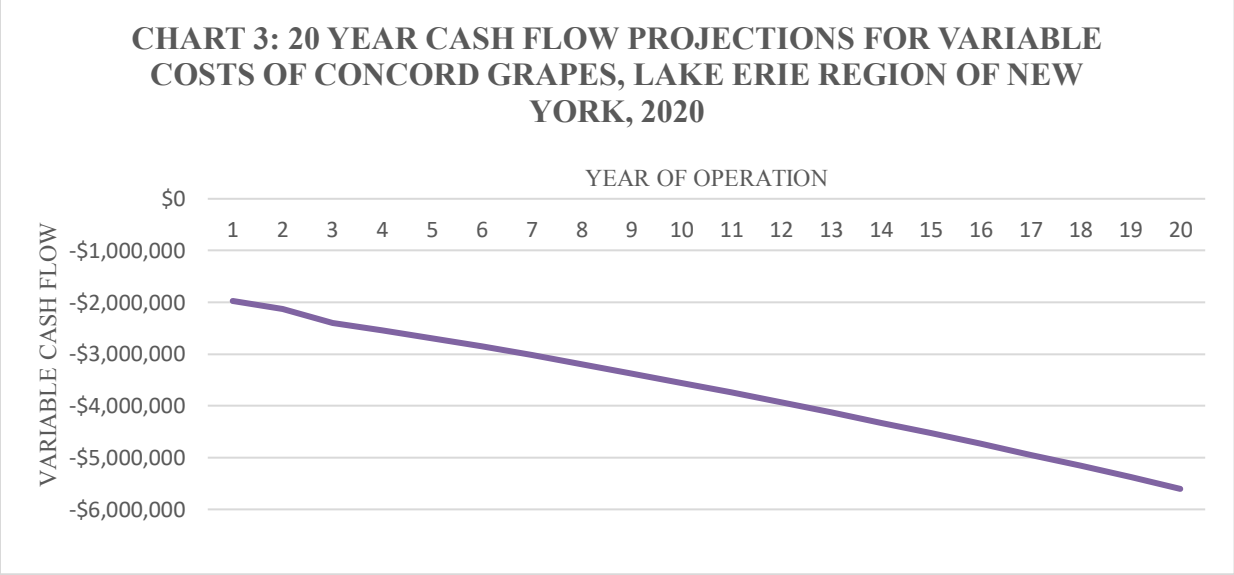


Chart 3 shows the projected cash flows for 20 years of operations in regards to variable costs. After 20 years of operations cash flows have yet to fully cover total variable costs of the establishment of the vineyard. This is mainly due to the significant upfront costs to establish the vineyard. At the end of 20 years cash flows shows a loss of ($5,604,302).



Concluding Comments

The cost and returns estimates derived in this publication indicate results for Concord grapes in the Lake Erie region 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 Lake Erie region can change. In some years, an oversupply of grape juice may depress Concord grape sales prices significantly, like in 2015/2016. However, since then overall production of Concord grape in the region has decrease roughly 10%. Furthermore, New York State government programs have been established to help strengthen the NYS Concord industry. The Lake Erie Concord Grape Belt is an established Concord producing region with roots dating back to the 1870's. This region is the largest Concord producing region in the Eastern United States and is a vital component of the regional economy.

Given the current estimates used in these models the economic viability of a Concord vineyard may seem less than ideal. The models show a Concord vineyard will continuously see economic losses year-over-year. It is important to note these models assume the vineyard owner needs to buy everything upon the start of the vineyard. In many cases vineyard owners may already own the land they use for grape production, or they may already own most of the equipment needed to establish a new vineyard. The information provided in this report is meant to act as a baseline for producers to compare their information to, and many producers may be able to incorporate management or investment practices which save significant amounts of money, thus, lowering overall production costs.

Labor, especially the potential of more reliance on "under the table" labor, is a concern. More growers may 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 Lake Erie region are harvested mechanically, the industry is not as vulnerable as the tree fruit or vegetable industries. Immigration reform would help ease growers' minds considerably, but meaningful reform is unsure at the time of writing this publication.

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 *V. Vinifera* Grapes in the Finger Lakes publications, and which has been used as a base model for this report. Mark is now viticulturist of the Pisoni Vineyards and Winery, Gonzales, California.

Appendix Table 1: Sample Herbicide for Cold Hardy Grapes, Chautauqua Region NY, 2019

Year	Spray #	Reason for Spray	Material	Rate/acre	Unit	Price	Per 1 Unit	$/acre
Year 0 Site Preparation	1	Custom Herbicide	Glyphosate	4	qt	$4.00	qt	$16.00
			Ammonia Sulfate	1.7	lbs.	$3.80	lb.	$6.46
						Total per spray		**$22.46**
Year 1	1	Chem. Weed control - Trellis	Surflan	1.5	qt	$18.02	qt	$27.03
	2	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**
Year 2 - 3	1	Chem. Weed control - Trellis	Prowl H20	6	qt	$12.00	qt	$71.97
	2	Spot herbicide treatment	Glyphosate	2	qt	$4.00	qt	$8.00
			Ammonia Sulfate	1.7	lbs.	$3.80	lb	$6.46
	3	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**
Year 4+	1	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
	2	Spot herbicide treatment	Glyphosate	2	qt.	$4.00	qt	$8.00
			Ammonia Sulfate	1.7	lbs.	$3.80	lb	$6.46
						Total per spray		**$41.69**

Table A2: Machinery, equipment, and building capital recovery and interest costs, Concord Grapes, Lake Erie Region, NY, 2020

Machinery and Equipment	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, 80-HP 4WD, Loader	$75,000	10	$7,500	$67,500	0.1172	$7,913	$225	$8,138
Tractor, 70-HP, 4WD	$55,000	10	$5,500	$49,500	0.1172	$5,803	$165	$5,968
Tractor, 60-HP, 4WD	$45,000	10	$4,500	$40,500	0.1172	$4,748	$135	$4,883
4 Row Sprayer	$85,000	10	$8,500	$76,500	0.1172	$8,968	$255	$9,223
Herbicide sprayer- 200 gallon twin-tank	$15,000	10	$1,500	$13,500	0.1172	$1,583	$45	$1,628
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 (large)	$18,000	10	$1,800	$16,200	0.1172	$1,899	$54	$1,953
Small disc	$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	$9,000	10	$900	$8,100	0.1172	$950	$27	$977
Vineyard Trailer	$4,500	10	$450	$4,050	0.1172	$475	$14	$488
Pickup truck (enw)	$45,000	10	$4,500	$40,500	0.1172	$4,748	$135	$4,883
Auger	$1,220	10	$122	$1,098	0.1172	$129	$4	$132
Mechanical hedger	$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 per 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 sheers ($2,500 x 3)	$7,500	5	$1,500	$6,000	0.2184	$1,310	$45	$1,355
Harvester	$420,000	22	$19,091	$400,909	0.0627	$25,156	$573	$25,729
Macrobin (X15)	$4,500	10	$450	$4,050	0.1172	$475	$14	$488
Total Machine & Equipment costs	$906,720		$48,158	$426,562				$79,616
Cost per planted acre	$6,045							$517
Buildings								
Shop (1,500 ft^2 @ $46 ft^2)	$82,500	30	$0	$82,500	0.0510	$4,209	$0	$4,209
Cost per planted acre	$550							$27.33

Table A3: Hourly Machinery and Equipment Variable Costs, Concord Grapes, Lake Erie Region, NY, 2020

Item	Purchase Price	Hours of life	Total Repairs	Repairs	Fuel	Lube (15% of fuel)	Total Hourly Variable Costs
Tractor, 80-HP 4WD, Loader	$ 75,000	7000	100%	$10.71	$8.12	$1.22	$20.05
Tractor, 70-HP, 4WD	$ 55,000	7000	100%	$7.86	$8.12	$1.22	$17.20
Tractor, 60-HP, 4WD	$ 45,000	7000	100%	$6.43	$8.12	$1.22	$15.77
4 Row Sprayer	$ 85,000	2000	60%	$25.50			$25.50
Herbicide sprayer- 200 gallon twin-tank	$ 15,000	2000	60%	$4.50			$4.50
Environmist 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 (large)	$ 18,000	1200	80%	$12.00			$12.00
Small disc (used)	$ 3,000	2000	60%	$0.90			$0.90
Grape hoe	$ 18,000	2000	60%	$5.40			$5.40
Post driver	$ 9,000	2000	80%	$3.60			$3.60
Trailer	$ 4,500	3000	80%	$1.20			$1.20
Pickup truck (new)	$ 45,000	2500	83%	$14.94	$5.78	$0.87	$21.59
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
Harvester	$ 420,000	7000	80%	48.00			$48.00
ATV	$ 12,000	1200	80%	$8.00			$8.00

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EB No	Title	Fee (if applicable)	Author(s)
2020-11	Cost of Establishment and Development of Concord Grapes in the Lake Erie Region of New York - 2020		Davis, T.J., Gómez, M.I., and Martin, K.
2020-10	Six Year Trend Analysis 2018, New York State Dairy Farms, Selected Financial and Production Factors		Karszes, J., and Skellie, J.
2020-09	NY FarmNet 2019 Program Evaluation		Parseghian, A., and Downes, K.
2020-08	Dairy Replacement Programs: Costs and Analysis Summer 2019		Karszes, J. and Hill, L.
2020-07	Dairy Farm Business Summary New York State 2018		Karszes, J, Hill, L, Christman, A, and Knoblauch, W.
2020-06	Sensitivity Analysis of Profits for V. Vinifera Grapes in the Finger Lakes Region of New York - 2019		Davis, T., and Gomez, M.
2020-05	Progress of the Dairy Farm Report Selected Financial and Production Factors Dairy Farm Business Summary New York State, 2019 153 Farms		Karszes, J., Hill, L., and Knoblauch, W.
2020-04	Business Tools for NYS Berry Growers		Williams, K., Kalaitzandonakes, M., Gómez, M.
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2020-02	Cost of Establishment and Production of Cold Hardy Grapes in the Chautaqua Region of New York - 2019		Davis, T., Gómez, M., Moss, R., Martin, K., and Walter-Peterson, H.
2020-01	Cost of Establishment and Production of V. Vinifera Grapes in the Finger Lakes Region of New York - 2019		Davis, T., Gómez, M., Moss, R., Walter-Peterson, H.
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