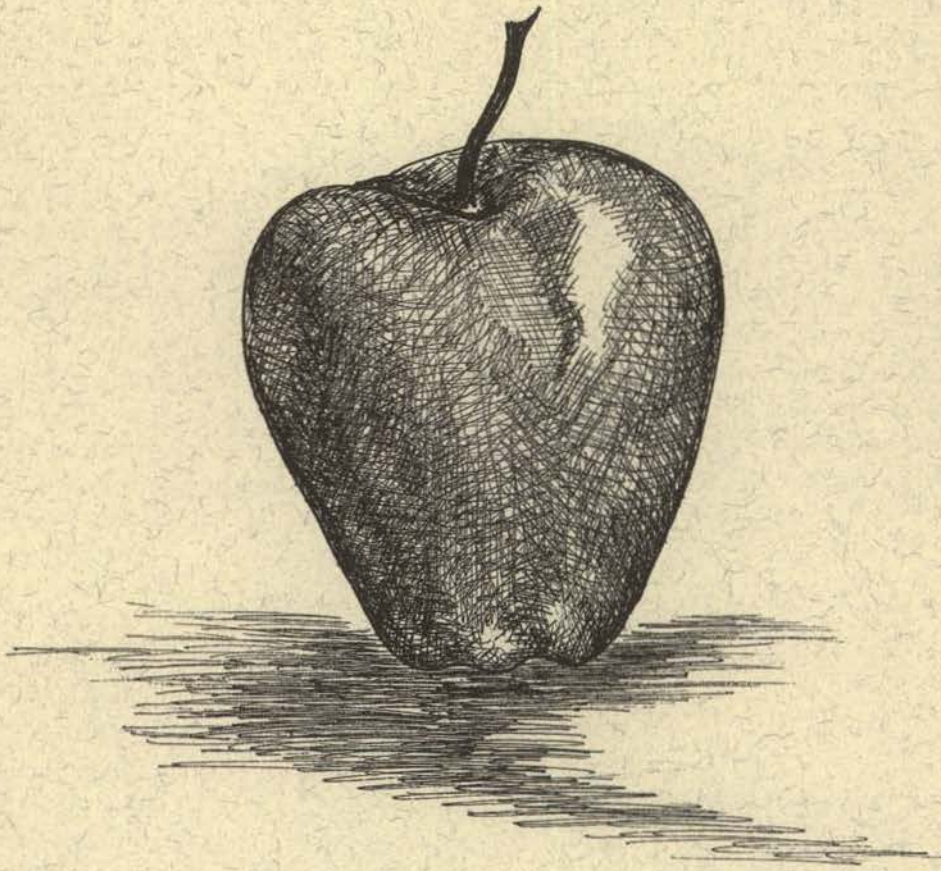



**Economic Feasibility of Growing
Red Delicious Apples
in Southwestern Idaho**



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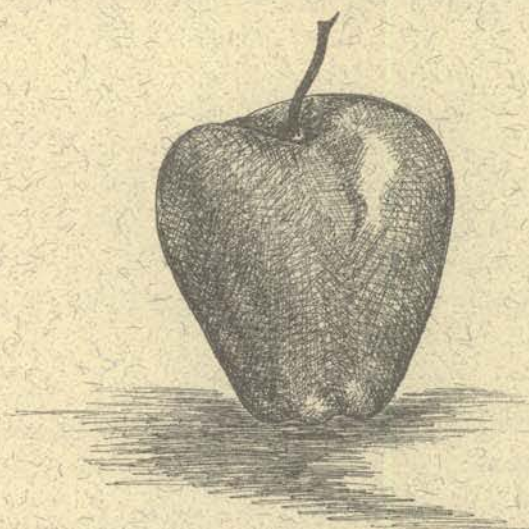
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Robert Smathers, Corby Garrett, & Michael Colt

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Introduction

Commercial apple production is a relatively minor agricultural crop in Idaho in comparison to commodities like potatoes, sugarbeets, and grain, but is a significant crop in the southwestern region of the state. Approximately 90 percent of the 110 million pounds of apples produced in Idaho in 1997 (Idaho Agricultural Statistics, 1998) were grown in a three-county area that included Canyon, Gem, and Payette counties. Cultivars of apples commonly grown in these counties include Red Delicious, Jonathans, and Romes. Newer cultivars such as Fuji and Gala are also becoming more common as markets for these varieties continue to grow.

For many Americans, there is only one apple cultivar that is synonymous with the word "apple" — the Red Delicious. Many consumers like this attractive, all-red apple with its sweet flavor. Growers like it because they are familiar with this variety and its problems. Packers, shippers, and sales people like it because its tough red skin hides bruises and stands up well in shipment and because its appearance is usually "as advertised." However, poor market returns in recent years due to a variety of reasons has encouraged the planting of newer and different cultivars such as Fuji and Gala. Some fruit industry leaders have even suggested that Red Delicious will not be a major cultivar at some point in the future. This is not to say that it won't continue its dominance in the foreseeable future.

There is no question that some Red Delicious blocks do not produce the type of product today's competitive markets demand, so these blocks should be removed and replaced. However, due to the high initial costs of planting, growers should be careful to assess the economics of keeping existing blocks of apples versus replanting to newer or traditional varieties.

The objective of this study is to estimate the cost of replanting a 10-acre block of existing trees to a medium to low-density Red Delicious stand. While the acreage and cultural practices may not fit all situations, they are consistent with growers' practices in southwestern Idaho.

Assumptions

The assumptions used in this study were based upon information from Idaho growers and extension specialists, and information published by other Northwest universities. The cultural practices and inputs used are representative of typical operations. The inputs and levels of inputs specified in this publication are not University of Idaho recommendations.

Due to variations in individual orchards (site characteristics, size, degree of technology, tree densities, age of equipment, varietal selection, etc.) the costs associated with establishment and production of apples will differ. The costs and returns for producing apples in this study are based on the following specific assumptions.

1. The size of orchard is 100 acres, with 50 acres in existing Red Delicious apples, 15 acres in Jonathans, 25 acres in Romes, and 10 acres to be replanted to Red Delicious.
2. Based on traditional Red Delicious orchards, a medium-density stand was used. A rootstock adaptable to the soil, site, and climatic conditions prevalent in southwest Idaho is planted in 11 X 16 foot spaces, resulting in 250 trees per planted acre. Twenty-two pollinizing trees are also planted on each acre. Since the new trees will be planted into old orchard ground, it will be necessary to fumigate, remove old trees and roots, and cleanup.
3. All hourly labor in the operation is valued at \$7.20 per hour and includes a base wage plus 20 percent for Social Security, Medicare, unemployment insurance, and other labor overhead expenses. A charge for management is not included in this study.
The orchard will use migrant labor, but will not supply housing.
4. Table 1 lists the machinery and equipment used in the orchard operation. All items are valued at new replacement cost. Fuel costs are based on a diesel price of \$.88 per gallon and an unleaded gasoline price of \$1.38.

A miscellaneous category includes tools, bins, buildings, and other equipment.

5. Interest on operating capital is charged at 9.5 percent from the time inputs are used until the month that capital is recovered. Interest on investment capital is calculated at a rate of 9 percent. Interest on carryover in the cost and return tables (Tables B2 through B6, Appendix B) is interest on accumulated investment in establishing the orchard. This interest is incurred as an expense from the beginning of year 2 until the first year of full production. It is then added to other establishment costs and allocated over the full production years (15 years). This prorated cost is labeled amortized establishment cost in the full-production budget, Table B7.
6. An opportunity cost for land is included in the costs and returns estimates, based on an interest rate of 9 percent and a land value of \$2,000 per acre. A cost is also included for land taxes.
7. Red Delicious apples in this study are valued at \$95.00 per bin. This is based on average bin returns reported by several local packing sheds.
8. Herbicides for strip maintenance are applied on one third of each acre and formulations reflect this coverage.
9. An underground solid set irrigation system is installed the planting year and capital recovery is used to calculate depreciation and interest (Appendix A). The system has a 25-year useful life with no salvage value at the end. Labor to install the system is included in its cost.

Table 1. Equipment and Building Investment for a 100-Acre Apple Operation

Description	1997 Purchase Price (\$)	Expected Years Life	Annual Use
Machinery			
30 HP 2wd tractor	22,000	15	700 hours
65 HP 2wd tractor (2 units)	29,200	15	550 hours
Blast sprayer 400 gallon (2 units)	11,000	10	200 hours
Weed sprayer w/boom - 100 gallon	2,100	15	150 hours
Fertilizer spreader	3,100	15	20 hours
Rotary mower, 6 ft	4,000	7	100 hours
Pickup, 1/2 ton	26,500	6	12,000 miles
Truck, 5 ton (used)	30,000	15	2,700 miles
Equipment and Buildings			
ATV	2,500	5	—
Backfork	1,200	20	—
Bin trailer (2 units)	5,400	15	—
Bins (1,200 units)	48,600	20	—
Pole pruners (6 chainsaw units)	3,600	5	—
Irrigation system (includes pumps)	140,000	25	—
Ladders (15 - 6 ft, 15 - 8 ft, and 15 - 10 ft)	3,300	20	—
Picking equipment (25 bags)	600	5	—
Machine shed and shop	30,000	25	—
Tools	10,000	15	—
Miscellaneous	2,000	20	—
Wind machines (3 units)	50,000	25	—
Land	200,000	—	—

Sources for equipment and building information include growers and extension specialists.

10. Three wind machines, including smudge pots for frost protection, are included and valued at \$50,000.

Labor Requirements

An adequate labor supply is essential for pruning and training branches, and thinning apples. Pruning and training are generally performed during the winter and spring months. Thinning can start as early as June and end in October, depending on the variety of apple.

Pruning and training costs vary with the age of the tree. In the early years, it is crucial that time is spent training and pruning for a certain tree shape. This is needed to achieve optimum light penetration, which leads to higher quality and quantity of fruit. The shape of the tree should be complete when full bearing is reached, requiring only a maintenance program for pruning. See Table 2 for labor requirements.

As trees come into bearing, growers must thin apples for optimum size and quality standards. In the past, chemical thinners worked effectively in thinning clusters of apples to singles or doubles which resulted in large-size, higher-quality fruit in the marketplace. However, the Environmental Protection Agency has limited the use of certain chemical thinners, and growers must now rely on hand labor to thin apple clusters that the current chemical thinners do not thin. The size of the crop

determines the amount of labor required to thin the apples.

Harvest labor requirements also increase with the size of the crop. Pickers are usually paid by the bin to remove apples from the tree and place them into a bin. This study uses a piece rate of \$12 per bin. Occasionally, pickers are paid by the hour to reduce fruit bruising when placing the apples into a bin or to slow down harvest so that apples can be picked for color to maximize profits to the grower. Additional harvest labor includes tractor drivers to move bins to and from the field, workers to load bins onto trucks, and supervisors. These laborers are paid by the hour. Hourly paid labor also increases with the size of the crop.

There are also labor requirements to apply chemicals, irrigate trees, mow the orchard floor, and fertilize. However, the largest amount of labor hours are spent to prune, train, thin, and harvest the apples. Typical of the tree fruit industry is the need for large amounts of labor for a short period of time: February and March for pruning; June and July for training; June and July for thinning apples; and August and September for harvesting.

Marketing

A packinghouse will market the fruit for the grower. They find brokers, buyers, and merchandisers to buy the fruit. The packinghouse charges the grower a fee to unload the trucks,

Table 2. Labor Requirements for Pruning, Training, and Thinning Medium-Density Red Delicious Apples¹

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7-21
	(hours per acre)						
Pruning	0	0	0	0	20	22	28
Training	12	17	39	31	0	0	0
Thinning	0	0	0	8	23	26	40
Other ²	48	28	22	30	32	35	43
Total ³	60	45	61	69	75	83	111

¹ Harvest labor costs are not included in this table because they are computed on a cost per-bin basis.

See Tables B2-B7 for a summary of all labor costs.

² Other labor includes labor to apply inputs, irrigate trees, mow orchard floor, etc.

³ Sources for labor information included growers and extension specialists.

store, pack, and sell the apples. These fees are subtracted from F.O.B. prices received by the packinghouse, resulting in a grower return on a per box basis. The grower usually receives an advance to pay the pickers at delivery of the apples, and additional money is gradually dispersed to the growers when the apples are sold.

Costs and Returns Estimates

The costs and returns estimates developed in this study for Red Delicious apples are shown in Appendix B. These include separate budgets for six years of establishment and one budget representing full production, Tables B1-B7. The establishment years are characterized by high capital costs and zero-to-moderate yields. Red Delicious production is negligible until year 4, when 10 bins of apples are produced, but gradually increases until year 7, when it peaks at 40 bins per acre. Apple yields will average 40 bins per acre through year 21, given proper management. It is assumed that each bin yields about 15 boxes of fresh-packed apples and six boxes of process-grade apples.

The costs in Appendix B, Tables B1 - B7, are categorized as operating and ownership costs. Operating costs are the costs of the day-to-day maintenance and operations of the orchard. These costs include items such as fertilizer, chemicals, hired labor, fuel, training materials, and repair costs. Ownership costs pertain to capital investments lasting more than one year, such as machinery, equipment, buildings, land, and tools. These costs are depreciation, interest on investment, property taxes, and property insurance. Even if production does not take place, the costs associated with ownership are still incurred.

Returns above operating costs are necessary for the producer to stay in business in the short run. If returns do not equal or exceed operating costs, then producing apples is uneconomical in the short run.

In the long run, returns must meet or exceed both operating and ownership costs for the orchard to be economically viable. If returns are just equal to the sum of operating and ownership costs (total costs), which means the

enterprise is at break-even, then the grower is recovering all out-of-pocket expenses and realizing a competitive return on his capital invested in land, equipment, trees, and buildings. If the breakeven is exceeded, the grower earns a residual to management and risk.

Year 1

The 10-acre site to be planted was previously in apple production, so tree removal, burning, tillage, and fumigation are required to prepare the site.

Young Red Delicious trees are planted in 11 X 16 feet spaces, resulting in 250 trees per acre. In addition, 28 pollenizing trees are also planted on each acre of ground. Trees are planted with a rented planter and labor provided by the orchard. The planter cost is \$37.50 per acre and tree cost is \$1,496 per acre.

After planting trees, a solid set irrigation system is installed at a cost of \$1,400 per acre for materials and labor. Grass is seeded between the tree rows after the irrigation system is installed in 11 to 12 feet wide strips. Grass is not mowed in the establishment year, but will be in subsequent years with a tractor and rotary mower.

Weed spraying is necessary to maintain the strips under the trees where grass is not planted. The cash cost for each spray operation is \$14.06 per acre, including machinery, labor, and materials. The orchard is sprayed three times in year 1. See Appendix C, Tables C1-C6, for monthly cash expense summaries for orchard operations.

Fertilizer is applied in one operation during year 1. The quantities reported in this study are based on surveys with Idaho growers, but may differ given site-specific soil fertility. The cash cost in year 1 for application, labor, machinery, and materials, as shown in Table C1, is \$77.60 per acre.

Additional labor is required in year 1 to lay out and stake plantings, hoe around trees, install tree wraps, train trees, prune, irrigate, and control rodents. Total labor cost for the year is \$436 (Table B1).

Total cost of establishing the orchard in year 1 is \$4,047 per acre as shown in Table B1.

Year 2

Table B2 shows the projected costs for establishment of Red Delicious apples in year 2. Orchard operations performed in year 2 include fertilization, spraying, and mowing. Fertilizer is applied in March at a cash cost of \$147 for machinery, labor, and materials (Table C2). Dormant spray is also applied in March with a blast sprayer and tractor at a cash cost of \$39.93 per acre.

Herbicide is sprayed on strips three times in year 2 for weed control. This is accomplished with a 100-gallon weed sprayer pulled by a 65-horsepower tractor. The cash cost for the machinery, labor, and materials is about the same as year 1.

Micronutrients are applied two times in year 2 at a cost of \$18.67 per acre for each operation.

Mowing is done using the 65-horsepower tractor and a 6-foot rotary mower. Row centers are mowed two times in year 2 at a cost of \$5.98 per acre for each operation. Additional labor is used throughout year 2 for pruning, tree training, and controlling rodents.

Total operating and ownership costs per acre in year 2 are \$901 and \$966 respectively. Total costs per acre (the sum of operating and ownership costs) are \$1,867. Interest on the costs carried over from year 1 (\$364 per acre) is included in non-cash ownership costs.

Year 3

The number of orchard operations performed in year 3 and the costs per operation for fertilizing, spraying, and mowing are not significantly different from year 2. However, labor costs are slightly higher because of additional training. Total labor costs in year 3 are \$438, compared to \$326 in year 2.

Total operating and ownership costs in year 3 are \$1,034 and \$1,137 per acre, with a total cost of \$2,171. Interest on expenses carried over from years 1 and 2 is \$532 per acre.

Year 4

Ten bins of apples are produced in year 4 and sold at an average price of \$95 per bin for projected gross returns of \$950 per acre.

Most orchard operations remain unchanged from year 3, with the exception of one cover spray for insects. The machinery, labor, and material costs are \$27.37 per acre for each insect spray operation, as shown in Table C4.

Labor cost in year 4 is \$617 per acre with most of the difference from year 3 being additional harvest labor.

Total operating and ownership costs in year 4 are \$1,227 and \$1,370 respectively, resulting in a total cost of \$2,597 per acre. Interest on capital carried over from previous years is \$728.

Year 5

The yield in year 5, shown in Table B5, is now up to 15 bins per acre, with projected gross returns of \$1,425.

Orchard operations are unchanged from year 4, with the exception of additional cover and nutrient spray operations as shown in Table C5. Both of these operations use the 65-horsepower tractor and blast sprayer.

Orchard labor is up \$100 per acre from year 4 to \$717 due to an increase in harvest and hand thinning costs.

Total operating and ownership costs in year 5 are \$1,186 and \$1,590 respectively, for a total cost of \$2,776 per acre. Interest on capital carried over from previous years is \$876.

Year 6

Year 6 is the final year of establishing Red Delicious apples before full production is reached. The yield in year 6, shown in Table B6, is now up to 20 bins per acre, with projected gross returns of \$1,900.

Orchard operations are unchanged from year 5, with the exception of a chemical thinning operation to thin clusters of apples. This operation is performed in the spring with a tractor and blast sprayer.

Orchard labor is up \$118 over year 5 to \$835 per acre, due again to an increase in harvest and hand-thinning costs.

Total operating and ownership costs in year 6 are \$1,324 and \$1,727 respectively, for a total cost of \$3,051 per acre. Interest on capital carried over is \$998 per acre.

Year 7

Year 7 is the first year of full production. The average yield for years 7 through 21 is 40 bins per acre (see Table B7). At \$95 per bin, the projected gross return is \$3,800 per acre. It is assumed that a yield of 40 bins will be maintained through the next 15 years of the orchard's life.

Pruning, thinning, fertilizer, and herbicide programs remain unchanged from year 6. The insecticide and thinning spray programs changed slightly and harvest costs increased due to the increase in orchard production.

Total net establishment cost for years 1 through 6 is \$12,235 per acre. This represents the total investment less crop income required to establish one acre of Red Delicious apples. The projected annualized cost of this investment in the orchard over 15 years of production is \$1,518 per acre and includes stand depreciation plus interest on investment. This is calculated using the capital recovery approach shown in Appendix A and labeled as amortized establishment cost in the full production budget (Table B7).

Total annual operating and ownership costs in years 7 through 21 are about \$1,913 and \$2,302 respectively, for a total annual cost of \$4,215 per acre. The average net return for Red Delicious apples over the 15 production years is projected at -\$415.04 per acre. (Note that this analysis does not take into account inflation.)

Economic Analysis

The analysis in Table 3, generated from Tables C1-C7, summarizes the first 10 years of cash flows for an acre of Red Delicious apples grown in southwestern Idaho. As shown in Table 3, the enterprise does not generate a positive annual cash flow until year 5. This is the first year during establishment that gross income exceeds total cash costs. It's not until year 10 that cumulative gross income exceeds cumulative cash costs. This is not to declare year 10 as the economic break-even point; it's simply the year that initial out-of-pocket expenses are fully recovered.

A cash flow analysis is a good indicator of the cash requirements needed to establish an acre of apples and when sufficient income will be available to recover initial cash investment. However, enterprise profit or the economic break-even point cannot be projected using a cash flow analysis because non-cash items such as depreciation and interest on owner equity are not included.

Table 4 is a summary of the economic costs presented in Tables B1-B6. It summarizes projected gross income, total costs, net projected returns, and cumulative net returns. Total costs to establish Red Delicious apples (the sum of cumulative operating and ownership costs, years 1-6) are \$16,510 per acre. Cumulative net returns are the sum of net projected returns and amount to the cumulative net cost of establishment. The economic break-even point occurs in the year that cumulative net returns become positive. This is the year when total costs of establishing the orchard (\$16,510 per acre) are fully recovered.

In this analysis of Red Delicious apples, a net loss is projected to occur during the full production years as shown in table B7. This means that the economic breakeven point will not be reached, no matter how long the orchard is kept in production (See Figure 1). As stated earlier, returns must meet or exceed both operating and ownership costs (total costs) for the orchard to be economically viable in the long run. If crop returns are less than total costs, then the grower will not realize a competitive return on his capital invested in the

Table 3. Cash Flow Analysis, Red Delicious Apples in Southwestern Idaho*

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Gross income	0	0	0	950	1425	1900	3800	3800	3800	3800
Cash operating costs	3392	900	1034	1227	1186	1324	1913	1913	1913	1913
Cash ownership costs	174	112	115	123	127	132	149	149	149	149
Total cash costs	3566	1013	1149	1350	1313	1456	2062	2062	2062	2062
Annual cash flow	-3566	-1013	-1149	-400	112	444	1738	1738	1738	1738
Cumulative cash flow	-3566	-4579	-5728	-6128	-6016	-5572	-3834	-2096	-358	1379

*The total cost of the trees are included in this cash flow analysis.

Table 4. Economic Costs and Returns of Establishing Red Delicious Apples in Southwestern Idaho

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total cumulative costs and returns
Gross income	\$0	\$0	\$0	\$950	\$1,425	\$1,900	\$4,275
Operating costs	3,392	901	1,034	1,227	1,186	1,324	9,064
Ownership costs	655	966	1,137	1,370	1,590	1,727	7,445
Total costs	4,047	1,867	2,171	2,598	2,776	3,051	16,510
Net projected returns	-4,047	-1,867	-2,171	-1,648	-1,351	-1,151	—
Cumulative net returns	-4,047	-5,914	-8,085	-9,733	-11,084	-12,235	—

operation. In other words, a higher return might be realized by investing his capital elsewhere.

The pie charts in Figures 2 and 3 show the allocation of the establishment costs summarized in Table 4. Figure 2 summarizes accumulated operating costs and shows that hired labor and tree expenses were the two largest expenses, 37 and 17 percent respectively. All other items amount to about 46 percent of cumulative operating costs.

Figure 3 summarizes cumulative operating and ownership costs of establishment. Hired labor, trees, and interest costs represent 53 percent of the total, with interest being the largest single cost at 24 percent.

Sensitivity Analysis

Two of the greatest uncertainties facing growers are crop yields and prices. The yields and prices used in this study are considered average and achievable given experienced management, average weather, and market conditions. However, fluctuations will occur due to many factors beyond the grower's control, so it's imperative that growers evaluate the impacts that price and yield fluctuations will have on profits. In Table 5, yields and prices during years 1 through 6 are varied to monitor the impacts of income fluctuations on accumulated net establishment cost. The accumulated six-year net cost is the amount of money net of crop income that the grower would have

Table 5. Six Year Accumulated Net Cost of Establishing Red Delicious Apples at Varying Price and Yield Levels

	Average Price of Red Delicious Apples (\$/bin)					
	\$55.00	\$75.00	\$95.00	\$115.00	\$135.00	\$155.00
Percent of Base Yield (years 1-6)	Accumulated 6 Year Net Establishment Cost (\$)					
60%	14,687	14,147	13,607	13,067	12,527	11,987
80%	14,361	13,641	12,921	12,201	11,481	10,761
100%	14,036	13,136	12,235	11,336	10,436	9,536
120%	13,710	12,630	11,550	10,470	9,390	8,177
140%	13,384	12,124	10,864	9,604	8,344	7,084

Table 6. Break-even Yields for Red Delicious Apples at Various Prices and Establishment Yield Levels

	Average Price of Red Delicious Apples (\$/bin)					
	\$55.00	\$75.00	\$95.00	\$115.00	\$135.00	\$155.00
Percent of Base Yield (years 1-6)	Break-even Yield for Years 7 - 21 (bins per acre)					
60%	101	64	46	36	29	25
80%	100	63	45	35	28	24
100%	99	62	44	34	27	22
120%	98	61	43	33	26	21
140%	97	60	42	32	25	20

invested in each acre of apples at the end of six years. This accumulated investment is then prorated over 15 years of production and included as a production cost (labeled amortized establishment cost) in the mature apple budget (Table B7).

The break-even yields in Table 6 are the yields necessary to cover all costs of production including orchard investment in full production years (years 7 - 21) at corresponding levels of net establishment cost shown in Table 5. Any production above this break-even yield is profit after subtracting additional harvest costs.

Tables 5 and 6 show how accumulated net establishment cost and break-even yields vary

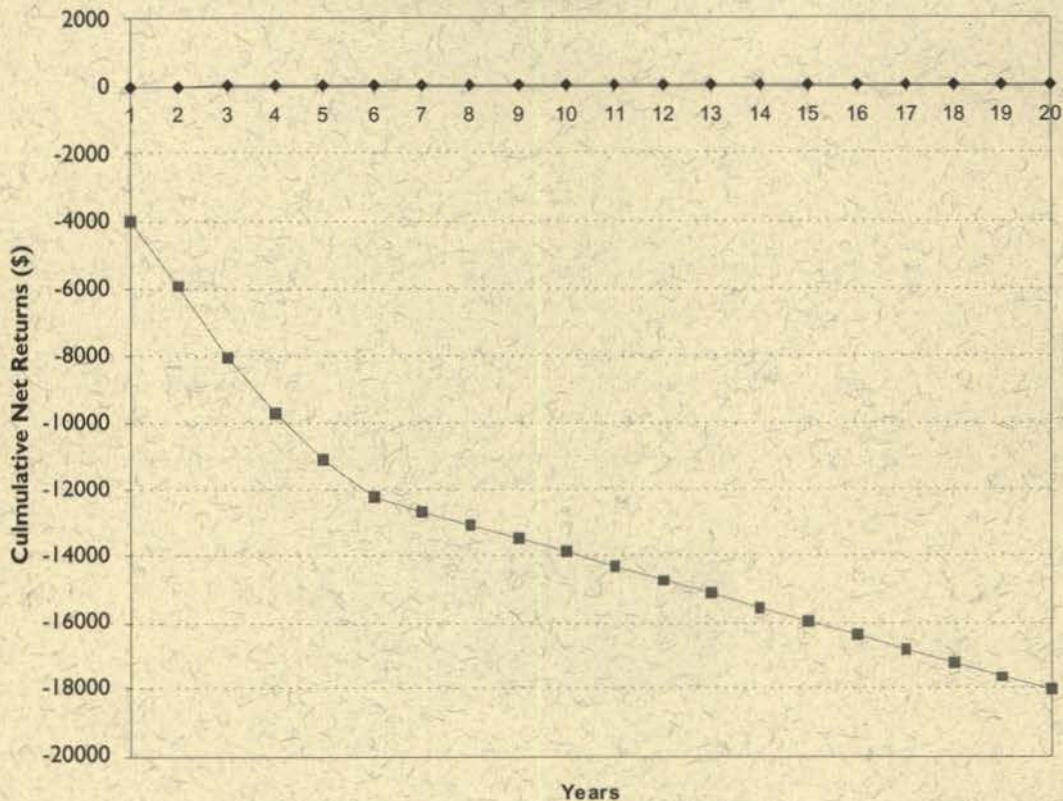
with fluctuations in Red Delicious apple yields and price. For example, at \$95 average price per bin for apples and 100 percent of base yield in establishment years 1 through 6, the accumulated six-year net cost would be \$12,235 per acre. The corresponding break-even yield during the production years would be 44 bins per acre. At \$135 per bin and 100 percent of base yield, the accumulated net establishment cost would be \$10,436, and only 27 bins would be required to cover economic costs during full production years. This information illustrates the influence that early yields and especially market conditions have on the profitability of growing apples.

Conclusion

The production and financial risks associated with apple production are well known by those in the industry. Considerable time lags between planting trees and realization of profits make it difficult and risky to finance orchard renewal. The availability of new "quicker yielding apple varieties" and more diverse varieties has helped, but the capital needs are still considerable. Because of the expense and risk associated with orchard renewal, growers should be careful to assess the economics of keeping versus replacing older blocks of trees.

The costs and returns estimates generated in Tables B1-B7 are based on the assumptions outlined in this study. They should be revised to reflect any changes in the conditions that might influence the underlying assumptions. Changes in factor prices, market fluctuations, labor availability, cost of capital, and weather could have substantial influences on orchard profitability.

Figure 1. Cumulative Net Returns of Growing Red Delicious Apples in Southwestern Idaho (years 1-20)¹



¹Economic breakeven occurs in the year when cumulative net returns reaches zero. The economic breakeven point for the Red Delicious enterprise analyzed in this study is not reached as shown above.

Figure 2. Cumulative Operating Costs Per Acre for Red Delicious Apples. Establishment (Years 1-6)

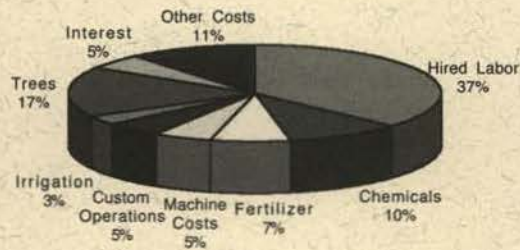
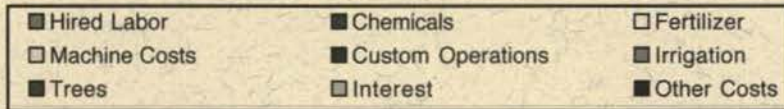
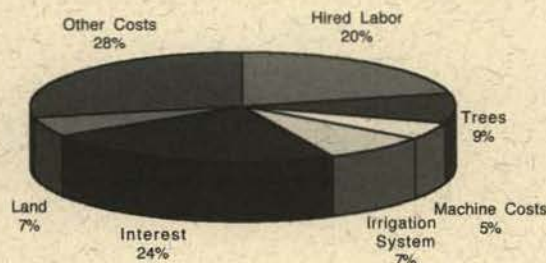
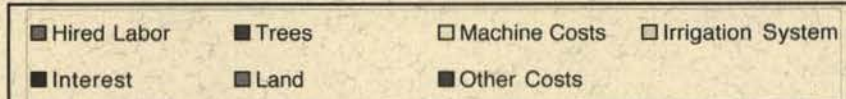


Figure 3. Cumulative Operating and Ownership Costs Per Acre for Red Delicious Apples. Establishment (Years 1-6)



Appendix A. Ownership Cost Calculations

Ownership costs for an asset lasting more than one year must be allocated over its useful life to derive an annual ownership cost. Ownership costs include both the decline in value over time based on expected use or obsolescence (depreciation) and the opportunity interest on the value of the asset. Ownership costs also include property tax and casualty insurance.

The following methods for calculating depreciation and interest and for calculating taxes and insurance are consistent with the recommendations of the National Task Force on Commodity Costs and Returns Measurement Methods sponsored by the American Agricultural Economics Association.

Depreciation and Interest

Depreciation and interest were calculated using the annual equivalent capital recovery technique. This method is recommended over the estimation technique using straight-line depreciation (repayment) plus return on the average investment.

$$\begin{aligned} \text{Depreciation and Interest} &= B^{(a/p)} - V^{(a/f)} \\ \text{where: } B &= \text{initial investment} \\ V &= \text{salvage value} \\ i &= \text{interest rate in decimal form} \\ n &= \text{years of useful life} \\ (a/p) = i(1+i)^n / [(1+i)^n - 1] &= \text{uniform series end-of-period amount} \\ & \quad \text{(a) equivalent to present sum (p); or capital} \\ & \quad \text{recovery factor.} \\ (a/f) = i / [(1+i)^n - 1] &= \text{uniform series end of period amount} \\ & \quad \text{(a) equivalent to future sum (f); or sinking fund} \\ & \quad \text{factor.} \end{aligned}$$

Source: Thuesen, H. G., W. J. Fabrycky, and G. J. Thuesen. 1971. *Engineering Economy*. New York: Prentice-Hall.

Taxes and Insurance

Insurance

The property tax and insurance cost calculations were made using rates of 1.0 and 0.6 percent respectively, applied to the average level of investment.

$$\begin{aligned} \text{Insurance} &= I[(B+V)/2] & \text{Taxes} &= T[B+V/2] \\ \text{where: } B &= \text{initial investment} & \text{where: } B &= \text{initial investment} \\ V &= \text{salvage value} & V &= \text{salvage value} \\ I &= \text{insurance rate} & T &= \text{personal property tax rate} \end{aligned}$$

Appendix B. Costs and Returns Estimate

Table B1. Costs And Returns Per Acre to Establish Red Delicious Apples - Year 1

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	0.00	bin	95.00	0.00	_____
Total Gross Returns for Apples				<u>0.00</u>	_____
Operating Costs					
Custom:					
Tree removal	1.00	acre	250.00	250.00	_____
Root removal	1.00	acre	50.00	50.00	_____
Ripping	1.00	acre	110.00	110.00	_____
Plow	1.00	acre	21.50	21.50	_____
Disc	2.00	acre	8.00	16.00	_____
Seed and harrow	1.00	acre	9.00	9.00	_____
Fumigant:					
Vapam	90.00	gal	4.00	360.00	_____
Fertilizer:					
Nitrogen	100.00	lb	0.35	35.00	_____
Phosphate	60.00	lb	0.24	14.40	_____
Potash	60.00	lb	0.14	8.40	_____
Sulfur	60.00	lb	0.15	9.00	_____
Tree:					
Trees (Red Delicious)	250.00	tree	5.50	1375.00	_____
Pollenizer trees	22.00	tree	5.50	121.00	_____
Rent:					
Planter attachment	1.00	acre	37.50	37.50	_____
Tree aids:					
Tree wraps	250.00	tree	0.06	15.00	_____
Spreader sticks	1250.00	each	0.20	140.00	_____
Herbicide:					
Gramoxone	1.89	qt	8.78	16.59	_____
Water:					
Irrigation power	36.00	acre	0.69	24.84	_____
Assessments	1.00	acre	30.00	30.00	_____
Seed:					
Grass seed	20.00	lb	1.55	31.00	_____
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	_____
Labor (machine)	8.79	hrs	7.20	63.30	_____
Labor (non-machine)	51.70	hrs	7.20	372.24	_____
Fuel - gas	20.00	gal	1.38	27.60	_____
Fuel - diesel	8.55	gal	0.88	7.53	_____
Lube				5.26	_____
Machinery Repair				16.88	_____
Interest on Operating Capital @ 9.50%				220.11	_____
Total Operating Costs/Acre				<u>3392.14</u>	_____
Net Returns Above Operating Costs				-3392.14	_____
Cash Ownership Costs					
Overhead				86.97	_____
Property taxes (machinery)				34.78	_____
Property insurance				7.39	_____
Investment repairs				44.50	_____
Total Cash Ownership Costs/Acre				<u>173.64</u>	_____
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	_____
Miscellaneous tools and equipment				116.84	_____
Land				180.00	_____
Machinery				41.98	_____
Total Non-Cash Ownership Costs/Acre				<u>481.35</u>	_____
Total Costs/Acre				4047.13	_____
Returns to Risk and Management				-4047.13	_____

Table B2. Costs And Returns Per Acre to Establish Red Delicious Apples - Year 2

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	0.00	bin	95.00	0.00	
Total Gross Returns for Apples				0.00	
Operating Costs					
Fertilizer:					
Nitrogen	200.00	lb	0.35	68.00	
Phosphate	120.00	lb	0.24	28.20	
Potash	80.00	lb	0.14	11.20	
Sulfur	120.00	lb	0.15	18.00	
Micro nutrients	2.00	acre	12.00	24.00	
Insecticide:					
Lorsban 4E	2.00	qt	12.13	24.26	
Oil	3.00	gal	3.00	9.00	
Pollinate:					
Hive rental	1.00	acre	15.00	15.00	
Tree aids:					
Spreader sticks	2000.00	each	0.09	180.00	
Tree:					
Trees (Red Delicious)	2.00	tree	5.50	11.00	
Herbicide:					
Gramoxone	1.89	qt	8.78	16.59	
Water:					
Irrigation power	36.00	acre	0.69	24.84	
Assessments	1.00	acre	30.00	30.00	
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	
Labor (machine)	8.87	hrs	7.20	63.87	
Labor (non-machine)	36.45	hrs	7.20	262.44	
Fuel - gas	20.00	gal	1.38	27.60	
Fuel - diesel	7.44	gal	0.88	6.55	
Lube				5.12	
Machinery Repair				19.02	
Interest on Operating Capital @ 9.50%				51.49	
Total Operating Costs/Acre				901.16	
Net Returns Above Operating Costs				-901.16	
Cash Ownership Costs					
Overhead				24.69	
Property taxes (machinery)				35.10	
Property insurance				7.55	
Investment repairs				44.50	
Total Cash Ownership Costs/Acre				111.84	
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	
Miscellaneous tools and equipment				116.85	
Land				180.00	
Interest on carryover				364.00	
Machinery				50.61	
Total Non-Cash Ownership Costs/Acre				853.99	
Total Costs/Acre				1866.98	
Returns to Risk and Management				-1866.98	

Table B3. Costs And Returns Per Acre to Establish Red Delicious Apples - Year 3

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	0.00	bin	95.00	0.00	
Total Gross Returns for Apples				0.00	
Operating Costs					
Fertilizer:					
Nitrogen	100.00	lb	0.35	35.00	
Phosphate	60.00	lb	0.24	14.40	
Potash	60.00	lb	0.14	8.40	
Sulfur	40.00	lb	0.15	6.00	
Micro nutrients	2.00	acre	24.00	48.00	
Insecticide:					
Lorsban 4E	2.00	qt	12.13	24.26	
Oil	3.00	gal	3.00	9.00	
Pollinate:					
Hive rental	1.00	acre	15.00	15.00	
Tree:					
Trees (Red Delicious)	1.00	tree	5.50	5.50	
Tree aids:					
Spreader stick 48"	800.00	each	0.30	240.00	
Herbicide:					
Gramoxone	1.89	qt	8.78	16.59	
Water:					
Irrigation power	36.00	acre	0.69	24.84	
Assessments	1.00	acre	30.00	30.00	
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	
Labor (machine)	8.87	hrs	7.20	63.87	
Labor (non-machine)	51.95	hrs	7.20	374.04	
Fuel - gas	20.00	gal	1.38	27.60	
Fuel - diesel	7.44	gal	0.88	6.55	
Lube				5.12	
Machinery Repair				19.02	
Interest on Operating Capital @ 9.50%				55.85	
Total Operating Costs/Acre				1034.01	
Net Returns Above Operating Costs				-1034.01	
Cash Ownership Costs					
Overhead				28.02	
Property taxes (machinery)				35.10	
Property insurance				7.55	
Investment repairs				44.50	
Total Cash Ownership Costs/Acre				115.17	
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	
Miscellaneous tools and equipment				116.84	
Land				180.00	
Interest on carryover				532.00	
Machinery				50.61	
Total Non-Cash Ownership Costs/Acre				1021.98	
Total Costs/Acre				2171.16	
Returns to Risk and Management				-2171.16	

Table B4. Costs And Returns Per Acre to Establish Red Delicious Apples - Year 4

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	10.00	bin	95.00	950.00	
Total Gross Returns for Apples				950.00	
Operating Costs					
Fertilizer:					
Nitrogen	40.00	lb	0.35	14.00	
Phosphate	60.00	lb	0.24	14.40	
Potash	40.00	lb	0.14	5.60	
Sulfur	60.00	lb	0.15	9.00	
Micro nutrients	2.00	acre	24.00	48.00	
Insecticide:					
Lorsban 4E	2.00	qt	12.13	24.26	
Oil	3.00	gal	3.00	9.00	
Guthion	2.00	lb	7.10	14.20	
Stopit calcium	1.00	gal	6.50	6.50	
Provado	4.00	oz	3.52	14.08	
Pollinate:					
Hive rental	1.00	acre	15.00	15.00	
Tree aids:					
Spreader stick 48"	800.00	each	0.30	240.00	
Herbicide:					
Gramoxone	1.89	qt	8.78	16.59	
Water:					
Irrigation power	36.00	acre	0.69	24.84	
Assessments	1.00	acre	30.00	30.00	
Harvest:					
Pick apples	10.00	bin	12.00	120.00	
Rent:					
Forklift, rental	1.00	acre	12.00	12.00	
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	
Labor (machine)	13.06	hrs	7.20	94.00	
Labor (non-machine)	55.95	hrs	7.20	402.84	
Fuel - gas	20.00	gal	1.38	27.60	
Fuel - diesel	16.80	gal	0.88	14.79	
Lube				6.35	
Machinery Repair				24.98	
Interest on Operating Capital @ 9.50%				34.23	
Total Operating Costs/Acre				1227.22	
Net Returns Above Operating Costs				-277.22	
Cash Ownership Costs					
Overhead				32.94	
Property taxes (machinery)				36.45	
Property insurance				8.22	
Investment repairs				45.70	
Total Cash Ownership Costs/Acre				123.31	
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	
Miscellaneous tools and equipment				122.00	
Land				180.00	
Interest on carryover				728.00	
Machinery				74.62	
Total Non-Cash Ownership Costs/Acre				1247.15	
Total Costs/Acre				2597.68	
Total Costs/Bin				259.80	
Returns to Risk and Management				-1647.68	

Table B5. Costs And Returns Per Acre to Establish Red Delicious Apples - Year 5

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	15.00	bin	95.00	1425.00	
Total Gross Returns for Apples				1425.00	
Operating Costs					
Fertilizer:					
Nitrogen	40.00	lb	0.35	14.00	
Phosphate	60.00	lb	0.24	14.40	
Potash	40.00	lb	0.14	5.60	
Sulfur	60.00	lb	0.15	9.00	
Micro nutrients	3.00	acre	24.00	72.00	
Insecticide:					
Lorsban 4E	2.00	qt	12.75	25.50	
Oil	3.00	gal	3.00	9.00	
Provado	5.00	oz	3.52	17.60	
Guthion	4.00	lb	7.10	28.40	
Thiadan	2.00	lb	6.65	13.30	
Stopit calcium	1.00	gal	6.50	6.50	
Pollinate:					
Hive rental	1.00	acre	15.00	15.00	
Water:					
Irrigation power	36.00	acre	0.69	24.84	
Assessments	1.00	acre	30.00	30.00	
Herbicide:					
Roundup	3.75	qt	13.25	49.69	
Rent:					
Forklift, rental	1.00	acre	12.00	12.00	
Harvest:					
Pick fruit	15.00	bin	12.00	180.00	
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	
Labor (machine)	15.14	hrs	7.20	109.02	
Labor (non-machine)	59.45	hrs	7.20	428.04	
Fuel - gas	20.00	gal	1.38	27.60	
Fuel - diesel	22.88	gal	0.88	20.14	
Lube				7.15	
Machinery Repair				28.70	
Interest on Operating Capital @ 9.50%				33.66	
Total Operating Costs/Acre				1186.10	
Net Returns Above Operating Costs				238.90	
Cash Ownership Costs					
Overhead				32.03	
Property taxes (machinery)				39.59	
Property insurance				9.80	
Investment repairs				45.70	
Total Cash Ownership Costs/Acre				127.12	
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	
Miscellaneous tools and equipment				175.24	
Land				180.00	
Interest on carryover				876.00	
Machinery				89.47	
Total Non-Cash Ownership Costs/Acre				1463.24	
Total Costs/Acre				2776.46	
Total Costs/Bin				185.10	
Returns to Risk and Management				-1351.46	

Table B6. Costs And Returns Per Acre to Establish Red Delicious Apples - Year 6

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	20.00	bin	95.00	1900.00	
Total Gross Returns for Apples				1900.00	
Operating Costs					
Fertilizer:					
Nitrogen	20.00	lb	0.35	7.00	
Phosphate	60.00	lb	0.24	14.40	
Potash	40.00	lb	0.14	5.60	
Sulfur	60.00	lb	0.15	9.00	
Micro nutrients	3.00	acre	24.00	72.00	
Insecticide:					
Lorsban 4E	2.00	qt	12.13	24.26	
Oil	3.00	gal	3.00	9.00	
Provado	5.00	oz	3.52	17.60	
Guthion	4.00	lb	7.10	28.40	
Thiadan	2.00	lb	6.65	13.30	
Stopit calcium	1.00	gal	6.50	6.50	
Chemical thin:					
Sevin	1.00	lb	3.00	3.00	
NAA 200	0.30	pint	11.88	3.56	
Pollinate:					
Hive rental	1.00	acre	15.00	15.00	
Water:					
Irrigation power	36.00	acre	0.69	24.84	
Assessments	1.00	acre	30.00	30.00	
Herbicide:					
Roundup	3.75	qt	13.25	49.69	
Rent:					
Forklift, rental	2.00	acre	12.00	24.00	
Harvest:					
Pick fruit	20.00	bin	12.00	240.00	
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	
Labor (machine)	17.00	hrs	7.20	122.40	
Labor (non-machine)	65.70	hrs	7.20	473.04	
Fuel - gas	20.00	gal	1.38	27.60	
Fuel - diesel	27.07	gal	0.88	23.82	
Lube				7.71	
Machinery Repair				31.52	
Interest on Operating Capital @ 9.50%				36.06	
Total Operating Costs/Acre				1324.26	
Net Returns Above Operating Costs				575.74	
Cash Ownership Costs					
Overhead				35.51	
Property taxes (machinery)				40.10	
Property insurance				10.05	
Investment repairs				45.70	
Total Cash Ownership Costs/Acre				131.36	
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	
Miscellaneous tools and equipment				175.24	
Land				180.00	
Interest on carryover				998.00	
Machinery				99.75	
Total Non-Cash Ownership Costs/Acre				1595.52	
Total Costs/Acre				3051.14	
Total Costs/Bin				152.56	
Returns to Risk and Management				-1151.14	

Table B7. Costs And Returns Per Acre to Produce Red Delicious Apples - Full Production

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Red Delicious Apples	40.00	bin	95.00	3800.00	
Total Gross Returns for Apples				3800.00	
Operating Costs					
Fertilizer:					
Nitrogen	20.00	lb.	0.33	6.60	
Phosphate	60.00	lb	0.23	13.80	
Potash	40.00	lb	0.14	5.60	
Sulfur	60.00	lb	0.15	9.00	
Micro nutrients	3.00	acre	24.00	72.00	
Insecticide:					
Lorsban 4E	2.00	qt	12.13	24.26	
Oil	3.00	gal	3.00	9.00	
Guthion	6.00	lb	7.10	42.60	
Thiadan	2.00	lb	6.65	13.30	
Provado	5.00	oz	3.52	17.60	
Stopit calcium	3.00	gal	6.50	19.50	
Omite	6.00	lb	5.50	33.00	
Chemical thin:					
Sevin	3.00	lb	3.00	9.00	
NAA 200	1.30	pint	11.88	15.44	
Pollinate:					
Hive rental	1.00	acre	15.00	15.00	
Water:					
Irrigation power	36.00	acre	0.69	24.84	
Assessments	1.00	acre	30.00	30.00	
Herbicide:					
Roundup	3.75	qt	13.25	49.69	
Rent:					
Forklift, rental	2.00	acre	12.00	24.00	
Bins	8.00	bin	4.00	32.00	
Harvest:					
Pick fruit	40.00	bin	12.00	480.00	
Rodenticide:					
Rodent control	1.00	acre	5.00	5.00	
Labor (machine)	23.37	hrs	7.20	168.26	
Labor (non-machine)	87.70	hrs	7.20	631.44	
Fuel - gas	20.00	gal	1.38	27.60	
Fuel - diesel	42.95	gal	0.88	37.79	
Lube				9.80	
Machinery Repair				40.12	
Interest on Operating Capital @ 9.50%				46.92	
Total Operating Costs/Acre				1913.11	
Net Returns Above Operating Costs				1886.89	
Cash Ownership Costs					
Overhead				50.24	
Property taxes (machinery)				41.97	
Property insurance				10.99	
Investment repairs				45.70	
Total Cash Ownership Costs/Acre				148.90	
Non-Cash Ownership Costs (Depreciation and Interest)					
Irrigation system				142.53	
Miscellaneous tools and equipment				175.23	
Land				180.00	
Amortized establishment cost				1517.86	
Machinery				137.41	
Total Non-Cash Ownership Costs/Acre				2153.03	
Total Costs/Acre				4215.04	
Total Costs/Bin				105.38	
Returns to Risk and Management				-415.04	

Appendix C. Cash Flow, Years 1-7

Table C1. Monthly Summary of Cash Expenses per Acre for Red Delicious Apples - Establishment Year 1

	Sep 96	Oct 96	Nov 96	Dec 96	Jan 97	Feb 97	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Total
Land Prep:															
Tree removal	250.00														250.00
Root removal	50.00														50.00
Ripping		110.00													110.00
Plow		21.50													21.50
Total Land Prep Costs	300.00	131.50													431.50
Plant:															
Plant trees						1627.65									1627.65
Plant grass seed													40.00		40.00
Total Plant Costs						1627.65							40.00		1667.65
Cultural:															
Disc		16.00													16.00
Fumigate		360.00													360.00
Mark rows						10.03									10.03
Fertilize						77.60									77.60
Protect trees						51.00									51.00
Branch training									86.00	140.40					226.40
Weed control									14.06	14.06	14.06				42.19
Irrigate									112.44						112.44
Hand hoeing									28.80	28.80	28.80				86.40
Pickup use												78.61			78.61
Rodent control													12.20		12.20
Total Cultural Costs		376.00				138.63			241.30	183.26	42.86	78.61	12.20		1072.87
Interest on Operating Capital	2.38	6.39	6.39	6.39	6.39	6.39	20.38	20.38	22.29	23.74	24.08	24.70	25.11	25.11	220.11
Operating Costs/Acre	302.38	513.89	6.39	6.39	6.39	6.39	1786.66	20.38	263.59	207.00	66.94	103.31	77.31	25.11	3392.14
Cash Ownership															
Cash overhead	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25			86.97
Property taxes (machinery)				17.39											34.78
Property insurance				3.70											7.39
Investment repairs	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71			44.50
Cash Ownership Costs	10.96	10.96	10.96	32.04	10.96	10.96	10.96	10.96	10.96	32.04	10.96	10.96			173.64
Total Cash Costs/Acre	313.33	524.85	17.35	38.43	17.35	17.35	1797.62	31.33	274.55	239.04	77.90	114.26	77.31	25.11	3565.78

Table C2. Monthly Summary of Cash Expenses Per Acre for Red Delicious Apples - Establishment Year 2

	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Total
Cultural:													
Fertilize	147.00												147.00
Dormant spray	39.93												39.93
Pollinate trees			15.00										15.00
Branch training			266.40	36.00									302.40
Tree replacement				14.60									14.60
Hand hoe				36.00									36.00
Weed control				14.06	14.06	14.06							42.19
Irrigate				112.44									112.44
Mow row centers				5.98		5.98							11.96
Spray nutrients				18.67		18.67							37.33
Pickup use						78.61							78.61
Rodent control							12.20						12.20
Total Cultural Costs	186.93		281.40	237.75	14.06	117.32	12.20						849.66
Interest on Operating Capital	1.48	1.48	3.71	5.59	5.70	6.63	6.73	6.73	6.73	6.73			51.49
Operating Costs/Acre	188.41	1.48	285.11	243.34	19.76	123.95	18.93	6.73	6.73	6.73			901.16
Cash Ownership													
Cash ownership	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	24.69
Property taxes (machinery)				17.55						17.55			35.10
Property insurance				3.77						3.77			7.55
Investment repairs	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	44.50
Cash Ownership Costs	5.77	5.77	5.77	27.09	5.77	5.77	5.77	5.77	5.77	27.09	5.77	5.77	111.84
Total Cash Costs/Acre	194.17	7.25	290.87	270.43	25.53	129.72	24.69	12.49	12.49	33.82	5.77	5.77	1012.99

Table C3. Monthly Summary of Cash Expenses per Acre for Red Delicious Apples - Establishment Year 3

	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Total
Cultural:													
Fertilize	74.60												74.60
Dormant spray	39.93												39.93
Pollinate trees			15.00										15.00
Branch training			158.40	362.40									520.80
Tree replacement				9.10									9.10
Weed control				14.06	14.06	14.06							42.19
Irrigate				112.44									112.44
Mow row centers				5.98		5.98							11.96
Spray nutrients				30.67		30.67							61.33
Pickup use						78.61							78.61
Rodent control							12.20						12.20
Total Cultural Costs	114.53		173.40	534.65	14.06	129.32	12.20						978.16
Interest on Operating Capital	0.91	0.91	2.28	6.51	6.62	7.65	7.74	7.74	7.74	7.74			55.85
Operating Costs/Acre	115.43	0.91	175.68	541.16	20.69	136.97	19.94	7.74	7.74	7.74			1034.01
Cash Ownership													
Cash overhead	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	28.02
Property taxes (machinery)				17.55						17.55			35.10
Property insurance				3.77						3.77			7.55
Investment repairs	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	44.50
Cash Ownership Costs	6.04	6.04	6.04	27.37	6.04	6.04	6.04	6.04	6.04	27.37	6.04	6.04	115.17
Total Cash Costs/Acre	121.48	6.95	181.72	568.53	26.73	143.01	25.99	13.79	13.79	35.11	6.04	6.04	1149.18

Table C4. Monthly Summary of Cash Expenses Per Acre for Red Delicious Apples - Establishment Year 4

	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Total
Cultural:													
Fertilize	53.80												53.80
Dormant spray	39.98												39.98
Pollinate trees			15.00										15.00
Branch training			100.80	362.40									463.20
Cover spray				27.37									27.37
Hand thinning				57.60									57.60
Aphid spray				20.75									20.75
Weed control				14.06	14.06	14.06							42.19
Irrigate				126.84									126.84
Mow row centers				5.98	5.98	5.98							17.94
Spray nutrients				30.05		30.67							60.71
Pickup use						78.61							78.61
Rodent control							12.20						12.20
Total Cultural Costs	93.78		115.80	645.04	20.04	129.32	12.20						1016.19
Harvest:													
Pick fruit							171.03						171.03
Haul apples							5.77						5.77
Total Harvest Costs							176.80						176.80
Interest on Operating Capital	0.74	0.74	1.66	6.77	6.92	7.95	9.44						34.23
Operating Costs/Acre	94.53	0.74	117.46	651.81	26.97	137.27	198.44						1227.22
Cash Ownership													
Cash overhead	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	32.94
Property taxes (machinery)				18.22						18.22			36.45
Property insurance				4.11						4.11			8.22
Investment repairs	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	45.70
Cash Ownership Costs	6.55	6.55	6.55	28.89	6.55	6.55	6.55	6.55	6.55	28.89	6.55	6.55	123.31
Total Cash Costs/Acre	101.08	7.30	124.01	680.70	33.52	143.82	205.00	6.55	6.55	28.89	6.55	6.55	1350.53

Table C5. Monthly Summary of Cash Expenses per Acre for Red Delicious Apples - Establishment Year 5

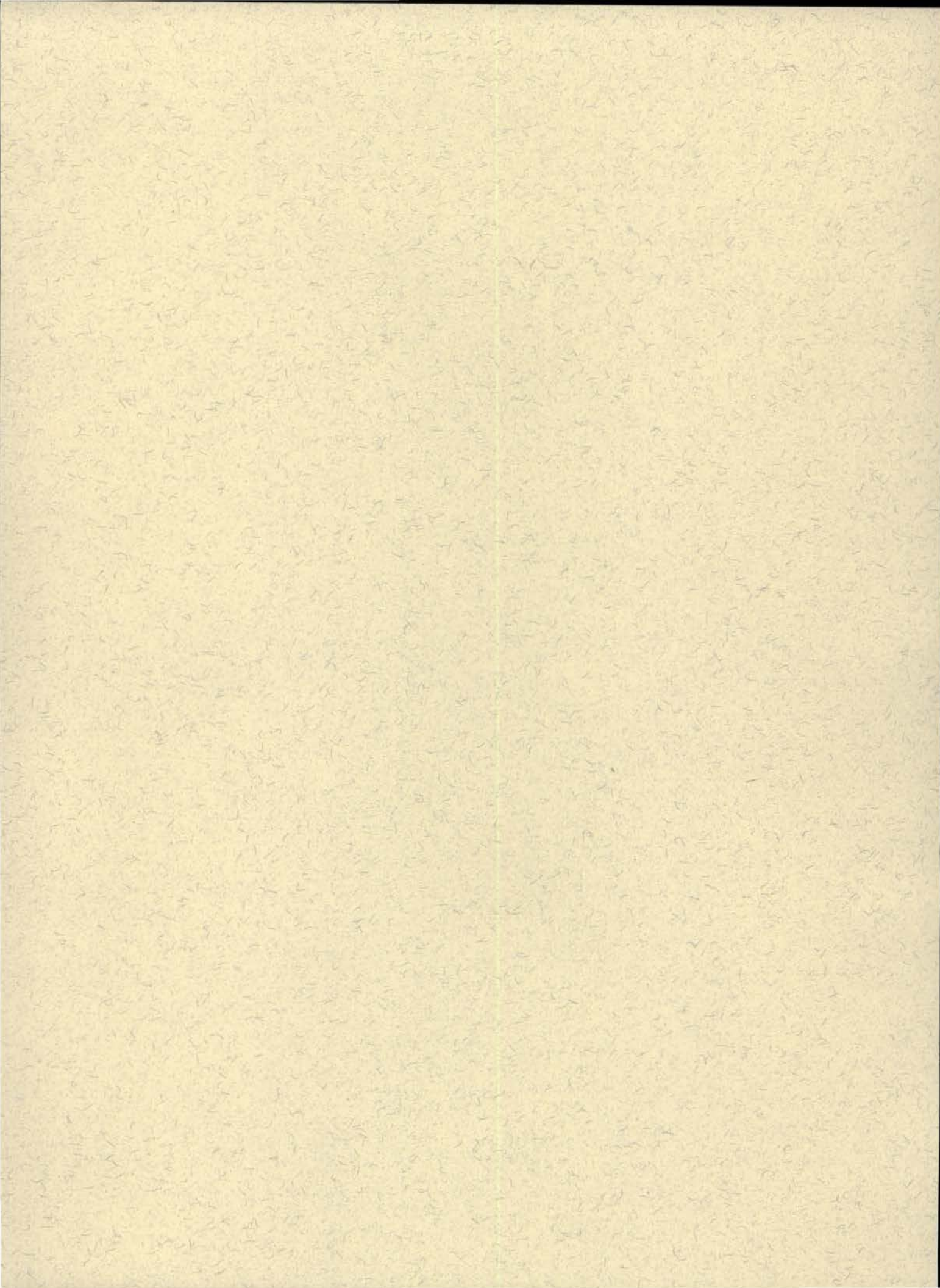
	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Total
Cultural:													
Prune trees	144.00												144.00
Fertilize	53.80												53.80
Dormant spray	41.17												41.17
Pollinate trees			15.00										15.00
Spray nutrients			30.72	30.72	30.67								92.11
Aphid spray				24.27									24.27
Irrigate				112.44									112.44
Hand thin				165.60									165.60
Weed control				25.09	25.09	25.09							75.28
Mow row centers				5.98	5.98	5.98							17.94
Cover spray				34.17	27.42								61.59
Pickup use						78.61							78.61
Rodent control							12.20						12.20
Total Cultural Costs	238.97		45.72	398.27	89.17	109.69	12.20						894.01
Harvest:													
Pick fruit							249.72						249.72
Haul apples							8.71						8.71
Total Harvest Costs							258.43						258.43
Interest on Operating Capital	1.89	1.89	2.25	5.41	6.11	6.98	9.12						33.66
Operating Costs/Acre	240.86	1.89	47.98	403.68	95.28	116.67	279.75						1186.10
Cash Ownership													
Cash overhead	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	32.03
Property taxes (machinery)				19.80						19.80			39.59
Property insurance				4.90						4.90			9.80
Investment repairs	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	45.70
Cash Ownership Costs	6.48	6.48	6.48	31.17	6.48	6.48	6.48	6.48	6.48	31.17	6.48	6.48	127.12
Total Cash Costs/Acre	247.34	8.37	54.45	434.85	101.76	123.14	286.23	6.48	6.48	31.17	6.48	6.48	1313.22

Table C6. Monthly Summary of Cash Expenses per Acre for Red Delicious Apples - Establishment Year 6

	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Total
Cultural:													
Prune trees	158.40												158.40
Fertilize	46.80												46.80
Dormant spray	39.93												39.93
Thin with chemicals		13.23											13.23
Pollinate trees			15.00										15.00
Spray nutrients			30.72	30.72	30.72								92.17
Aphid spray				24.32									24.32
Irrigate				112.44									112.44
Hand thin				187.20									187.20
Weed control				25.09	25.09	25.09							75.28
Mow row centers				5.98	5.98	5.48							17.44
Cover spray				34.22	27.37								61.59
Pickup use						78.61							78.61
Rodent control							12.20						12.20
Total Cultural Costs	245.13	13.23	45.72	419.99	89.17	109.18	12.20						934.61
Harvest:													
Pick fruit							342.05						342.05
Haul apples							11.53						11.53
Total Harvest Costs							353.58						353.58
Interest on Operating Capital	1.94	2.05	2.41	5.73	6.44	7.30	10.20						36.06
Operating Costs/Acre	247.07	15.28	48.13	425.72	95.60	116.48	375.98						1324.26
Cash Ownership													
Cash overhead	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	35.51
Property taxes (machinery)				20.05						20.05			40.10
Property insurance				5.03						5.03			10.05
Investment repairs	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	45.70
Cash Ownership Costs	6.77	6.77	6.77	31.84	6.77	6.77	6.77	6.77	6.77	31.84	6.77	6.77	131.36
Total Cash Costs/Acre	253.83	22.04	54.90	457.56	102.37	123.25	382.75	6.77	6.77	31.84	6.77	6.77	1455.62

Table C7. Monthly Summary of Cash Expenses per Acre for Red Delicious Apples - Full Production

	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Total
Cultural:													
Prune trees	201.60												201.60
Fertilize	45.80												45.80
Dormant spray	39.98												39.98
Thin with chemicals		19.23											19.23
Pollinate trees			15.00										15.00
Cover spray			34.22	27.37	60.42								122.01
Spray nutrients			30.67	30.72	30.67								92.06
Aphid spray				24.32									24.32
Irrigate				112.44									112.44
Hand thin				288.00									288.00
Weed control				25.09	25.09	25.09							75.28
Mow row centers				5.98	5.98	5.48							17.44
Pickup use						78.61							78.61
Stop drop spray						25.05							25.05
Rodent control							8.60						8.60
Total Cultural Costs	287.38	19.23	79.89	513.93	122.17	134.23	8.60						1165.43
Harvest:													
Pick fruit							677.70						677.70
Haul apples							23.06						23.06
Total Harvest Costs							700.76						700.76
Interest on Operating Capital	2.28	2.43	3.06	7.13	8.10	9.16	14.77						46.92
Operating Costs/Acre	289.66	21.66	82.95	521.06	130.26	143.39	724.14						1913.11
Cash Ownership													
Cash overhead	4.19	4.19	4.19	4.19	4.19	4.19	4.19	4.19	4.19	4.19	4.19	4.19	50.24
Property taxes (machinery)				20.99						20.99			41.97
Property insurance				5.49						5.49			10.99
Investment repairs	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	3.81	45.70
Cash Ownership Costs	8.00	8.00	8.00	34.47	8.00	8.00	8.00	8.00	8.00	34.47	8.00	8.00	148.90
Total Cash Costs/Acre	297.65	29.65	90.94	555.53	138.26	151.38	732.13	8.00	8.00	34.47	8.00	8.00	2062.01



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