

MICHIGAN TART CHERRY COST OF PRODUCTION STUDY 2022

Cherry Marketing Institute & Michigan State University Extension

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Executive Summary

This cost of production study for Michigan tart cherries, conducted by specialists at Michigan State University (MSU) Extension and the Cherry Marketing Institute, is based on information gathered at a grower focus group meeting, numerous grower spray records, third-party data, and information provided from input and service suppliers. The majority of tarts are grown in Northwest Michigan. Based on the area's 7,733-pound yield average, costs related to the operation and harvest of bearing tart cherry acreage are currently 26.5 cents/lb, and costs related to orchard establishment and land control are an additional 12.6 cents/lb. Including tart cherry assessments of about 1.17 cents/lb, this leads to an overall cost of 40 cents/lb.

However, when applying the average Michigan yield of 7,043 pounds to our cost findings, operation and harvest costs add up to 28.8 cents/lb and orchard establishment and land control costs another 13.9 cents/lb, for a total of 44 cents/lb after assessments. To this calculation, we add the caveat that the growers involved in our study tend to have higher than average yields, and our total cost data may well be higher than the average farmer's as well.

Based on spray application records, we found that crop protection costs were similar to those from the previous cost of production study, despite increased pest pressure from spotted wing drosophila. However, we hypothesize that this could be a result of growers being conservative with sprays during 2020 and 2021 due to knowledge of low yields due to spring freeze events. Harvest costs have dropped slightly, due to faster equipment.



Input costs are generally higher across the board and supply chain disruptions are often making input availability difficult. While many crop protection input costs have not changed substantially, some important protectants are difficult to find, and herbicides are scarce and expensive. Steel, crop protectant, equipment, and fertilizer suppliers are currently reluctant to give price quotes because prices are volatile and subject to change. Labor costs, especially hourly manual labor, are also high.

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Introduction

Michigan is the dominant tart-cherry-producing state in the United States, boasting 75% of the nation’s tart cherry acreage (U.S. Department of Agriculture [USDA], 2022). Michigan’s three main producing regions (Northwest, West Central, and Southwest) are all on the west side of the state and benefit from their proximity to Lake Michigan. Tart cherries are perennial plantings that can last 28 years or more, with a substantial amount of the investment occurring in the early, nonbearing years. This makes the decision to plant a major financial commitment. With rising input costs and multiple challenges such as the fruit pest spotted wing drosophila, it is important to determine the current level of costs to assist growers in production, selling, and planting decisions.

This cost of production study for Michigan tart cherries was conducted over the winter and spring of 2022. To gather the information needed for the study, a focus group meeting took place with cherry growers and related industry support staff. Attendees included growers from each of the three Michigan regions; representatives of smaller, mid-sized, and larger operations; MSU Extension personnel; and a financial services and lending officer. The meeting focused on identifying new cost issues and updating numbers from the previous study, which was conducted in 2010 and partially updated in 2016.

Additionally, spray application records for crop protection and herbicides were gathered from growers to calculate detailed input costs. Updated price information was obtained from three equipment dealers, three chemical suppliers, and other support businesses. Yield numbers were calculated using data from the Cherry Marketing Institute, the Cherry Industry Administrative Board, and the USDA National Agricultural Statistics Service (NASS).

Note that at the time of this study, costs for agricultural input materials, labor, and services had risen dramatically from two years earlier. Much of this was due to supply chain issues related to the COVID-19 pandemic and the Russia-Ukraine war. The results of this study also need to be adjusted for individual farm situations. For example, land control costs might be higher or lower; growers might not choose to construct deer fencing, but instead use cheaper alternatives; some orchards might not need to be fumigated; and some orchards will get trickle irrigation. Equipment costs can vary based on ability to maintain used tractors, develop truck forklifts and sprayers, and maximize the utilization of the equipment.

Average Farm Characteristics

To determine the characteristics of a representative farm to use for our cost model, we looked to the consensus of our multiple stakeholder focus group. An average Michigan cherry farm will currently have about 300 acres total, with 150 acres in tart cherries, and the other half of the acreage in other fruit crops such as apples or sweet cherries. This results in the sharing of many pieces of equipment across crops. It is also assumed that the average farm has existing buildings and a shop to use for basic maintenance.

Three hundred acres is a substantial increase in the representative farm size from the previous cost of production study (200 acres, 50% tart cherries), likely reflecting farm consolidation and some degree of technological advancement.

Labor

Labor costs have risen substantially since the last study, especially for hourly manual labor. The H-2A temporary agricultural program has become much more frequently used to ensure a consistent work force. It requires growers or contractors to provide housing, but due to a COVID-19-related spike in domestic wages, H-2A and manual domestic wages are fairly equivalent.

Farms typically fall in one of three categories: small farms using mostly family labor, mid-sized farms having a mix of family and employee workers, or larger operations staffed mostly by full-time workers with benefits. However, the wage levels required by manager-level employees and farm owners are not substantially different once benefits are taken into account. Table 1, which follows, illustrates the average labor costs across Michigan’s regions.

Table 1. Labor Categories & Rates

Skill Level	Salaries \$/hour	Benefits %	Total \$/hour
Owner & manager/supervisor	\$30.00	45%	\$43.50
Skilled, year-round	\$25.00	30%	\$32.50
Manual, hourly	\$22.00	0%	\$22.00



Equipment

The type of equipment used in production has largely remained the same. Tractors needed are similar in size, though available options tend to be a few more horsepower (65 versus 60HP, 90 versus 85HP). The air-blast type sprayer was determined as the usual for most cases, though some operations use truck sprayers for crop protection. However, more growers now use truck-type weed sprayers, and cherry shakers are both faster and more expensive.

Due to the high price and low availability of steel and other supply chain issues, the availability of new equipment is spottier, and the cost is higher. In fact, prices were rising so fast during the study period that many dealers were not able to make quotes, with each piece having “call for availability” status from the manufacturer. Some manufacturers were putting substantial surcharges on equipment en route to dealers.

Equipment costs can vary substantially by farm. Buying used equipment, keeping equipment functioning for longer periods using rigorous maintenance, and spreading use and costs over more acres or crops can save on equipment costs. Some farms have facilities and skilled staff able to fabricate machinery and can gain some efficiencies by creating forklifts and sprayers out of trucks. However, these gains may be offset to some degree by the expense of specialized shop equipment and highly skilled labor needed to build the equipment.

Table 2, which follows, provides details on equipment types currently used for production. The interest rate used for equipment purchase loans is 4.5%. The appendix includes more detailed information including salvage values, maintenance, and hourly cost computations. Costs are based on current quotes from dealers, information from the American Society of Agricultural Engineers contained in the previous study, and formulas developed by William Lazarus, PhD, at the University of Minnesota.¹

¹See the University of Minnesota webpage, which has links to the current estimates, at <http://z.umn.edu/machdata>.

Table 2. Equipment Used in Tart Cherry Production

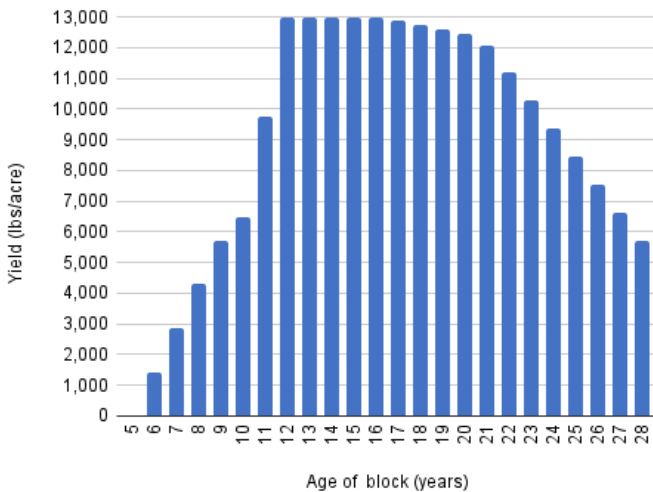
Equipment type	Purchase price
90 HP 4WD tractor w/cab	\$ 61,000
90 HP 4WD tractor w/forklift, cab	\$ 70,000
65 HP 2WD tractor w/forklift #1 (or forklift truck)	\$ 38,000
65 HP 2WD used tractor #2 (or forklift truck)	\$ 9,742
Shaker (100% allocation to tarts)	\$275,000
Orchard sprayer #1 pull type (or truck type)	\$ 47,000
Orchard sprayer #2 pull type (or truck type)	\$ 47,000
Weed sprayer - truck	\$ 40,000
Rotary mower (100% allocation to tarts)	\$ 18,000
Flail chopper	\$ 15,000
Pull-type spreader	\$ 25,000
Tractor mount hedger	\$ 22,000
Flatbed shuttle truck, used	\$ 15,000
Tanks, 50 (used \$340 each)	\$ 17,000



Establishment Years & Land Control Costs

Establishment costs include land clearing, fumigation, tree planting, mulching, mice control, early-year crop protection, and land control. These costs occur early on during the first six years out of a 28-year life cycle, during which time there is no marketable yield for income (see Figure 1). As such, these costs are amortized and spread over the productive life of the trees (23 years). The following interest rates were used: 5.5% for operating and 6.5% for land and establishment 20-year loans. Tree costs are currently around \$12 per tree, and an average of 125 trees per acre were used. The appendix contains details on establishment costs in tables 8 through 11.

Figure 1: Orchard life cycle yield assessment.



We have included deer fencing in our calculations per the focus group consensus that if deer fencing is not used, savings are offset by other costs (for example, tree replacement and deer repellent bags). Many growers are using deer fencing for new plantings.

However, we did not include drip irrigation as a usual cost. While some tart cherry blocks have irrigation, it is often used where water systems already exist. Adding irrigation would add at least \$500 per acre, for a yearly cost during the production years of \$52 per acre.

LAND CONTROL

Land control costs are highly variable, and there are multiple methods of calculating it. Due in no small part to housing pressure and tourism, land values in some regions are higher than what agricultural use will support on its own. Therefore, we consider land values using the prevailing prices that growers would reasonably be willing to pay, as determined by our grower sample:

- Northwest: \$6,500/acre
- West Central: \$5,500/acre
- Southwest: \$7,500/acre

For our calculations, we used the (non-weighted) average of \$6,500 per acre. Beyond such a price, other investment goals may exist in addition to agricultural use goals.

In calculating costs, we considered the total cost of an amortized, 20-year land loan at 6.5% interest, and divided over the 23 bearing years. We then subtract out annual estimated land appreciation at 3.5%. Table 3, which follows, illustrates our calculation.

Table 3. Land Control Calculation Based on Land Purchase

Initial cost/acre	\$6,500
Interest on amortized, 20-year loan at 6.5%	\$5,131
Total loan amount/acre	\$11,631
Total land + interest, divided over 23 bearing years	\$506
3.5% appreciation on land value per year	\$(228)
TOTAL /acre/year	\$278

Another method of calculation for land control cost is to consider the fair market arm's length rate of a long-term rental. Information on this is scant, but from our available example, the rate would be about \$325 per year average. This number is feasible for landowners wanting to keep land in agriculture but hold on to it for the long term (where the alternatives are \$25 to \$100 per acre for hay or corn). However, a rate much higher than \$325 gets a farmer fairly close to the cost of just purchasing land outright (if it is available). This \$325 rental rate is relatively close to our land control calculation in Table 3, giving us higher confidence in our formula (purchase price + loan interest - appreciation).



Production & Harvesting

As previously mentioned, many production-related costs have risen significantly, including for inputs such as fuel, fertilizer, labor, and herbicides. Operating loan interest rates have risen to 5.5%. However, with little exception, the time and cultural methods have not changed; pruning times, labor times, and tractor and equipment use times are largely the same across time.

FOOD SAFETY

Food safety and worker protection costs have risen due to a grower focus on preventative safety and documentation of compliance. Costs relate to employee training in farm and food safety, paperwork time, implementation time and materials, and certification costs.

CROP PROTECTION

Crop protection has been challenging due to the SWD pest, and as a result, the average number of acres coverable by one tractor/sprayer combination has dropped to 75 from 100. However, based on 15 sets of spray records, spray program costs have not raised substantially overall. We hypothesize that farmers may have responded to low crop levels due to spring freeze events in 2020 and 2021 (the years for which we gathered spray records) by cutting costs, using less expensive options where possible. This could help explain the stagnation in crop protection input costs despite increased pest pressure from SWD over the last decade.

While herbicide costs are up, crop protection input costs are largely similar to those in 2016. That said, some chemicals are scarce due to supply chain disruptions and high demand, and prices are not stable. Information on volume discounts was not readily available, and currently, most companies will only provide discounts on a case-by-case basis, if at all.

Our calculations, based on grower spray records, indicate an equivalent of nine full sprays on average per year (not including foliar nutrient sprays), with some of these being half side sprays. Overall spray time totals are consistent with those determined by the previous cost of production study. Note that regional differences in SWD management are potentially counterbalanced by postharvest disease (leaf spot) needs. This could help explain the similarity in the total number of spray trips needed across regions. For example, relative to Northwest Michigan, Southwest Michigan growers might avoid several SWD sprays due to harvesting earlier in the year, but they will likely have an increased number of postharvest fungicide applications.

HARVEST

Harvest costs have dropped slightly from 2010. Harvesting is faster than a decade ago, and a cherry shaker, while more expensive to purchase, can cover 150 acres a year versus 100 from previous study estimates. However, as a result, we found that a third tractor/forklift and driver for hauling is needed about half of the time. Due to lack of proximity to cooling pads, we also found that a shuttle truck/flatbed and driver is needed about half of the time.

Table 4, on the next page, details average operation and harvest costs for bearing years (years 7 through 28). Totals including land and establishment costs appear at the bottom of the table. Find information on variations in harvest costs based on yield in the appendix (Table 13).





Table 4. Operating & Harvest Costs, & Cost Totals for Tart Cherry Production in 2022

Operating and Harvest Costs, and Cost Totals for Tart Cherry Production in 2022									
Operation	Time	Labor	Materials	Equipment		Subtotal		TOTAL	
	Hrs/A	Cash (variable) \$/hour	Cash (variable) \$/Acre	Cash (variable) \$/Hour	Non-cash (fixed) \$/Hour	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre
Pruning, Tipping, and Brush Disposal								\$191	\$18
• Pruning-Chain Saw	5.7	\$22.00		\$0.30		\$127.11	\$0.00		
• 90 HP Tractor for Brush Disposal	0.6	\$32.50		\$21.85	\$7.12	\$32.61	\$4.27		
• Flail Chopper	0.6			\$4.27	\$7.29	\$2.56	\$4.38		
• 90 HP Tractor for Summer Tipping	0.5	\$32.50		\$21.85	\$8.62	\$27.18	\$4.31		
• Hedger for Summer Tipping	0.5			\$3.50	\$10.96	\$1.75	\$5.48		
Mowing								\$12	\$2
• 65 HP Tractor	0.3	\$22.00		\$14.49	\$4.73	\$10.95	\$1.42		
• Rotary Mower	0.3			\$3.54	\$2.99	\$1.06	\$0.90		
Crop Protection								\$385	\$22
• 90 HP Tractor	0.90			\$21.85	\$8.62	\$19.67	\$7.76		
• Orchard Sprayer	0.90			\$9.40	\$16.37	\$8.46	\$14.74		
• Total Insecticide, fungicide, growth regulator			\$308.54			\$308.54	\$0.00		
			\$0.00			\$0.00	\$0.00		
			\$0.00			\$0.00	\$0.00		
• Total Spray Labor	1.50	\$32.50				\$48.75	\$0.00		
Borer Control¹								\$0	\$0
• 90 HP Tractor	0			\$0.00	\$0.00	\$0.00	\$0.00		
• Orchard Sprayer	0			\$0.00	\$0.00	\$0.00	\$0.00		
• Labor	0		\$0.00			\$0.00	\$0.00		
Herbicide								\$61	\$8
						\$0.00	\$0.00		
• Weed Sprayer - Truck Type	0.2			\$48.72	\$41.52	\$9.74	\$8.30		
• Total Herbicide			\$41.05			\$41.05	\$0.00		
• Total labor	0.3	\$32.50				\$9.75	\$0.00		
Fertilizer								\$175	\$7
• 65 HP Used Tractor for Nitrogen App	0.3	\$32.50		\$22.20	\$4.24	\$16.41	\$1.27		
• Spreader - Pull Type	0.3			\$3.00	\$15.79	\$0.90	\$4.74		
• 65 HP Used Tractor for Potassium App	0.05	\$32.50		\$22.20	\$4.24	\$2.74	\$0.21		
• Spreader - Pull Type	0.05			\$3.00	\$15.79	\$0.15	\$0.79		
• Fertilizer			\$145.70			\$145.70	\$0.00		
• Lime (2 Ton/Acre @ Each 5th Year)			\$9.40			\$9.40	\$0.00		
Bee Rental (1 Hive/ Acre)			\$65.00			\$65.00	\$0.00	\$65	
Pest Management Service			\$27.50			\$27.50	\$0.00	\$28	
Crop Insurance			\$105.00			\$105.00	\$0.00	\$105	
Food Safety Compliance²			\$30.00			\$30.00	\$0.00	\$30	
Pickup (40 miles/A @ \$0.585/mile)				\$23.40	\$0.00	\$23.40	\$0.00	\$23	\$0
TOTAL OPERATING COSTS						\$1,075.38	\$58.56	\$1,075	\$59
Harvest									
• Double Incline Shaker ³	1.2	\$54.50		\$40.34	\$91.34	\$113.81	\$109.60		
• 90 HP Tractor/Forklift	0.6	\$22.00		\$21.85	\$8.62	\$26.31	\$5.17		
• 65 HP New Tractor/Forklift	1.2	\$22.00		\$14.49	\$4.73				
• 65 HP Used Tractor/Forklift	1.2	\$22.00		\$22.20	\$4.24	\$53.04	\$5.09		
• Shuttle Truck	0.6	\$22.00		\$45.72	\$8.75				
• Skimmer (or Miscellaneous Labor)	1.2	\$22.00				\$26.40	\$0.00		
• Shipping (\$0.016 cent/pound*Ave yield ⁴)						\$123.73	\$0.00		



Operating and Harvest Costs, and Cost Totals for Tart Cherry Production in 2022

Operation	Time	Labor	Materials	Equipment		Subtotal		TOTAL	
	Hrs/A	Cash (variable) \$/hour	Cash (variable) \$/Acre	Cash (variable) \$/Hour	Non-cash (fixed) \$/Hour	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre
• Cooling Pad Operation (\$0.007/lb*Ave Yield ⁴)						\$54.13	\$0.00		
• Tanks (50)	2			\$1.70	\$4.02	\$3.40	\$8.04		
TOTAL HARVEST COSTS								\$401	\$128
Management and Labor Supervision	6.9	\$43.50				\$300.15	\$0.00	\$300	
Interest on operating capital @ 5.5%						\$43.10		\$43	
Property Taxes						\$40.00		\$40	
TOTAL OPERATING AND HARVEST COSTS								\$1,859	\$186
Establishment & Land Cost								\$976	\$0
Establishment Cost - Amortized Annual Operating Expense Years 6-28						\$698.27			
Annual Land Control Cost Expensed Over Bearing Years (6-28) ⁵						\$278.20			
TOTAL ESTABLISHMENT and LAND COST								\$976	\$0
TOTAL CASH (variable) and NON-CASH (fixed/depreciated) COSTS								\$2,836	\$186
GRAND TOTAL PRODUCTION CASH COST PER ACRE								\$3,022	

1 Due to chlorpyrifos being taken off of the market, growers do not have a borer control for the foreseeable future.

2 Food Safety Compliance includes worker protection/safety training, inspection costs, compliance costs, and rental of porta-potty and handwashing unit.

3 Assume shaker requires 1 Skilled, Year-round worker PLUS 1 Hourly worker.

4 Annual saleable yield can be adjusted to account for tart cherry yield-price correlation.

5 Could be a cash expense if ground is rented or mortgaged. If land is owned with no mortgage, this expense is a non-cash cost.

Yield & Cost per Pound Calculations

Yield numbers were calculated for Michigan and its three cherry-growing regions using Cherry Marketing Institute, Cherry Industry Administrative Board, and USDA NASS data. NASS rotational surveys were used to determine bearing acreage and calculate final yield per acre numbers for the different regions, which can be found in the appendix (Table 12).

Note that for this time period, determination of a reliable yield average is challenging, due in part to several unusually light crops resulting from freeze events. To mitigate these, yield was calculated by averaging the crop levels from 2011 until the present, but dropping 2012, 2020, and 2021 from the calculation. The justification for not including these years is that current tart cherry crop insurance will engage for crop loss levels that high. The consensus of growers in our focus group was to include crop insurance as a regular cost, and so adjustment in this manner is reasonable.

We also gathered yield data from the past five years from a number of growers. We can't broadly generalize from this data due to a lower level of responses, but the data we did receive indicate that growers in our sample have higher than average yields (except for freezeout years). Consequently, we are wary of applying our grower sample's production cost numbers to state and regional average yield

numbers. Growers across the state that have lower or average yields may also have lower overall costs, for example, through application of lower amounts of inputs and cultural activities such as pruning.

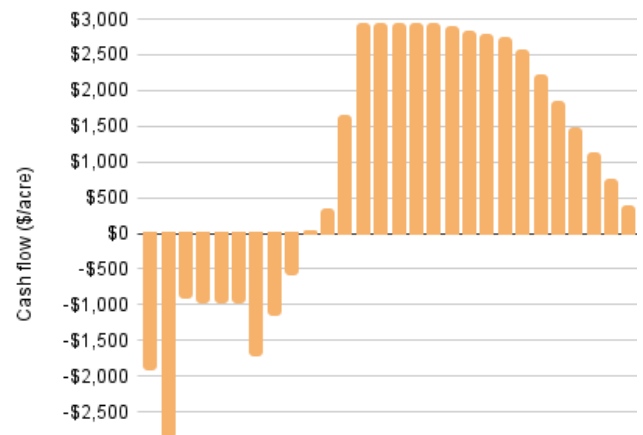


Figure 2: Annual net cash flow.

Figure 2 depicts the annual cash flow over an average block's life cycle, based on annual expected yields (as previously depicted in Figure 1). Table 5, on the next page, illustrates the overall cost per pound when dividing our cost findings over different levels of yield.

Table 5. Cost/lb at Varying Yield Levels. ²

Cost/lb at Varying Yield Levels								
	Yield (lb.)	Total Operating and Harvest Costs	Operating/Harvest Cost/lb.	Establishment Cost (\$698 per acre) per lb.	Land Cost (\$278 per acre) per lb.	Total Costs	Total Production Cost/lb.	Total costs/lb. including assessments of \$0.01165/lb
West Central Average	5,466	\$1,994	\$0.36	\$0.13	\$0.05	\$2,970	\$0.54	\$0.56
	6,000	\$2,006	\$0.33	\$0.12	\$0.05	\$2,983	\$0.50	\$0.51
	7,000	\$2,029	\$0.29	\$0.10	\$0.04	\$3,006	\$0.43	\$0.44
Michigan Average	7,043	\$2,030	\$0.29	\$0.10	\$0.04	\$3,007	\$0.43	\$0.44
Northwest Average	7,733	\$2,046	\$0.26	\$0.09	\$0.04	\$3,023	\$0.39	\$0.40
	8,000	\$2,052	\$0.26	\$0.09	\$0.03	\$3,029	\$0.38	\$0.39
Southwest Average	8,099	\$2,054	\$0.25	\$0.09	\$0.03	\$3,031	\$0.37	\$0.39
	9,000	\$2,075	\$0.23	\$0.08	\$0.03	\$3,052	\$0.34	\$0.35
	10,000	\$2,098	\$0.21	\$0.07	\$0.03	\$3,075	\$0.31	\$0.32
	12,000	\$2,179	\$0.18	\$0.06	\$0.02	\$3,156	\$0.26	\$0.27
	14,000	\$2,225	\$0.16	\$0.05	\$0.02	\$3,202	\$0.23	\$0.24

Tart Cherry Assessments

Michigan Cherry Committee (MCC) assessments were figured at 0.5 cents/lb for pitted and 0.25 cents/lb for juice. These were averaged based on 2021 percentages of pitted (96%) and juice (4%) to yield an average MCC assessment of 0.49 cents/lb. Cherry Industry Administrative Board assessments were 0.575 cents/lb, and Michigan Tree Fruit Commission assessments were 0.1 cent/lb. The total average assessment was calculated to be 1.165 cents/lb.

Summary

This study of Michigan tart cherry production costs establishes an average cost of 44 cents per pound using Michigan average yields. However, our sample of growers has higher yields and possibly higher costs than average. For growers that achieve the Northwest Michigan average yield of about 7,737 pounds per acre, cost per pound for bearing years' operating and harvest activities would be 26.5 cents, and for establishment years and land control costs is an additional 12.6 cents. When tart cherry assessments of 1.165 cents are added, the total overall cost is 40 cents per pound.

ADJUSTMENTS

The numbers used to calculate these costs need to be adjusted for the individual farm based on its specific areas of cost savings, grower efficiencies, and any additional costs not included in our assumptions.

For example, if land control is not an actual cost for a grower because their farm is debt free, this would equate to a 3.6 cents per pound cost savings at a 7,733 pound yield. Also, if a grower does not need to use bank loans and instead can use cash for establishment period costs, a similar level of savings results. Both items reflect the cost of capital.

On the other hand, the addition of drip irrigation would raise costs about 2/3 of a cent to a full cent per pound, depending on the proximity of a well. Additional mulch applications in the early years would also raise costs.

Adjustments for not fumigating or not building deer fencing are a bit more complicated. This is because these items provide other cost savings, for example, on tree replacement and deer repellent tools. Deer fencing can also lower management time. Therefore, it is prudent to also account for some of these (new) costs not included in the tables initially due to the assumption that the average grower will construct deer fencing.

Reference

U.S. Department of Agriculture, National Agricultural Statistics Service. (2022, May 5). *Michigan fruit production 2021* (NR-22-27). https://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/Current_News_Release/2022/nr2227mi.pdf

² The Operating and Harvest Cost column uses calculations from both Table 4 (shown previously) and Table 13 in the appendix. See Table 12 in the appendix for the average yield calculations for the regions and the state.



Appendix

EQUIPMENT COSTS

Table 6. Annual Equipment Costs

Annual Equipment Costs										
Description	Year	Purchase Price	Yrs Life	Salvage Value	Salvage Value in Today's Dollars	Interest Rate	Annual Machinery Cost	Insurance	Taxes	Total Annual Cost
90 HP 4WD Tractor w/Forklift, Cab	2022	\$70,000	12.0	\$10,500	\$6,191	4.5%	\$6,998	\$175	\$0	\$7,173
90 HP 4WD Tractor w/Cab	2022	\$61,000	10.0	\$9,150	\$5,892	4.5%	\$6,964	\$153	\$0	\$7,117
65 HP 2WD Tractor	2022	\$38,000	12.5	\$5,700	\$3,288	4.5%	\$3,691	\$95	\$0	\$3,786
65 HP 2WD Used Tractor	2022	\$9,742	6.0	\$1,461	\$1,122	4.5%	\$1,671	\$24	\$0	\$1,696
Shaker	2022	\$275,000	12.5	\$41,250	\$23,794	4.5%	\$26,713	\$688	\$0	\$27,401
Orchard Sprayer Airblast	2022	\$47,000	12.5	\$7,050	\$4,067	4.5%	\$4,566	\$118	\$0	\$4,683
Orchard Sprayer Airblast	2022	\$47,000	12.5	\$7,050	\$4,067	4.5%	\$4,566	\$118	\$0	\$4,683
Weed Sprayer Truck type	2022	\$40,000	12.5	\$6,000	\$3,461	4.5%	\$3,886	\$100	\$0	\$3,986
Rotary Mower	2022	\$18,000	12.5	\$2,700	\$1,557	4.5%	\$1,748	\$45	\$0	\$1,793
Flail Chopper	2022	\$15,000	10.0	\$2,250	\$1,449	4.5%	\$1,713	\$38	\$0	\$1,750
Spreader - Pull Type	2022	\$25,000	15.0	\$3,750	\$1,938	4.5%	\$2,147	\$63	\$0	\$2,210
Tractor Mount Hedger	2022	\$22,000	12.5	\$3,300	\$1,904	4.5%	\$2,137	\$55	\$0	\$2,192
Flatbed Shuttle Truck, Used	2022	\$15,000	10.0	\$2,250	\$1,449	4.5%	\$1,713	\$38	\$0	\$1,750
Tanks, 50	2022	\$17,000	22.0	\$2,550	\$968	4.5%	\$1,163	\$43	\$0	\$1,206

Table 7. Hourly Equipment Costs

Hourly Equipment Costs							Operating Costs		Total	Total
Description	Year	Total Hours Used ¹	Hours for Tart Cherries	Capital Recovery Cost ²	Insurance	Taxes	Repairs ³	Fuel & Lube ⁴	Operating Cost/Hr	Cost / Hr
90 HP 4WD Tractor w/Forklift,Cab	2022	832	416	\$8.41	\$0.21	\$0	\$4.43	\$17.42	\$21.85	\$30.47
90 HP 4WD Tractor w/Cab	2022	1,000	500	\$6.96	\$0.15	\$0	\$4.43	\$17.42	\$21.85	\$28.97
65 HP 2WD Tractor	2022	800	400	\$4.61	\$0.12	\$0	\$1.91	\$12.58	\$14.49	\$19.23
65 HP 2WD Used Tractor	2022	400	200	\$4.18	\$0.06	\$0	\$9.62	\$12.58	\$22.20	\$26.44
Shaker (150 HP)	2022	300	300	\$89.04	\$2.29	\$0	\$11.30	\$29.04	\$40.34	\$131.68
Orchard Sprayer Airblast	2022	286	286	\$15.96	\$0.41	\$0	\$9.40	\$0	\$9.40	\$25.78
Orchard Sprayer Airblast	2022	286	286	\$15.96	\$0.41	\$0	\$9.40	\$0	\$9.40	\$25.78
Weed Sprayer Truck Type	2022	96	48	\$40.47	\$1.04	\$0	\$10.00	\$38.72	\$48.72	\$90.24
Rotary Mower	2022	600	300	\$2.91	\$0.08	\$0	\$3.54	\$0	\$3.54	\$6.53
Flail Chopper	2022	240	120	\$7.14	\$0.16	\$0	\$4.27	\$0	\$4.27	\$11.56
Spreader - Pull Type	2022	140	70	\$15.34	\$0.45	\$0	\$3.00	\$0	\$3.00	\$18.79
Tractor Mount Hedger	2022	200	100	\$10.69	\$0.28	\$0	\$3.50	\$0	\$3.50	\$14.46
Flatbed Shuttle Truck, Used	2022	200	100	\$8.56	\$0.19	\$0	\$7.00	\$38.72	\$45.72	\$54.47
Tanks, 50	2022	300	300	\$3.88	\$0.14	\$0	\$1.70	\$0	\$1.70	\$5.72

1 Assumes that other half of the farm uses the equipment equally, except for the shaker, of which 100% is allocated to cherries and the Orchard Sprayers, which are used exclusively for tart cherries because of the increased number and timing sensitivity of spray applications.

2 Annual Machinery Cost from table above divided by Total Hours Used; this is the fixed/depreciable cost of equipment per hour.

3 See formulas from ASAE, tractor functions rescaled to 6000 hours. Except 65HP 2WD new tractor- Minnesota study number is used (2021).

4 Assumes diesel cost of \$4.00/gallon.



Table 8. Pre-Planting Costs

	Time	Labor	Materials	Equipment		Subtotal		TOTAL		Grand Total
	Hrs/A	Cash (variable) \$/hour	Cash (variable) \$/Acre	Cash (variable) \$/Hour	Non-cash (fixed) \$/Hour	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	
Pre-Planting Costs								\$1,509	\$43.70	\$1,553
Land Clearing (\$563 per acre for custom removal and burning)						\$563.00				
Ground Prep (rock picking and removal)	10.00	\$22.00				\$220.00				
90 HP tractor	2.00	\$32.50		\$21.85	\$7.12	\$108.71	\$14.23			
Disc and Drag (90 HP Tractor only)	1.00	\$32.50		\$21.85	\$7.12	\$54.35	\$7.12			
Fumigation of tree rows (\$308 materials and custom application)						\$308.00				
Herbicide treatment (twice normal rate/time to cover all acreage)	0.50	\$32.50	\$82.10			\$98.35				
Weed Sprayer- truck type	0.40			\$48.72	\$41.52	\$19.49	\$16.61			
Subsoil tillage	0.20	\$32.50				\$6.50				
	0.20			\$21.85	\$7.12	\$4.37	\$1.42			
Cover Crop Establishment (\$25.00 material cost for seed)										
90 HP tractor	0.30	\$32.50	\$25.00	\$21.85	\$7.12	\$41.31	\$2.14			
Spreader- Pull Type	0.30			\$4.27	\$7.29	\$1.28	\$2.19			
Real Estate Tax			\$40.00			\$40.00				
Management	1.00	\$43.50				\$43.50				



Table 9. Year 1 (Planting) Costs

	Time	Labor	Materials	Equipment		Subtotal		TOTAL		Grand Total
	Hrs/A	Cash (variable) \$/hour	Cash (variable) \$/Acre	Cash (variable) \$/Hour	Non-cash (fixed) \$/Hour	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	
Year 1 (Planting) Costs								\$2,710.82	\$25.56	\$2,736
Trees (125 per acre, \$12 per tree)			\$1,500.00			\$1,500.00				
Planting (5 man crew planting 2 acre per hour)	0.5	\$120.50				\$60.25				
90 HP Tractor	0.5			\$21.85	\$7.12	\$10.93	\$3.56			
Planter	0.5					\$0.00	\$0.00			
Mulching (\$3.00/bale, 28 bales/acre)	1.50	\$22.00	\$84.00			\$117.00				
Tree guards (\$.27 average cost x 125 trees per acre)			\$33.75			\$33.75				
Mouse Bait (\$0.50 per tree)	0.5	\$32.50	\$62.50			\$78.75				
65 HP Tractor	0.5			\$14.49	\$4.73	\$7.25	\$2.37			
Spreader-Pull Type	0.5			\$3.00	\$15.79	\$1.50	\$7.89			
Crop Protection	0.8	\$32.50	\$180.27			\$206.27				
90 HP Tractor	0.5			\$21.85	\$7.12	\$10.93	\$3.56			
Orchard Sprayer	0.5			\$9.40	\$16.37	\$4.70	\$8.19			
Pruning	1	\$22.00				\$22.00				
Real Estate Tax			\$40.00			\$40.00				
Management	1	\$43.50				\$43.50				
Deer Fencing (1 acre)						\$574.00				

Table 10. Year 2 Costs

	Time	Labor	Materials	Equipment		Subtotal		TOTAL		Grand Total
	Hrs/A	Cash (variable) \$/hour	Cash (variable) \$/Acre	Cash (variable) \$/Hour	Non-cash (fixed) \$/Hour	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	
Year 2 Costs								\$632.81	\$27.97	\$661
Tree Replacement (4 trees per acre, \$12 per tree)	0.2	\$22.00	\$48.00			\$52.40				
Mouse Bait (\$0.50 per tree)	0.5	\$32.50	\$62.50			\$78.75				
Pruning	1	\$22.00				\$22.00				
Fertilizer										
65 HP Tractor	0.3	\$32.50	\$72.85	\$14.49	\$4.73	\$86.95	\$1.42			
Spreader-Pull Type	0.3			\$3.00	\$15.79	\$0.90	\$4.74			
Mowing (3 times per year, 1 hour total)										
65 HP Tractor	1	\$32.50		\$14.49	\$4.73	\$46.99	\$4.73			
Rotary Mower	1			\$3.54	\$2.99	\$3.54	\$2.99			
Crop Protection	1	\$32.50	206.53			\$239.03				
90 HP Tractor	0.6			\$21.85	\$7.12	\$13.11	\$4.27			
Orchard Sprayer	0.6			\$9.40	\$16.37	\$5.64	\$9.82			
Real Estate Tax			\$40.00			\$40.00				
Management	1	\$43.50				\$43.50				

Table 11. Cost Per Year for Years 3, 4, and 5

	Time	Labor	Materials	Equipment		Subtotal		TOTAL		Grand Total
	Hrs/A	Cash (variable) \$/hour	Cash (variable) \$/Acre	Cash (variable) \$/Hour	Non-cash (fixed) \$/Hour	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	Cash (variable) \$/Acre	Non-cash (fixed) \$/Acre	
Cost per Year for Years 3, 4, and 5								\$697.26	\$27.97	\$725
Mouse Bait (\$0.50 per tree)	0.5	\$32.50	\$62.50			\$78.75				
Pruning	3	\$22.00				\$66.00				
Fertilizer										
65 HP Tractor	0.3	\$32.50	\$145.70	\$14.49	\$4.73	\$159.80	\$1.42			
Spreader-Pull Type	0.3			\$3.00	\$15.79	\$0.90	\$4.74			
Mowing (3 times per year, 1 hour total)										
65 HP Tractor	1	\$32.50		\$14.49	\$4.73	\$46.99	\$4.73			
Rotary Mower	1			\$3.54	\$2.99	\$3.54	\$2.99			
Crop Protection	1	\$32.50	206.53			\$239.03				
90 HP Tractor	0.6			\$21.85	\$7.12	\$13.11	\$4.27			
Orchard Sprayer	0.6			\$9.40	\$16.37	\$5.64	\$9.82			
Real Estate Tax			\$40.00			\$40.00				
Management	1	\$43.50				\$43.50				

YIELD CALCULATIONS

Table 12. Yield Calculations by Region

Yield Calculations by Region												
Pounds per bearing acre	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average*
Northwest	6,234	171	8,142	9,013	5,629	9,233	8,392	7,986	7,234	3,299	3,502	7,733
West Central	5,567	885	6,901	4,998	3,964	7,612	3,912	6,683	4,089	2,720	3,768	5,466
Southwest (& other)	5,326	368	8,844	5,722	9,756	6,883	10,296	8,472	9,496	1,655	7,672	8,099
Michigan	5,899	425	7,811	7,280	5,563	8,410	7,140	7,600	6,641	2,949	4,060	7,043

* Average includes all years except 2012, 2020, and 2021, which, due to weather events, were low enough that crop insurance would engage.

HARVEST COSTS/YIELD

Table 13. Harvest Cost Variation by Yield

Harvest Cost Variation by Yield							
	Yield (lb./acre)	Cost/acre Adjustment	Harvest Cost per Acre before Cooling and Shipping	Harvest Cost per lb. before Cooling and Shipping	Cost per lb. Cooling and Shipping (.023 \$/lb.**)	Total Harvest Cost per Lb.	Total Harvest Cost per Acre
	2,000	-10%	\$316	\$0.16	\$0.023	\$0.18	\$362
	4,000	-10%	\$316	\$0.08	\$0.023	\$0.10	\$408
West Central Average*	5,466	0	\$351	\$0.06	\$0.023	\$0.09	\$477
	6,000	0	\$351	\$0.06	\$0.023	\$0.08	\$489
	7,000	0	\$351	\$0.05	\$0.023	\$0.07	\$512
Michigan Average*	7,043	0	\$351	\$0.05	\$0.023	\$0.07	\$513
Northwest Average*	7,733	0	\$351	\$0.05	\$0.023	\$0.07	\$529
	8,000	0	\$351	\$0.04	\$0.023	\$0.07	\$535
Southwest Average*	8,099	0	\$351	\$0.04	\$0.023	\$0.07	\$537
	9,000	0	\$351	\$0.04	\$0.023	\$0.06	\$558
	10,000	0	\$351	\$0.04	\$0.023	\$0.06	\$581
	12,000	10%	\$386	\$0.03	\$0.023	\$0.06	\$662
	14,000	10%	\$386	\$0.03	\$0.023	\$0.05	\$708

* Average includes all years except 2012, 2020, and 2021, which, due to weather events, were low enough that crop insurance would engage.

** Cooling at 0.007 \$/lb + Shipping at 0.016 \$/lb = total of 0.023 \$/lb



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