

Cost of Producing Fresh Market Apples in Western Michigan, 1998

By
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This cost and return evaluation of fresh apple production in western Michigan is a summary of estimated costs developed from focus group discussions with apple growers in the winter and spring of 1998. It is a comparison of the development and annual growing costs of the three most common training systems for new orchards

currently used in western Michigan — **central leader, vertical axe** and **slender spindle** (see Figure 1).

For the assumptions made in this analysis, the central leader system generated the greatest total accumulated profit over the 20-year productive life of the orchard, assuming 12 cents per pound return to the grower. This return is higher

than the average return for fresh market apples over the past 28 years, but recent plantings of new varieties have generated significantly higher returns to growers. The slender spindle system accumulated the greatest up-front investment cost and took 12 years to fully recover the initial year's investments and carrying charges (see Figure 2).

Figure 1. Orchard characteristics

System	Density	Trees/acre	Spacing	Rows/acre
Central leader	Low	182	12 x 20	4.4
Vertical axe	Medium	519	6 x 14	6.2
Slender spindle	High	908	4 x 12	7.3

System	Central leader	Vertical axe	Slender spindle
Maximum tree height	18 feet	12 feet	8 feet

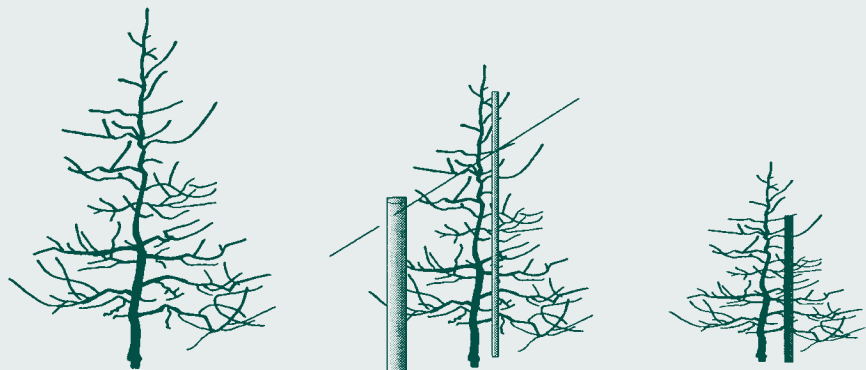
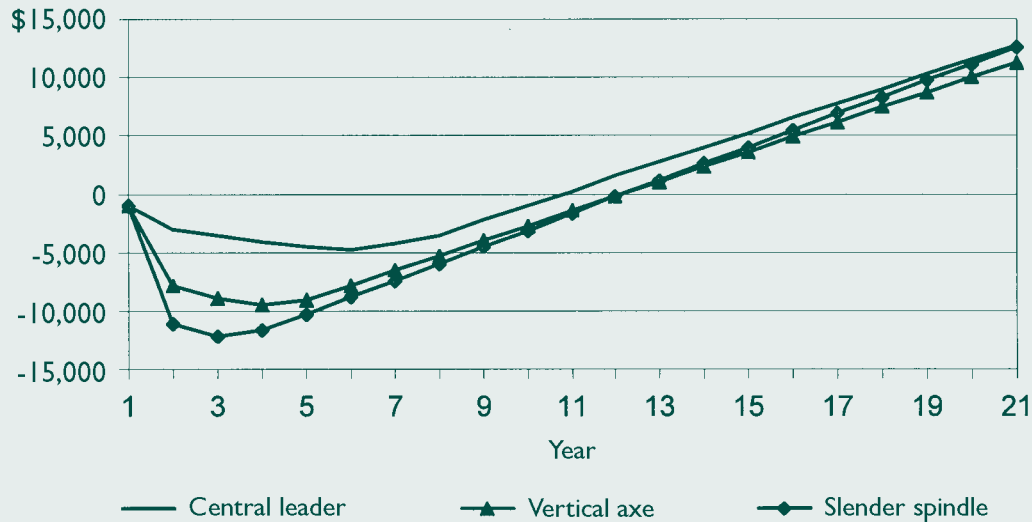




Figure 2. Accumulated profit per acre for three training systems of apples, 1998.



The annual costs, yields and accumulated profit for the three systems are summarized in Tables 1-6. Presented in Table 7 for the central leader system are the estimated annual accounting costs per bearing acre for each activity.

This cost analysis does not include a charge for land. Therefore, net income can be evaluated as a return to the fixed land investment on a before-income-tax basis.

A detailed summary of these costs by system and year can be obtained by contacting M.P. Kelsey, Agricultural Economics Department, Michigan State University, East Lansing, MI 48824-1039, or calling (517) 353-4520 and asking for Agricultural Economics Report #99-43. An Excel 7.0 spreadsheet containing the data

and analytical template can be obtained by contacting Philip Schwallier at the West Central Michigan Horticultural Research Station, 9302 Portland Rd., Clarksville, MI 48815, or calling (616) 693-2193. This computer program will allow you to change costs, prices and other variables to better fit your situation. This may be very desirable to do, given the close results in accumulated profit in the analysis given the cost and yield assumptions.

This program is also available on the Fruit Area of Expertise Web page at <<http://www.msue.msu.edu>>.

Labor Costs

The full-time labor classification includes the working time of the operator and regular hired help devoted to apples. Operator labor is not considered a cash expense, but to allow for differences in the proportion of work performed by regular hired help, which is a cash expense, or by the operator, both have been included at the \$12.50 per hour rate. As a result, producers who do a major portion of the work may have a lower cash labor cost than the figures indicate. This rate includes Social Security, Worker's Compensation and other fringe benefits. An \$8 per hour rate was used for unskilled part-time help.



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Table 1. Per acre potential profit for central leader system, 1998.

(assuming 12 cents/lb. return to growers)

Year	Bushel yield	Gross income	Annual growing costs ¹	Harvest costs	Interest	Total cost	Annual profit	Accum. profit	Net present value
0	0	\$ 0	\$ 784	\$ 0	\$ 215	\$ 999	\$ -999	\$ -999	\$ -999
1	0	0	1707	0	257	1964	-1964	-2963	-1836
2	0	0	400	0	198	598	-598	-3561	-522
3	0	0	381	0	197	578	-578	-4139	-472
4	100	504	554	139	211	904	-400	-4539	-305
5	150	756	589	208	216	1013	-257	-4796	-188
6	400	2016	704	555	237	1496	520	-4276	347
7	650	3276	1331	903	281	2514	762	-3514	474
8	800	4032	1379	1110	292	2782	1250	-2264	728
9	800	4032	1379	1110	292	2782	1250	-1014	680
10	800	4032	1379	1110	292	2782	1250	236	635
11	800	4032	1379	1110	292	2782	1250	1486	594
12	800	4032	1379	1110	292	2782	1250	2736	555
13	800	4032	1379	1110	292	2782	1250	3986	519
14	800	4032	1379	1110	292	2782	1250	5236	485
15	800	4032	1379	1110	292	2782	1250	6486	453
16	800	4032	1379	1110	292	2782	1250	7736	423
17	800	4032	1379	1110	292	2782	1250	8986	396
18	800	4032	1379	1110	292	2782	1250	10,236	370
19	800	4032	1379	1110	292	2782	1250	11,486	346
20	800	4032	1379	1110	292	2782	1250	12,736	323
Totals	11,700	\$58,968	\$24,377	\$16,247	\$5608	\$46,232		\$12,736	\$3,010

¹See Table 7 for details on growing costs.



Table 2. Effect of varying yield on cost per bushel for fresh market apples, 1998, central leader system.

(based on costs for a mature bearing year)

Yield/ acre	Growing costs	Interest costs	Harvest costs	Total costs	Cost/ bushel	Cost/ pound
200	\$ 1379	\$ 292	\$ 278	\$ 1948	\$ 9.74	\$ 0.23
300	1379	292	417	2088	6.96	0.17
400	1379	292	555	2226	5.57	0.13
500	1379	292	694	2365	4.73	0.11
600	1379	292	833	2504	4.17	0.10
700	1379	292	972	2643	3.78	0.09
800	1379	292	1111	2782	3.48	0.08
900	1379	292	1250	2921	3.25	0.08
1000	1379	292	1389	3060	3.06	0.07
1100	1379	292	1527	3198	2.91	0.07
1200	1379	292	1666	3337	2.78	0.07
1300	1379	292	1805	3476	2.67	0.06
1400	1379	292	1944	3615	2.58	0.06
1500	1379	292	2083	3754	2.50	0.06

Equipment Costs

Some major factors considered in the computation of equipment costs are initial cost, salvage value, years of life, annual usage, repair costs, insurance, interest, and operating expenses such as gas and oil. The operating costs for each piece of equipment are charged to the crop in Table 7 on the basis of direct hourly use of the equipment.

Variable Costs

Variable costs incurred in apple production are categorized by labor, machinery and materials. The details of hours and types of labor, machinery used and hours of use, and kinds and amounts of materials used by operation are shown in Table 7. If your costs for particular items are substantially higher than those shown, you may need to

analyze those components closely to see if they can be reduced. A high cost for a particular component may be justified if it contributes to a sufficiently higher yield or improved quality.

The variable costs incurred in harvesting an acre are shown in Tables 1, 3 and 5. Labor is the major cost. Therefore, good labor management should enhance the



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Table 3. Per acre potential profit for vertical axe system, 1998.

(assuming 12 cents/lb. return to growers)

Year	Bushel yield	Gross income	Annual growing costs ¹	Harvest costs	Interest	Total cost	Annual profit	Accum. profit	Net present value
0	0	\$ 0	\$ 784	\$ 0	\$ 215	\$ 999	\$ -999	-999	\$ -999
1	0	0	6362	0	466	6828	-6828	-7827	-6381
2	0	0	927	0	222	1149	-1149	-8976	-1003
3	150	756	778	208	224	1211	-455	-9431	-371
4	400	2016	832	555	242	1630	386	-9044	295
5	750	3780	1257	1041	283	2582	1198	-7846	854
6	825	4158	1442	1146	296	2884	1274	-6572	849
7	825	4158	1442	1146	296	2884	1274	-5297	794
8	825	4158	1442	1146	296	2884	1274	-4023	742
9	825	4158	1442	1146	296	2884	1274	-2748	693
10	825	4158	1442	1146	296	2884	1274	-1474	648
11	825	4158	1442	1146	296	2884	1274	-199	605
12	825	4158	1442	1146	296	2884	1274	1075	566
13	825	4158	1442	1146	296	2884	1274	2349	529
14	825	4158	1442	1146	296	2884	1274	3624	494
15	825	4158	1442	1146	296	2884	1274	4898	462
16	825	4158	1442	1146	296	2884	1274	6173	432
17	825	4158	1442	1146	296	2884	1274	7447	403
18	825	4158	1442	1146	296	2884	1274	8722	377
19	825	4158	1442	1146	296	2884	1274	9996	352
20	825	4158	1442	1146	296	2884	1274	11,271	329
Totals	13,675	\$68,922	\$32,562	\$18,989	\$6100	\$57,651		\$11,271	\$670

¹See Table 7 for an example of the breakdown of growing costs.



Table 4. Effect of varying yield on cost per bushel for fresh market apples, 1998, vertical axe system.

(based on costs for a mature bearing year)

Yield/ acre	Growing costs	Interest costs	Harvest costs	Total costs	Cost/ bushel	Cost/ pound
200	\$ 1442	\$ 296	\$ 278	\$ 2016	\$10.08	\$ 0.24
300	1442	296	417	2155	7.18	0.17
400	1442	296	555	2293	5.73	0.14
500	1442	296	694	2432	4.86	0.12
600	1442	296	833	2571	4.29	0.10
700	1442	296	972	2710	3.87	0.09
800	1442	296	1111	2849	3.56	0.08
900	1442	296	1250	2988	3.32	0.08
1000	1442	296	1389	3127	3.13	0.07
1100	1442	296	1527	3265	2.97	0.07
1200	1442	296	1666	3403	2.84	0.07
1300	1442	296	1805	3543	2.73	0.06
1400	1442	296	1944	3682	2.63	0.06
1500	1442	296	2083	3821	2.55	0.06

profit picture. In most cases, there will be some higher or lower costs for some items associated with higher or lower yields.

Production Costs per Hundredweight

Per acre yields are very important in determining cost per bushel of

apples (Tables 2, 4 and 6). Costs per bushel vary with yield because preharvest costs per acre — such as spraying, pruning, mowing, etc. — do not vary greatly, regardless of the yield obtained. The Michigan Department of Agriculture annually publishes sale prices for fresh and processed apples and an overall average price of the two groups, which reflects average prices to

growers (Figure 3). This information will help you determine profitability in your farm analysis of costs.

Present Value Analysis

Streams of income and expense incurred in future years do not have the same real value as dollars



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Table 5. Per acre potential profit for slender spindle system, 1998.

(assuming 12 cents/lb. return to growers)

Year	Bushel yield	Gross income	Annual growing costs ¹	Harvest costs	Interest	Total cost	Annual profit	Accum. profit	Net present value
0	0	\$ 0	\$ 784	\$ 0	\$ 215	\$ 999	\$ -999	\$ -999	\$ -999
1	0	0	9460	0	606	10,066	-10,066	-11,065	-9407
2	100	504	1220	139	241	1600	-1096	-12,161	-957
3	500	2520	1100	694	261	2055	465	-11,696	380
4	850	4284	1380	1180	295	2855	1429	-10,268	1090
5	850	4284	1380	1180	295	2855	1429	-8839	1019
6	850	4284	1380	1180	295	2855	1429	-7410	952
7	850	4284	1380	1180	295	2855	1429	-5982	890
8	850	4284	1380	1180	295	2855	1429	-4553	831
9	850	4284	1380	1180	295	2855	1429	-3125	777
10	850	4284	1380	1180	295	2855	1429	-1696	726
11	850	4284	1380	1180	295	2855	1429	-268	679
12	850	4284	1380	1180	295	2855	1429	1161	634
13	850	4284	1380	1180	295	2855	1429	2589	593
14	850	4284	1380	1180	295	2855	1429	4018	554
15	850	4284	1380	1180	295	2855	1429	5446	518
16	850	4284	1380	1180	295	2855	1429	6875	484
17	850	4284	1380	1180	295	2855	1429	8303	452
18	850	4284	1380	1180	295	2855	1429	9732	423
19	850	4284	1380	1180	295	2855	1429	11,160	395
20	850	4284	1380	1180	295	2855	1429	12,589	369
Totals	10,050	\$75,852	\$36,023	\$20,899	\$6341	\$63,263		\$12,589	\$401

¹See Table 7 for an example of the breakdown of growing costs.



Table 6. Effect of varying yield on cost per bushel for fresh market apples, 1998, slender spindle system.

(based on costs for a mature bearing year)

Yield/ acre	Growing costs	Interest costs	Harvest costs	Total costs	Cost/ bushel	Cost/ pound
200	\$ 1380	\$ 295	\$ 278	\$ 1952	\$ 9.76	\$ 0.23
300	1380	295	417	2092	6.97	0.17
400	1380	295	555	2230	5.58	0.13
500	1380	295	694	2369	4.74	0.11
600	1380	295	833	2508	4.18	0.10
700	1380	295	972	2647	3.78	0.09
800	1380	295	1111	2786	3.48	0.08
900	1380	296	1250	2925	3.25	0.08
1000	1380	296	1389	3062	3.06	0.07
1100	1380	296	1527	3202	2.91	0.07
1200	1380	296	1666	3341	2.78	0.07
1300	1380	296	1805	3480	2.68	0.06
1400	1380	296	1944	3619	2.59	0.06
1500	1380	296	2083	3758	2.51	0.06

incurred today. Investment in an orchard will generate income and expenses for many years into the future. Discounting these future streams of dollars is a recommended analytical technique that determines the net present value (NPV) in today's dollars. Comparing the net present value of each investment allows growers to determine the most profitable

investment over time and select that investment with the highest NPV.

In this analysis, using a discount rate of 7 percent, the central leader system has the highest net present value and therefore would be the preferred investment. However, different assumptions on yields, costs, useful life of the orchard, etc., could change the results.

Trends

Costs of production studies have been done at various times at MSU since 1970. Figure 3 provides a graphic presentation of the total cost trend since 1970. It is clear that during the 1970s and 1980s, apple prices have been variable, but there has been very little trend toward higher prices, while the cost of production has increased considerably.

Table 7. Annual growing cost per acre, mature bearing year, central leader system, 1998.

Activity	Labor hours	Equipment hours	Labor cost	Equipment cost	Material cost	Other cost	Total per acre
Training	0.0	2.0	\$ 0.00	\$ 26.91	\$ 0.00		\$ 26.91
Pruning	30.3	30.3	242.00	75.93			317.93
Brush removal	3.0	3.0	37.50	17.69			55.19
Tree replacement	0.5	0.5	4.00	6.73	10.89		21.62
Herbicide program							
40 hp tractor	0.8	0.8	10.00	4.72			14.72
Weed sprayer		0.8	0.00	3.33	17.25		20.58
Spray program¹							
80 hp tractor	1.8	1.8	22.50	26.30	631.77		680.58
Airblast sprayer		1.8		17.84			17.84
Mowing							
40 hp tractor	1.5	1.5	12.00	8.85			20.85
Mower		1.5	0.00	6.67			6.67
Mouse control							
40 hp tractor	0.3	0.3	2.40	1.77			4.17
Vicon spreader		0.3	0.00	0.99	5.50		6.49
Wildlife control	2.0	1.0	16.00	13.45	9.08		38.53
Fertilizer							
40 hp tractor	0.3	0.3	2.00	1.47	15.20		18.68
Vicon spreader		0.3	0.00	0.82			0.82
Lime					35.00		35.00
Scouting						\$15.00	15.00
Bees						35.00	35.00
Real estate tax			0.00	0.00		30.00	30.00
Management			0.00	0.00		12.50	12.50
Total	40.4	46.0	\$348.40	\$213.47	\$724.69	\$92.50	\$1379.06

¹Assumes 18 covers @ 10 acres per hour.



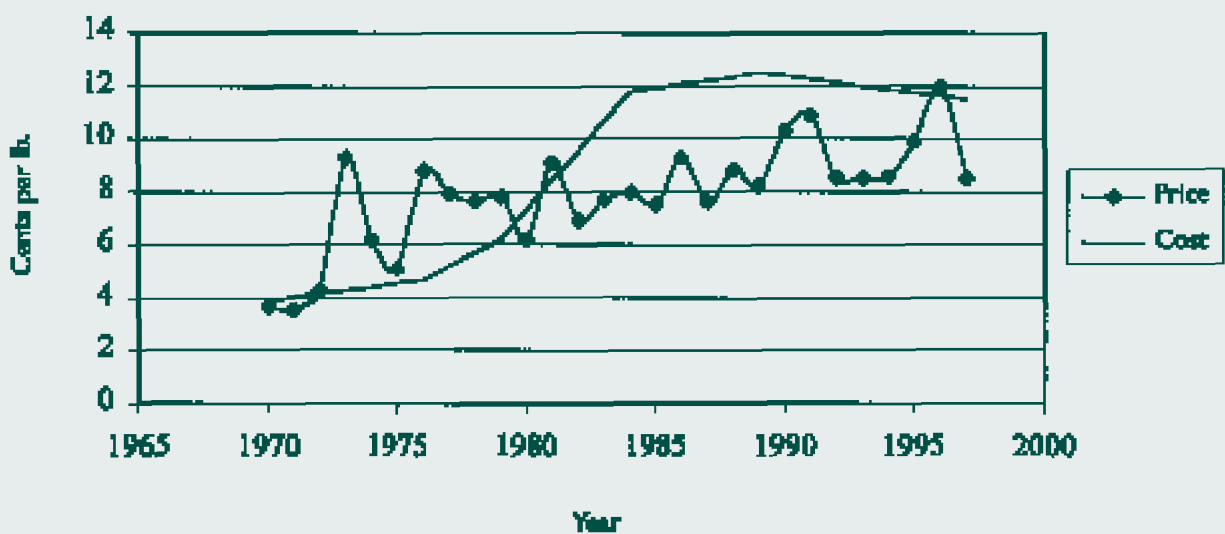
Table 8. Effect of varying yield on unit cost of three training systems of apples, 1998.

(850-lb. bins)

Yield/ acre	Central leader			Vertical axe			Slender spindle		
	Cost/ bin	Cost bushel	Cost/ pound	Cost/ bin	Cost/ bushel	Cost/ pound	Cost/ bin	Cost/ bushel	Cost/ pound
200	197.20	9.74	0.23	203.96	10.08	0.24	197.61	9.76	0.23
300	140.84	6.96	0.17	145.34	7.18	0.17	141.11	6.97	0.17
400	112.65	5.57	0.13	116.03	5.73	0.14	112.86	5.58	0.13
500	95.74	4.73	0.11	98.45	4.86	0.12	95.91	4.74	0.11
600	84.47	4.17	0.10	86.72	4.29	0.10	84.61	4.18	0.10
700	76.42	3.78	0.09	78.35	3.87	0.09	76.53	3.78	0.09
800	0.38	3.48	0.08	72.07	3.56	0.08	70.48	3.48	0.08
900	65.68	3.25	0.08	67.18	3.32	0.08	65.77	3.25	0.08
1000	61.92	3.06	0.07	63.27	3.13	0.07	62.00	3.06	0.07
1100	58.85	2.91	0.07	60.08	2.97	0.07	58.92	2.91	0.07
1200	56.29	2.78	0.07	57.41	2.84	0.07	56.35	2.78	0.07
1300	54.12	2.67	0.06	55.16	2.73	0.06	54.18	2.68	0.06
1400	52.26	2.58	0.06	53.23	2.63	0.06	52.3	2.59	0.06
1500	50.65	2.50	0.06	51.55	2.55	0.06	50.70	2.51	0.06



Figure 3. Total cost and price per pound for apples, Michigan, 1970-1996.





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