

# **Economic Analysis of Apple Orchard Management Systems with Three Varieties in Central Washington**



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## **Preface**

### **About the Authors and Project**

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# **Economic Analysis of Apple Orchard Management Systems with Three Varieties in Central Washington**

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## **INTRODUCTION**

Many producing apple orchards in central Washington are of older, less profitable varieties or strains and are past their most productive years. Growers who wish to remain in business must replant these orchards.

Replanting poses several interrelated problems. Initial expenses are considerable: removing old trees, preparing the ground, and purchasing and planting of new trees. Therefore, a long wait for production can lead to large interest costs. Given these factors, many growers are considering replacing their older blocks with higher value varieties and higher density growing systems using precocious rootstocks in an effort to recover their establishment costs more quickly. To capture higher prices while supplies of new varieties are low, growers need to achieve high production as soon as possible after planting.

This study evaluates the relative profitability of orchard management systems based on their performance in an orchard systems trial at the Washington State University Tree Fruit Research and Extension Center (TFREC) in Wenatchee. This trial, planted in 1987, included (1) the freestanding central leader growing system with 324 trees per acre, (2) the vertical axis growing system with 514 trees per acre, and (3) the slender spindle growing system with 772 trees per acre. These orchard systems were established in the trial with three varieties; Delicious (Redchief Mercier), Gala (Imperial) and Jonagold (Nicobel), each with several rootstocks. A total of 22 system/variety/rootstock combinations were included (Table 1). Each combination was planted as a 4- to 6-tree plot which was replicated 4 times in a randomized complete block design. The first six years of establishment, management, and production are evaluated in this study.

The traditional freestanding low density central leader system was included to serve as a control. However, the results can also be used to determine if a freestanding central leader system (with new, precocious rootstocks and varieties planted at a somewhat higher tree density than is traditional) is a viable alternative.

Much of the research at TFREC involves looking for techniques to achieve high early production; the assumption being that high early production equals profitability. Instead of traditional vigorous rootstocks and wide tree spacing, dwarfing or semi-dwarfing rootstocks were used in the TFREC trial: (1) to keep trees small and permit higher densities, (2) to reduce labor costs by eliminating the need for ladders, (3) to make trees intercept and distribute sunlight efficiently, and (4) to encourage early cropping. Dwarfing rootstocks are precocious. Planting dwarf trees at high densities increases early production per acre. Input and production data

were collected to analyze the economic potential of each of the 22 system/variety/rootstock combinations. A primary purpose of this orchard trial was to determine if horticultural technologies (vertical axis and slender spindle management systems) which have been used successfully in other apple growing regions can be adapted to Washington growing conditions.

TABLE 1. Variety/Rootstock Combinations for Three Orchard Systems in the Orchard Systems Trial at the Washington State University Tree Fruit Research and Extension Center, Wenatchee.

<b>Orchard Management System</b>		
<u>Central Leader</u> <u>364 Trees/Acre</u>	<u>Vertical Axis</u> <u>519 Trees/Acre</u>	<u>Slender Spindle</u> <u>772 Trees/Acre</u>
Gala/M.26	Gala/M.26	Gala/M.9
Gala/M.7	Gala/M.7	Gala/B.9
Jonagold/M.26	Jonagold/M.26	Gala/Mark
Jonagold/M.7	Jonagold/M.7	Gala/P.2
Delicious/M.26	Delicious/M.26	Jonagold/M.9
Delicious/M.7	Delicious/M.7	Jonagold/B.9
		Jonagold/Mark
		Jonagold/P.2
		Delicious/M.9
		Delicious/B.9

### **Sources of Information**

The data in this study were taken primarily from the TFREC production records of the orchard systems trial established in 1987. When figures were not available, industry and extension sources were used to determine a measure of the industry standard.

Data from the trials included planting, pruning and training times, all labor and machinery use, training materials, actual fruit production, and chemicals used and times applied. Prices for materials used were provided by agricultural suppliers in the Wenatchee area.

### **Budget Parameters**

The following facts and assumptions were adopted and used to generate the budgets:

1. A solid set under-tree irrigation system was installed at a cost of \$1,425 per acre consisting of \$550 for an irrigation pump and mainlines and \$875 per acre for other materials. The system has a 20-year life.

2. Land, excluding trees, has a value of \$2,750 per acre.
3. The required return on investment, which includes returns to equity, is 9 % . Land is expected to appreciate an average of 3 % per year, therefore, the required rate of return on land is 6%.
4. No management fees are charged.
5. Machinery and buildings are valued at replacement cost. This figure may overstate production costs but is a reasonable reflection of the enterprise's ability to generate the dollars needed to replace assets as needed. Because this study examines the long-term viability of an orchard enterprise, the ability to replace depreciable assets should be considered.
6. When there was a choice between two materials that could perform the same function, for example, 12-inch notched spreaders and 12-inch nail type spreaders, the least expensive alternative was chosen. Similarly, less expensive bulk chemicals and fertilizers were chosen.
7. Each orchard system combination, with the exception of those with Delicious, were sprayed with Rally to prevent mildew. Delicious is not treated for mildew since it is highly resistant.
8. Input prices used are retail prices as of July 15, 1993.
9. Returns presented are pre-tax returns. Income tax effects are not considered in the budgets even though they will impact the net return the grower will realize. It is unlikely, however, that income tax effects will affect the ranking of the profitability of the systems analyzed.
10. Because the budgets created are for a perennial crop, in the early years a large percentage of the fixed cost in the annual budgets are interest on accumulated establishment cost. In each of the early years, interest on the net accumulated establishment cost is carried forward to the next year at a 9 % interest rate to reflect the cost of investing the money in orchard establishment. Establishment cost for any given year is the sum of the net costs minus returns. Once annual returns exceed annual cost, the net establishment cost of the orchard begins to be paid off. In the payback break-even year, net accumulated establishment cost has been reduced to zero.
11. Because packout records were not kept, price per bin for each variety was estimated using the July 1993 Grower's Clearinghouse price for the 1992 apple crop. From this price, the packing and storage costs were deducted based on the percentage of each variety that is packed and stored in each manner. Because the Grower's Clearinghouse price is a fresh market price, the prices were reduced by 15 % to reflect a cullage rate. Culls were

assumed to have a net value of \$0. The resulting prices were: \$400 per bin for Gala, \$280 per bin for Jonagold, and \$160 for Delicious. The results cover the first 6 years of orchard life since complete data from TFREC is only available for 6 years.

## **Economic Analysis**

Actual 6-year orchard data and their underlying assumptions were used as a framework to compile enterprise budgets for years 1 through 6. The results of the budgets are presented in Appendix Tables 14 to 35 and provide a comparison of the total establishment cost and revenues from years 1 to 6 of each combination studied. These results were used as a framework to create computer spreadsheet models for break-even, net present value (NPV), and internal rate of return (IRR) comparisons in an effort to evaluate the relative profitability of each orchard system/variety/rootstock combination.

### **Break-Even Analysis**

The purpose of the break-even analysis is to project the year in which each orchard combination will break even given reasonable estimates of price and subsequent yields. In calculating the break-even year, only variable costs associated with harvest varies with the level of production. All other costs are assumed to be equal to year 6 costs; they do not change as the level of production increases.

The enterprise budgets that form the basis of the break-even analysis exist only for 6 years. Production costs for years 7 and beyond are estimated as follows. The orchard has achieved most of its vegetative growth by the end of the sixth year, therefore, chemical applications, training times, machine times and other costs in the following years can be reasonably approximated using the cost in year 6. These results do not take inflation of input prices into account. All input prices are kept at 1993 prices. Yields in years 7 through 20 are based on the estimated yields of each combination taking into account the system, variety, rootstock, and previous production. Revenue in years 7-20 are expected yields multiplied by expected price. The price used is assumed to be the same for all years of the orchard's life. Since the current price is likely to be an overstatement of prices in the long run, the analysis includes several prices to show the sensitivity of the results to changes in price.

Break-even analysis is used to determine the point at which total accumulated cost equals total accumulated revenue of a project, given certain price and yield assumptions. As a management tool, break-even analysis is useful because it is simple to apply, easy to understand, and is readily applicable to farm management.

An enterprise that breaks even early is more desirable than one with a long payback period. This is due to increased uncertainty of input and output prices and the cost of capital in future time periods. However, a drawback to using break-even as the sole means to rank orchard systems is that a system with a shorter payback

period may have lower total cash inflows over the life of the project than one with a longer payback period. Therefore, net present value and internal rate of return are included in our analysis because they take into consideration the timing of both cash inflows and cash outflows.

### **Net Present Value**

Net present value (NPV) analysis can be used to determine which of several investment opportunities will maximize wealth. The larger the NPV figure, the better the investment.

NPV analysis helps determine the profitability of an investment by taking the time value of money into account. The concept of time value of money is that a dollar today is worth more than a dollar that will be received some time in the future. A dollar today can be invested and earn interest or it can be consumed in some other fashion. The NPV method converts money flows that occur over a period of years into a single present value so that alternative investments with the same life, but with different annual cash flows, can be compared directly.

The concept of discounting is used to determine the present value of money earned in the future. The present value formula for a single time period is expressed as

$$\text{Present Value} = \frac{\text{Future Dollar Amount}}{(1+d)^n}$$

where "d" is the appropriate discount rate and "n" is the number of years before the amount being discounted is received.

The NPV of a stream of income to be received over a number of years can be calculated by

$$\text{NPV} = \sum_{n=1}^k \frac{(\text{Total Revenue} - \text{Total Cost})_n}{(1+d)^n}$$

where "k" is the expected life of the investment, "d" is the appropriate discount rate and "(Revenue - Cost)<sub>n</sub>" is the net revenue in time period "n".

In this study, NPV analysis was used to compare the profitability of all 22 system/variety/rootstock combinations. To avoid double counting, the interest on the accumulated establishment cost was subtracted before NPVs were calculated. Interest on accumulated establishment cost is an interest charge that is carried from one operating year to the next. Because NPV analysis takes into account annual interest on investments by using a discount rate, including an interest charge on the accumulated establishment cost would constitute double counting.



The choice of discount rate is determined by the investor's assumptions about inflation, risk, and earning potential of other investments. If a grower is financing the project internally, then the loan rate would be replaced by the grower's opportunity cost in the calculation. This study used a 9 % discount rate.

**Internal Rate of Return**

Like NPV, Internal Rate of Return (IRR) helps to determine the relative profitability of an investment. Both IRR and NPV are especially useful when costs and returns of the compared investments occur over a period of years. Where NPV is the dollar amount earned over the life of the enterprise, above or below the discount rate, the IRR is a measure of the actual percentage return the investment is making. When the discount rate and the IRR are the same, the NPV equals zero.

IRR and NPV do not necessarily rank combinations in the same order. A difference in ranking can occur because IRR and NPV calculations assume different returns on future earnings. The IRR of an investment assumes that future earnings are invested at the project's own IRR; therefore, it may apply too high a return to future earnings. NPV, however, assumes that future earnings are invested at the discount rate used in the analysis. Since future costs and revenues are discounted using an appropriate interest rate or opportunity cost, NPV is generally considered the better decision-making criterion.

In this study an IRR was calculated for each of the combinations under the cost, yield, and output price assumptions in the study. IRRs were also calculated under changing output price scenarios.

**CENTRAL LEADER ORCHARD SYSTEM**

This section presents the budget results and describes the horticultural practices for the first 6 years of the central leader combinations (Figure 1). The rootstocks M.7 EMLA and M.26 EMLA were used with varieties Gala, Jonagold and Delicious for the central leader growing system. Both rootstocks used were considered suitable for freestanding trees at the time this study was initiated. Tree density was 324 trees per acre with spacing of 8.2' x 16.4' . This is a higher tree density than occurs in many older commercial central leader orchards and reflects the less vigorous characteristic of M.26 and M.7 rootstocks as compared with rootstocks used in the past.

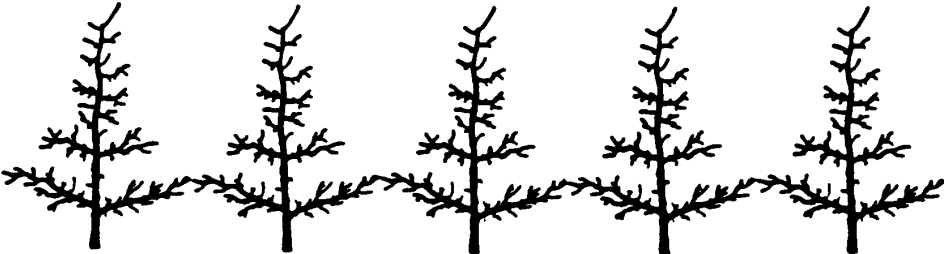


Figure 1. Freestanding central leader orchard system

## Horticultural Practices

Horticultural practices were the same for each combination studied unless stated otherwise. All combinations were planted on old orchard land. Therefore, in the fall prior to planting, the land was cleared, ripped and fumigated with methyl bromide.

The orchard site was marked and the trees were planted in March. The trees received two applications of urea, one shortly after planting and the other about 6 weeks later. Trees were irrigated on a calendar basis rather than as needed. A cover crop of grass was established during the first growing season. Weed-free strips were maintained with applications of Prowl and Gramoxone with X-77 used as a surfactant. The cover crop was mowed three times during the first summer.

No applications of fungicides were necessary during the first year. However, Thiodan 50WP was applied twice during the growing season for aphid control.<sup>1</sup> Wilco Gopher Bait (strychnine-treated milo) was used to control pocket gophers and ZP Ag Bait (zinc phosphide) was used for mouse control in the dormant season. There was no crop in year 1 for any of the combinations.

In year 2, the trees were pruned (headed) on both the central leaders and scaffold branches to induce branching and stiffen last season's growth. Wooden branch spreaders and twine were used on the 1-year-old branches to improve branch angles.

Nitrogen (urea) was applied twice during the growing season. A dormant oil spray was used for aphid and mite control. All combinations were sprayed for mildew, although in a commercial orchard Delicious would not be sprayed since it is resistant to mildew. All combinations were treated with a crown rot (*Phytophthora*) preventative. Subsequent applications of Thiodan 50WP were used for leafhopper and aphid control. Weed control was achieved with one application each of Princep and Surflan, mixed with Gramoxone and X-77 surfactant.

Insecticides for leafhoppers and aphids were applied several times during the growing season. The grass cover crop was mowed five times during the second growing season. Rodent control was the same as the first year.

A small crop was anticipated in year 2 because of the precocious rootstocks used. Hand thinning was necessary to encourage large fruit size and to decrease the likelihood of biennial bearing. No beehives were placed in the orchard during the second year because the crop was expected to be very small. Production levels were low for all combinations ranging from zero for Jonagold/M.7 to 0.30 bins per acre with Delicious/M.7 and Delicious/M.26 (Table 2).

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<sup>1</sup> Thiodan can be used as an alternative to Phosphamidon for aphid control. Phosphamidon has been voluntarily withdrawn from the market by the manufacturer, but growers may use supplies already on hand.

TABLE 2. Actual Yields in Bins Per Acre for the Central Leader Variety/Rootstock Combinations, Years 2-6.

Year	Gala M.26	Gala M.7	Jonagold M.26	Jonagold M.7	Delicious M.26	Delicious M.7
2	0.1	0.1	0.1	0.0	0.3	0.3
3	5.1	7.6	10.7	8.4	5.0	4.8
4	17.5	6.2	9.8	11.8	9.0	12.0
5	22.0	33.7	16.4	22.4	13.5	21.8
6	30.4	22.2	23.5	31.0	6.6	9.1
Total	75.1	69.8	60.5	73.6	34.4	48.0

In year 3, dormant pruning consisted of leader and scaffold heading, as well as removal of unwanted branches. A delayed dormant spray was applied to control aphids and mites. Branch spreaders and twine were used after dormant pruning for tree training purposes.

A small crop was anticipated in year 3. Hand thinning was necessary to increase fruit size, especially on the Gala combinations. Beehives were placed in the blocks to improve fruit set. Insecticides for codling moth, leafhoppers and aphids were applied several times during the growing season.

Weed control was the same as year 2. The grass strips between rows were mowed 5 times during the growing season. Nitrogen and water were applied as described in years 1 and 2. Fall applications of rodent baits were also used.

In year 3 the Jonagold/M.7 combination had its first crop of 8.4 bins per acre. The only combination with a larger crop in year 3 was Jonagold/M.26 with 10.7 bins per acre. The smallest crop, 4.8 bins per acre, was produced by Delicious/M.7.

By year 4, the second tier of permanent fruiting scaffold branches were developed. The leader and scaffolds were headed during the dormant season. Wooden spreaders and twine were used for tree training on the older branches. Insecticide, herbicide, rodent, fertilizer and irrigation management were the same as in previous years.

In year 4 hand thinning and chemical thinning were used to ensure adequate fruit size and return bloom. Production in year 4 was larger than production in year 3 for all combinations except Jonagold/M.26 and Gala/M.7. Gala/M.7 produced the smallest crop of any of the combinations that year with only 6.2 bins per acre, while Gala/M.26 had the largest crop with 17.5 bins per acre.

In year 5, trees were trained and pruned during the dormant period as in previous years. Pest management programs were similar to year 4. All other cultural

practices were conducted as described earlier. Yield was highest for Gala/M.7 at 33.7 bins per acre and lowest for Delicious/M.26 at 13.5 bins per acre.

Cultural practices and management techniques were the same in year 6 as in year 5 although spray volumes were higher. Production ranged from a low of 6.6 bins for Delicious/M.26 to a high of 31 bins per acre for Jonagold/M.7.

## **Economic Analysis**

A per-acre summary of the 6-year accumulated establishment cost for the six central leader combinations are presented in Appendix Tables 14 through 19. The accumulated cost tables detail the costs and revenues associated with planting each orchard. Costs are broken down into six categories; nonharvest variable cost, harvest variable cost, fixed cost, total cost, net cost and accumulated net cost. Nonharvest variable costs include labor, chemical applications and other cash costs that are incurred by the grower each year. Harvest variable cost includes the cost of labor, machinery and custom work directly associated with harvest. Total variable cost is the cash cost per year required to grow and harvest apples for each variety/rootstock combination.

Fixed costs include depreciation on equipment, property tax, and the interest on the accumulated establishment cost. They reflect the per-acre costs of land, equipment, and buildings already owned by the grower that must be allocated to this orchard combination. These costs do not change as the level of production changes and would be incurred even if no apples were produced.

Over the 6-year establishment period the highest cumulative production was achieved with Gala/M.26 which produced 75.1 bins per acre (Table 2). The combination with the lowest cumulative production was Delicious/ M.26 with 34.4 bins per acre. Because Delicious/M.26 trees were relatively small, this combination did not achieve high production per acre.

Jonagold and Delicious were more productive when combined with M.7 than with M.26 rootstock. The production of the Gala/M.26 combination increased every year whereas Gala/M.7 experienced some biennial bearing. Estimates of production for years 7-20 are presented in Table 3. Production per acre in years 7-20 is expected to be less for Gala/M.26 than for Gala/M.7 because the Gala/M.26 trees mature at a smaller size than the Gala/M.7 trees and, therefore, are not expected to completely fill their allotted space at the given tree density of 324 trees per acre.

A summary of the 6-year accumulated cost or revenue, the break-even year, the 20-year NPV, and IRR for the central leader combinations are presented in Table 4. The first price scenario assumed that Gala sold for \$400 per bin, Jonagold received \$280 and Delicious brought \$160 per bin. As supplies of Gala and Jonagold increase, prices will likely decline. Using these relatively high prices in the analysis, along with lower prices, will help demonstrate the importance of price on orchard profitability. Given this staggered price scenario, by the end of year 6, Gala/M.26

had an accumulated revenue of \$11,793, Gala/M.7 had an accumulated revenue of \$7,833, Jonagold/M.7 had an accumulated revenue of \$844. On the other hand, Jonagold/M.26 had an accumulated cost of \$1,173, Delicious/M.7 had accumulated cost of \$10,622, and Delicious/M.26 had an accumulated cost of \$11,586. Both the Gala combinations broke even in year 5 and Jonagold/M.7 broke even in year 6. It was estimated that Jonagold/M.26 would break even in year 7, Delicious/M.7 in year 11 and Delicious/M.26 in year 13.

TABLE 3. Estimated Yields in Bins Per Acre for the Central Leader Variety/Rootstock Combinations, Years 7-20.

Year	Gala M.26	Gala M.7	Jonagold M.26	Jonagold M.7	Delicious M.26	Delicious M.7
7	35	35	30	35	20	30
8	35	40	35	40	25	35
9	40	45	40	45	30	40
10-20 <sup>a</sup>	45	50	45	50	35	45

<sup>a</sup> Estimates of production for years 7-20.

When the 6 combinations were compared at a uniform output price of \$150 or \$200 per bin, none of the combinations paid back their accumulated establishment cost by the end of year 6. The lowest accumulated cost under the uniform price scenarios was achieved by the Gala/M.26. Delicious/M.26 had the highest accumulated cost. Under both uniform price scenarios, the order from the lowest to the highest accumulated cost was Gala/M.26, Jonagold/M.7, Jonagold/M.26, Gala/M.7, Delicious/M.7, and Delicious/M.26. At the \$150 uniform price scenario, the earliest to break even was Gala/M.26 in year 10. All the M.7 combinations and the Jonagold/M.26 combination broke even in year 11. Delicious/M.26 did not break even until the fourteenth year. Even though the cost of producing Gala was somewhat higher than the cost of producing Delicious, the higher price received for Gala more than made up for the difference.

Though the Gala/M.7 had higher expected year 7-20 yields than the Gala/ M.26, Gala/M.26 broke even earlier or in the same year as Gala/M.7 at all prices examined. Gala/M.26 was less costly to produce and because of the precocity of the M.26 rootstock, produced more apples in years 2 through 6 than did Gala/M.7.

Given the higher prices that growers are currently receiving for Gala and Jonagold, as well as their higher expected yields, these combinations should break even much earlier than the Delicious combinations. If the prices of Gala and Jonagold fall to the same level as Delicious, then the break-even results of these varieties will be close to those of Delicious/M.7, but should still break even earlier than Delicious/M.26 given the higher expected yields at full production.

TABLE 4. Summary of Break-Even Year, 20-Year Net Present Value, Internal Rate of Return, and 6-Year Accumulated Cost or Revenue for the Central Leader Variety/Rootstock Combinations.

Average Annual Price/Bin	Variety/Rootstock Combination	Accumulated 6-Year Net Cost or (Net Revenue)	Break-Even Year <sup>a</sup>	20-Year Net Present Value <sup>b</sup>	Internal Rate of Return
\$		\$	Year	\$	%
400 <sup>c</sup>	Gala/M.26	(11,793)	5	72,046	55.23
	Gala/M.7	(7,833)	5	76,351	53.47
280 <sup>c</sup>	Jonagold/M.26	1,173	7	39,862	38.88
	Jonagold/M.7	(844)	6	44,921	41.17
160 <sup>c</sup>	Delicious/M.26	11,586	13	5,809	15.32
	Delicious/M.7	10,622	11	11,164	19.90
200	Gala/M.26	4,383	8	23,052	29.66
	Gala/M.7	7,247	8	23,933	28.67
	Jonagold/M.26	6,535	8	21,195	27.74
	Jonagold/M.7	5,581	8	23,761	29.26
	Delicious/M.26	10,030	10	12,616	21.04
	Delicious/M.7	8,471	9	20,182	26.31
150	Gala/M.26	8,479	10	10,803	20.37
	Gala/M.7	11,061	11	10,829	19.53
	Jonagold/M.26	9,886	11	9,527	18.91
	Jonagold/M.7	9,597	11	10,537	19.67
	Delicious/M.26	11,975	14	4,108	13.66
	Delicious/M.7	11,159	11	8,910	18.06

<sup>a</sup> In calculating the break-even year, costs for each treatment in years 7-20 are the same as that treatment's year 6 cost with the exception of harvest cost, which changes with the level of production. Yields for years 7-20 are assumed to be those listed in Table 3.

<sup>b</sup> Discount rate = 9%.

<sup>c</sup> This price is used in the budgets and is based on the 1992 fresh market price for each variety in the study.

The combination with the highest 20-year net present value (NPV) under the staggered price scenario was Gala/ M.7 at \$76,351. Gala/M.26, which had a higher accumulated revenue at the end of year 6 than did Gala/M.7, had a slightly lower NPV than did Gala/M.7 because the Gala/M.7 combination has higher expected yields in years 7-20. The combination with the lowest NPV was Delicious/M.26 at \$5,809. This can be explained by the low yields in years 7-20 expected for this

combination as well as the high year 6 accumulated cost. When all combinations were compared under the \$150 uniform price scenario, Gala/M.7 had the highest NPV (\$10,829) with Gala/M.26, Jonagold/M.7, Jonagold/M.26 and Delicious/M.7 following close behind. Delicious/M.26 had the lowest NPV (\$4,108), significantly lower than the NPV of the other five combinations.

The combination with the highest internal rate of return (IRR) under the staggered price scenario was Gala/M.26 with an IRR of 55.23%. Delicious/M.26 had the lowest IRR (15.32%). All of the combinations had an IRR above the 9% discount rate used in the study.

When the per bin price is \$150, all combinations had IRRs greater than 13% . At the \$150 uniform output price Gala/M.26 had the highest IRR (20.37%) followed by Jonagold/M.7, Gala/M.7, Jonagold/M.26, Delicious/M.7, and Delicious/M.26 (13.66%). Note that due to reasons listed earlier, the two measures of profitability, NPV and IRR, rank the combinations slightly differently.

## **VERTICAL AXIS ORCHARD SYSTEM**

Jonagold, Gala and Delicious were combined with M.26 EMLA and M.7 EMLA and were trained to the vertical axis system (Figure 2). Tree density was 514 trees/acre with tree spacing of 5.7' x 14.8'. Bamboo poles for each tree were attached to a one-wire trellis system for tree support.

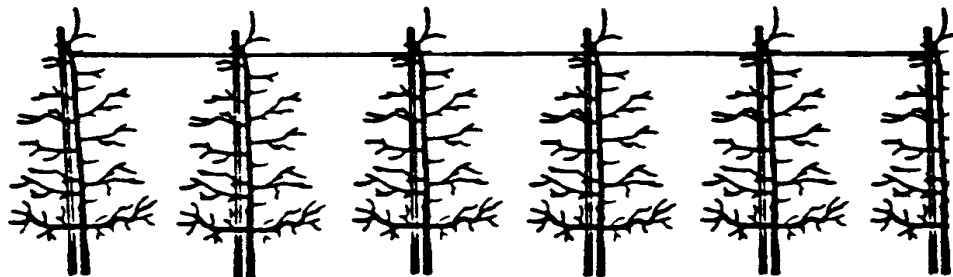


Figure 2. Vertical axis orchard system

## **Horticultural Practices**

Unbranched nursery stock was planted and headed 30 inches above the ground to induce lateral branching. Shortly after planting, a single-wire (at 10 ft.) trellis system was installed with 12-foot bamboo poles placed by every tree to support the vertical central leader. The leaders were attached to the poles with tape applied with a hand-held tying device (Max Tapener). During the growing season, branches were not spread.

Aphid control sprays were applied twice during the growing season. Weed control, rodent control, nutrient management, irrigation, and other cultural practices were

the same as for the central leader trees. There was no fruit production in the first growing season.

During year 2, dormant pruning consisted of removing strong vertical upright growth and attaching the leader vertically to the bamboo pole. The leader and side branches were not headed. Later during the growing season, branches were spread with concrete training weights, wooden spreaders, and heavy twine.

Cultural practices and pest management were the same as that described for the second year with central leader trees. All combinations had some fruit production in year 2 ,(Table 5).

TABLE 5. Actual Yields in Bins Per Acre for the Vertical Axis Variety/Rootstock Combinations, Years 2-6.

Year	Gala M.26	Gala M.7	Jonagold M.26	Jonagold M.7	Delicious M.26	Delicious M.7
2	2.10	0.38	0.72	0.30	0.32	0.89
3	18.44	18.19	16.72	22.41	13.01	10.35
4	15.00	11.77	17.31	15.24	13.95	14.37
5	42.11	50.84	29.03	33.26	36.08	36.10
6	43.80	34.60	38.30	33.30	12.40	9.50
Total	121.45	115.78	102.08	104.51	75.76	71.21

In the dormant season of the third year, trees were pruned to remove vigorous upright growth, select permanent lower scaffold branches and contain extension growth on the lower scaffolds. One-year-old growth of leaders and scaffolds was not headed. During early summer, vigorous upright shoots were removed by hand. Branches were tied down with tape and twine as necessary on a seasonal basis. Cultural practices and pest management were the same as described for the central leader system.

In the third growing season one beehive per acre was placed in the orchard. To eliminate doubles, fruit was thinned by hand. Yields ranged from 10.35 bins/acre for Delicious/M.7 to 22.41 bins/acre for Jonagold/M.7.

In year 4, trees were pruned and trained during both the winter and summer seasons as described in year 3. Pest management and cultural practices were the same as in previous years. Beehives (1 per acre) were placed in the orchard to improve fruit set. Return bloom was generally poor. Both Gala combinations as well as Jonagold/M.7 had lower yields in year 4 than in their third leaf. Jonagold/M.26 and the Delicious combinations had yields higher than in year 3 with Jonagold/M.26 having the highest overall yield of 17.31 bins/acre. Gala/M.7 had the lowest yield of 11.77 bins/acre.



By year 5, the tree canopies had generally filled their space with the exception of Delicious/M.26. Dormant pruning consisted of containment cuts on the lower scaffolds and renewal pruning (usually leaving a short stub) in the upper portions of the trees. The leaders were shortened to a height of about 10 feet at the location of a fruiting lateral or a weak side branch. Vigorous upright growth was also removed during the dormant season if it had not been removed during the summer of the 4th year. Summer training and pruning were conducted as previously described. Some lower branches were tied up with twine to support the crop load.

Nitrogen and water management were identical to previously described management. Weed, insect, and disease control measures were the same as in prior years. Rodent control continued with fall applications of strychnine-treated milo and zinc phosphide bait.

As in previous cropping years, beehives were placed in the orchard to promote fruit set. Some chemical and hand thinning were necessary to distribute the crop evenly. Yields increased substantially from the previous year for all combinations with a high of 50.84 bins/acre for Gala/M.7 and a low of 29.03 for Jonagold/M.26.

In year 6, the vertical axis trees were managed as previously described for year 5. Both Delicious combinations had poor return bloom and produced approximately a third of their year 5 yield. Gala/M.7 also had a lower yield in year 6 than in year 5 although the percent reduction was not as great as for Delicious. Gala/M.26 had the highest production at 43.8 bins/acre while Delicious/M.7 had the lowest at 9.5 bins/acre.

**Economic Analysis**

Table 6 shows the expected yields for years 7 through 20 for the vertical axis combinations. Table 7 presents a summary of the 6-year accumulated cost or revenue, the break-even year, the 20-year net present value, and internal rate of return for the vertical axis combinations. With staggered prices for each variety (\$400 for Gala, \$280 for Jonagold, \$160 for Delicious) the combination with the highest accumulated cost at the end of the sixth leaf was Delicious/M.26 at \$12,268 while the Gala/M.26 combination had the highest accumulated revenue of \$23,886

TABLE 6. Expected Yields in Bins Per Acre for the Vertical Axis Variety/Rootstock Combinations.

Year	Gala M.26	Gala M.7	Jonagold M.26	Jonagold M.7	Delicious M.26	Delicious M.7
7 <sup>a</sup>	45	45	40	40	30	40
8	45	50	45	45	30	40
9	50	50	45	45	35	45
10-20	50	50	50	50	35	45

<sup>a</sup> Year of maturity is year 7.

TABLE 7. Summary of Break-Even Year, 20-Year Net Present Value, Internal Rate of Return, and 6-Year Accumulated Cost or Revenue for the Vertical Axis Variety/Rootstock Combinations.

Average Annual Price/Bin	Variety/ Rootstock Combination	Accumulated 6-Year Net Cost or (Net Revenue) \$	Break-Even Year <sup>a</sup>	20-Year net Present Value <sup>b</sup> \$	Internal Rate of Return %
400 <sup>c</sup>	Gala/M.26	(23,886)	5	88,780	59.02
	Gala/M.7	(19,855)	5	85,402	55.83
280 <sup>c</sup>	Jonagold/M.26	(4,462)	6	49,518	40.07
	Jonagold/M.7	(3,500)	6	47,393	39.50
160 <sup>c</sup>	Delicious/M.26	12,268	13	4,790	13.83
	Delicious/M.7	11,945	10	12,346	19.27
200	Gala/M.26	2,099	7	27,379	29.96
	Gala/M.7	4,887	8	24,248	27.47
	Jonagold/M.26	4,593	8	26,371	28.33
	Jonagold/M.7	5,868	8	24,059	27.00
	Delicious/M.26	8,491	9	13,122	20.68
	Delicious/M.7	8,721	8	22,415	25.57
150	Gala/M.26	8,817	10	12,029	19.77
	Gala/M.7	11,292	11	8,959	17.11
	Jonagold/M.26	10,252	10	11,904	19.16
	Jonagold/M.7	11,724	11	9,475	17.27
	Delicious/M.26	11,789	15	2,708	11.85
	Delicious/M.7	12,751	11	9,829	17.48

<sup>a</sup> In calculating the break-even year, costs for each treatment in years 7-20 are the same as that treatment's year 6 cost with the exception of harvest cost, which changes with the level of production. Yields for years 7-20 are assumed to be those listed in Table 6.

<sup>b</sup> Discount rate = 9%.

<sup>c</sup> This price is used in the budgets and is based on the 1992 fresh market price for each variety in the study.

by the end of year 6. In fact, both of the Gala combinations broke even by the fifth year while the Delicious/M.26 would not break even until year 13, the longest of any of the vertical axis combinations.

When all varieties are compared at a price of \$200, none of the combinations had accumulated revenue by the end of year 6. Gala/M.26 had the lowest accumulated cost at \$2,099 and the Delicious/M.7 combination had the highest accumulated cost at \$8,721. At \$200/bin, only Gala/M.26 would break even in year 7, while the

Delicious/ M.26 would break even in year 9. The rest of the combinations would break even in year 8.

Under the staggered price scenarios, the Gala/M.26 combination had the highest 20-year NPV among the vertical axis combinations (\$88,780) while Delicious/M.26 had the lowest (\$4,790). Delicious/M.26 also had the lowest internal rate of return (13.83%) while the Gala/M.26 had the highest IRR (59.02%). Delicious/M.26 had the lowest expected yield (see Table 6) of any of the vertical axis combinations and therefore its poor financial performance is not surprising. Gala/M.26 had higher early production than Gala/M.7, thus accounting for its higher IRR and underscoring the importance of high early returns. When all varieties are compared at a price of \$200/bin and \$150/bin, Gala/M.26 and Delicious/ M.26 continue to have the highest and lowest NPV and IRR, respectively.

### **SLENDER SPINDLE ORCHARD SYSTEM**

Jonagold and Gala were combined with rootstocks M.9, B.9, Mark and P.2. Delicious was combined with M.9 and B.9. All ten combinations were trained to the slender spindle system (Figure 3). Tree density was 772 trees/ acre with tree spacing of 4.9' x 11.5' . Posts were placed next to each tree to provide vertical tree support.

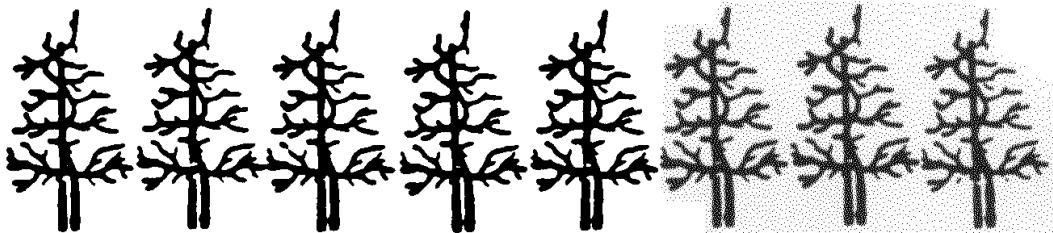


Figure 3. Slender spindle orchard system

### **Horticultural Practices**

Unbranched nursery stock was planted and pruned 30 inches above the ground to induce lateral branching. Shortly after planting, each tree was attached to the support post placed next to it. During the growing season, branches were not tied down or spread.

Aphid control sprays were applied twice during the growing season. Weed control, irrigation, cover crop planting and mowing, fertilizer applications, and rodent control practices were the same as those for the central leader and vertical axis systems during year 1. There was no fruit production in the first growing season.

During year 2, trees were pruned using conventional slender spindle techniques. The leader was removed to a weaker lower side branch which was tied up to the

post. Side branches were not pruned. During the early summer, branches were spread using twine and concrete weights.

Cultural practices, other than tree training, and pest management were similar for each rootstock during year 2. Fruit production began in year 2 with the Gala/P.2 combination producing the highest yield at 7.6 bins/acre and Jonagold/P.2 producing the lowest at 2.1 bins/acre (Table 8).

TABLE 8. Actual Yields in Bins Per Acre for the Slender Spindle Variety/Rootstock Combinations, Years 2-6.

Year	Gala				Jonagold				Delicious	
	M.9	B.9	Mark	P.2	M.9	B.9	Mark	P.2	M.9	B.9
2	7.13	4.87	4.60	7.60	5.77	2.84	2.30	2.10	3.36	3.86
3	23.69	20.54	22.90	23.90	27.49	22.50	30.10	20.50	14.18	12.80
4	40.30	27.17	45.40	31.80	18.01	20.38	14.80	13.10	15.72	18.53
5	43.80	42.71	40.70	35.80	38.08	27.05	38.19	27.70	27.84	27.05
6	68.60	42.20	54.30	47.40	42.40	48.60	55.60	38.30	14.30	7.00
Total	183.52	137.49	167.90	146.50	131.75	121.37	140.99	101.70	75.40	69.24

In year 3, the major difference between the slender spindle system and the other two orchard systems was that a significant amount of time was spent hand thinning the crop. Other cultural practices were basically the same as those conducted in the other two systems.

In year 3, the slender spindle production ranged from a high of 30.1 bins/acre for Jonagold/Mark to 12.8 bins/acre for Delicious/B.9.

Cultural practices for year 4, 5, and 6 were basically the same as those for the central leader and vertical axis trees. In the 4th year biennial bearing occurred with all Jonagold combinations, the result of overcropping in year 3. Yields ranged from 13.1 bins/acre for Jonagold/P.2 to 45.4 bins/acre for Gala/Mark.

Bloom was excellent in the fifth year and as a result fruit production was greater for all combinations than in year 4 with the exception of Gala/Mark. The Gala/M.9 combination had the highest yield at 43.80 bins/acre and Jonagold/B.9 and Delicious/B.9 had the lowest at 27.05 bins/acre.

In year 6, fruit production for most combinations was higher than in year 5. Gala/B.9 produced only one-half a bin/acre less than in year 5 whereas both Delicious combinations had greatly lower production. Delicious/B.9 had the lowest overall production at 7 bins/per acre (less than 26 percent of its year 5 production). Gala/M.9 had the highest production of all slender spindle combinations as well as the highest production for the entire trial.

**Economic Analysis**

Table 9 shows the estimated yield for years 7 through 20 of the slender spindle combinations. Table 10 presents a summary of the 6-year accumulated cost or revenue, the break-even year, the 20-year NPV, and IRR for the slender spindle combinations. At a price of \$160 for Delicious, \$280 for Jonagold and \$400 for Gala, the Gala/M.9 had the highest 20-year NPV, the highest IRR, the lowest 6-year accumulated cost and the earliest break-even year. This combination broke even by year 4 and had an accumulated revenue of \$43,153 by the end of the sixth leaf. Gala/M.9 had the largest accumulated yield at the end of year 6, 183.52 bins (Table 8). The Delicious/B.9 combination had the lowest 20-year NPV, the lowest IRR, the highest 6-year accumulated cost and did not break even until year 18. Delicious/B.9 also had the lowest accumulated yield for the 6-year period of all the slender spindle combinations, 69.24 bins.

High early returns marks the difference between Gala/Mark and Gala/ P.2 at a price of \$400/bin. Even though both Gala/P.2 and Gala/Mark had an annual expected yield of 50 bins/acre for years 7-20 (see Table 9), Gala/Mark had an accumulative yield of 167.9 bins after year 6 while Gala/P.2 had 146.5 bins. Gala/Mark also had a higher internal rate of return than Gala/P.2.

TABLE 9. Expected Yields in Bins Per Acre for the Slender Spindle Variety/Rootstock Combinations.

Year	Gala				Jonagold				Delicious	
	M.9	B.9	Mark	P.2	M.9	B.9	Mark	P.2	M.9	B.9
7	50	45	50	50	45	50	50	40	25	25
8 <sup>a</sup>	55	50	50	50	50	50	50	45	30	30
9	55	50	50	50	50	50	50	45	30	30
10-20	55	50	50	50	50	50	50	45	35	35

<sup>a</sup> Year 8 is year of maturity.

At prices of \$200/bin and \$150/bin for all varieties, Gala/M.9 still had the best overall profitability and Delicious/B.9 the poorest.

TABLE 10. Summary of Break-Even Year, 20-Year Net Present Value, Internal Rate of Return, and 6-Year Accumulated Cost or Revenue for the Slender Variety/Rootstock Combinations.

Average Annual Price/Bin	Variety/ Rootstock Combination	Accumulated 6-Year Net Cost or (Net Revenue) \$	Break-Even Year <sup>a</sup> Year	20-Year net Present Value <sup>b</sup> \$	Internal Rate of Return %
400 <sup>c</sup>	Gala/M.9	(43,153)	4	108,921	68.89
	Gala/B.9	(25,578)	5	89,514	56.67
	Gala/Mark	(37,954)	4	99,074	65.94
	Gala/P.2	(30,372)	4	94,656	63.12
280 <sup>c</sup>	Jonagold/M.9	(7,071)	6	50,459	40.04
	Jonagold/B.9	(3,402)	6	48,789	37.14
	Jonagold/Mark	(9,069)	6	52,521	40.68
	Jonagold/P.2	1,252	7	40,469	32.86
160 <sup>c</sup>	Delicious/M.9	15,932	17	2,024	10.78
	Delicious/B.9	16,753	18	1,296	10.15
<u>200</u>	Gala/M.9	(4,639)	6	33,956	33.60
	Gala/B.9	4,202	7	25,209	26.81
	Gala/Mark	(2,770)	6	30,139	31.94
	Gala/P.2	1,024	7	28,447	30.00
	Jonagold/M.9	4,853	8	24,998	26.68
	Jonagold/B.9	7,434	8	23,757	25.02
	Jonagold/Mark	3,494	7	26,460	27.52
	Jonagold/P.2	10,043	9	18,557	21.82
	Delicious/M.9	12,475	10	10,174	16.95
Delicious/B.9	13,532	12	9,305	16.27	
<u>150</u>	Gala/M.9	5,610	8	15,215	21.75
	Gala/B.9	11,928	11	9,133	16.52
	Gala/Mark	6,667	9	12,905	20.38
	Gala/P.2	9,318	9	11,895	19.10
	Jonagold/M.9	12,305	11	9,084	16.46
	Jonagold/B.9	14,206	12	8,112	15.43
	Jonagold/Mark	11,345	10	10,172	17.30
	Jonagold/P.2	16,015	14	4,862	12.96
	Delicious/M.9	16,796	>20	(13)	8.99
Delicious/B.9	17,558	>20	(706)	8.35	

<sup>a</sup> In calculating the break-even year, costs for each treatment in years 7-20 are the same as that treatment's year 6 cost with the exception of harvest cost, which changes with the level of production. Yields for years 7-20 are assumed to be those listed in Table 9.

<sup>b</sup> Discount rate = 9%.

<sup>c</sup> This price is used in the budgets and is based on the 1992 fresh market price for each variety in the study.

## **SUMMARY**

The profitability of an orchard system derives from the difference between income and expenses. The orchard systems in this study varied considerably in income due to differences in production per acre. An orchard system is not just a tree support system or a tree training system or a particular tree density or a particular rootstock, but an integration of these factors into a management system. For example, the slender spindle system combines a support system, high tree density and a dwarfing rootstock. Because it is an integrated system, it is not always possible to decide which of the components makes the greatest contribution to production per acre. In this study, the production per acre advantage of vertical axis over central leader was due primarily to tree density, as both systems had the same rootstocks. However, greater production per acre for slender spindle than for vertical axis with Gala and Jonagold could be due to efficient dwarfing rootstocks. In this study we compare orchard systems, but do not attribute differences in productivity or in profitability to individual components of the orchard systems.

The profitability of the various orchard systems in this trial was strongly influenced by variety. For NPV and IRR, there were significant orchard system/variety interactions. For example, at \$200/bin, the most profitable orchard system with Gala, in terms of NPV, was slender spindle/M.9; with Jonagold, slender spindle/Mark; and with Delicious, vertical axis/M.7 (Tables 11-13). The data, therefore, are summarized by variety.

### **Gala**

At all price levels, profitability (NPV) was greatest for the slender spindle/M.9 and slender spindle/Mark (Table 11). The least profitable combinations were central leader/M.26 and central leader/M.7 at price levels of both \$400/bin and \$200/bin. At the \$150/bin price level, vertical axis/M.7 and slender spindle/B.9 were the least profitable combinations. When profitability was measured as IRR and as the break-even year, similar results occurred.

With the central leader and vertical axis systems, differences in profitability between rootstocks M.26 and M.7 were relatively small. However, trees on M.7 are considerably larger than those on M.26 and this may negatively influence packout (fruit color and size) and the cost of pruning as the trees age. Data on these factors were not available through year 6 in this study. Central leader/M.26 trees did not fill their allotted space by year 6 nor would they during the life of the orchard. Because of smaller tree size, trees on M.26 could be planted at a higher tree density than trees on M.7, thus resulting in higher early production. Trees on M.26 should be supported to prevent leaning and to encourage vertical growth of the central leader.

Table 11. Summary of 20-Year Net Present Value Estimates at a 9 % Discount Rate for Gala with Eight Orchard System/Variety/Rootstock Combinations at Three Price Levels.

System	Price Bin <sup>a</sup>		
	\$400	\$200	\$150
<b>Central Leader</b>			
Gala/M.26	72,046 (8)	23,052 (8)	10,803 (6)
Gala/M.7	76,351 (7)	23,933 (7)	10,829 (5)
<b>Vertical Axis</b>			
Gala/M.26	88,780 (5)	27,379 (4)	12,029 (3)
Gala/M.7	85,402 (6)	24,059 (6)	8,959 (8)
<b>Slender Spindle</b>			
Gala/M.9	108,921 (1)	33,956 (1)	15,215 (1)
Gala/B.9	89,514 (4)	25,209 (5)	9,133 (7)
Gala/Mark	99,074 (2)	30,139 (2)	12,905 (2)
Gala/P.2	94,656 (3)	28,447 (3)	11,895 (4)

<sup>a</sup> Rank order presented in parentheses.

With the slender spindle system, the B.9 rootstock was somewhat less profitable than the other three rootstocks. Trees on P.2 were smaller than those on the other three rootstocks. Although this could result in lower pruning costs for trees on P.2, it also means less shoot growth and, therefore, a greater chance of fruit sunburn and reduced packout. Because trees on P.2 were smaller, they could have been planted at a higher density, resulting in greater early production.

In summary, for Gala the highest NPV, highest IRR and shortest breakeven period occurred with trees on M.9 rootstock trained to the slender spindle system.

### Jonagold

NPV was generally greatest for vertical axis/M.26 and slender spindle/Mark, and least profitable for slender spindle/P.2 and central leader/M.26 (Table 12). However, with Jonagold, as price level dropped, relative profitability of the various system/rootstock combinations changed. For example, at \$280/bin, central leader/M.26 and central leader/M.7 ranked 8th and 6th for NPV, but at the lower price of \$150/bin they ranked 4th and 2nd, respectively. The reverse occurred with slender spindle/Mark which ranked 1st for NPV at \$280/bin, but 3rd at \$150/bin. This indicates that the high cost input systems such as the slender spindle are profitable when prices are high, but as prices decline less capital intensive systems such as the central leader may be more profitable.

With the central leader and vertical axis systems, differences in profitability between rootstocks M.26 and M.7 were relatively small, although with central



leader (without tree support) M.7 was more profitable and with vertical axis (with trees supported) M.26 was more profitable. However, trees on M.26 were much less vigorous than trees on M.7 and generally had insufficient shoot leaf area to protect fruit from sunburn. Jonagold trees on M.7 were not overly vigorous at this site (although M.7 trees with Gala were overly vigorous). Trees on M.26 should be supported to prevent leaning and to encourage vertical growth of the central leader.

With the slender spindle system, differences in profitability (NPV) between the four rootstocks were generally small, although trees on P.2 were clearly the least profitable. The tree canopy on P.2 was smallest and contributed to its low production/acre compared with the other slender spindle combinations. P.2 trees produced insufficient shoot growth to protect the fruit from sunburn. Even though trees on P.2 could be planted at higher density due to their small size, Jonagold on P.2 is not recommended because of weak tree vigor and greater chance of fruit sunburn.

Table 12. Summary of 20-Year Net Present Value Estimates at a 9 % Discount Rate for Jonagold with Eight Orchard System/Variety/Rootstock Combinations at Three Price Levels.

System	Price Bin <sup>a</sup>		
	\$280	\$200	\$150
<b>Central Leader</b>			
Jonagold/M.26	39,862 (8)	21,195 (7)	9,527 (4)
Jonagold/M.7	44,921 (6)	23,761 (5)	10,537 (2)
<b>Vertical Axis</b>			
Jonagold/M.26	49,518 (3)	26,371 (2)	11,904 (1)
Jonagold/M.7	47,393 (5)	24,059 (4)	9,475 (5)
<b>Slender Spindle</b>			
Jonagold/M.9	50,459 (2)	24,998 (3)	9,084 (6)
Jonagold/B.9	48,789 (4)	23,757 (6)	8,112 (7)
Jonagold/Mark	52,521 (1)	26,460 (1)	10,172 (3)
Jonagold/P.2	40,469 (7)	18,557 (8)	4,862 (8)

<sup>a</sup> Rank order presented in parentheses.

## Delicious

The most profitable (NPV) combinations with Delicious were vertical axis and central leader systems on M.7 rootstock and the least profitable were slender spindle systems on M.9 and B.9 (Table 13). Ranking of orchard system/ rootstock combinations changed only for vertical axis/M.26 and central leader/ M.26 with a change in price/bin.

With the central leader and vertical axis systems, trees on M.7 were always more profitable than those on M.26. With the slender spindle system, the two rootstocks, M.9 and B.9 were equally unprofitable. The supported vertical axis system had a slight advantage over the freestanding central leader system in profitability (NPV).

Delicious trees have a spur-type habit and grow weakly. In this study, only Delicious trees on M.7 were sufficiently vigorous. Trees on M.26, B.9 and M.9 did not fill their allotted space, had insufficient canopy volume and were, therefore, unproductive on a per-acre basis. Rootstocks less vigorous than M.7 cannot be recommended for spur-type Delicious, even though more trees could be planted per acre on dwarfing rootstocks. For weakly growing spur-type Redchief Delicious variety, M.7 is the preferred rootstock.

Table 13. Summary of 20-Year Net Present Value Estimates at a 9 % Discount Rate for Jonagold with Eight Orchard System/Variety/Rootstock Combinations at Three Price Levels.

System	Price Bin <sup>a</sup>		
	\$200	\$160	\$150
<b>Central Leader</b>			
Delicious/M.26	12,616 (4)	5,809 (3)	4,108 (3)
Delicious/M.7	20,182 (2)	11,164 (2)	8,910 (2)
<b>Vertical Axis</b>			
Delicious/M.26	13,122 (3)	4,790 (4)	2,708 (4)
Delicious/M.7	22,415 (1)	12,346 (1)	9,829 (1)
<b>Slender Spindle</b>			
Delicious/M.9	10,174 (5)	2,024 (5)	(13)(5)
Delicious/B.9	9,305 (6)	1,296 (6)	(706)(6)

<sup>a</sup> Rank order presented in parentheses.

Table 14 presents an overall summary of the results of this study by ranking the 20-year net present value estimates for all orchard system/variety/rootstock combinations at different price levels.

The combinations with the best overall profitability results were slender spindle/Gala/M.9 and slender spindle/Gala/Mark, respectively, at all price levels. Slender spindle/Delicious/B.9 and slender spindle/Delicious/M.9, respectively, were the least profitable at all price levels.

At the staggered price levels of \$400 per bin for Gala, \$280 per bin for Jonagold, and \$160 per bin for Delicious, in all cases Gala returned more than Jonagold and Delicious, and Jonagold returned more than Delicious. This indicates that price played the major role in determining the relative profitability of the various varieties regardless of system and rootstock.

As price levels dropped to \$200 and then to \$150 per bin, the effect of yield levels and system costs became more evident in determining relative rankings. Although the slender spindle system is the most expensive of the three systems tested, the yields obtained by slender spindle/Gala/M.9 and slender spindle/Gala/Mark were significantly higher than the other system/variety/rootstock combinations. Even at the lower price levels they dominated in terms of net profitability. Slender spindle/Delicious/B.9 and slender spindle/Delicious/M.9 were not the lowest yielding combinations. However, the cost of the slender spindle system was greater than the yield advantage gained by using the slender spindle system in the lower yielding situations.

As previously mentioned, profitability is a combination of yield, price and expense. Table 14 shows how the relative profitability of combinations tested in this study change as price levels change. High cost systems must produce higher yields or capture higher prices than lower cost systems in order to be more profitable. In this study, slender spindle/Gala/M.9 and slender spindle/Gala/Mark were the only combinations to prevail throughout all price levels. All other combinations, with exception of slender spindle/Delicious/M.9 and slender spindle/Delicious/B.9, changed relative rank as price levels changed.

Table 14. Ranking of 20-Year Net Present Value Estimates at a 9 % Discount Rate for all Orchard System/Variety/Rootstock Combinations at Different Price Levels.

System	\$400/Bin, Gala \$280/Bin, Jonagold \$160/Bin, Delicious	System	\$200/Bin All Varieties	System	\$150/Bin All Varieties
	<b>\$NPV</b>		<b>\$NPV</b>		<b>\$NPV</b>
SS/Gala/M.9	108,921	SS/Gala/M.9	33,956	SS/Gala/M.9	15,215
SS/Gala/Mark	99,074	SS/Gala/Mark	30,139	SS/Gala/Mark	12,905
SS/Gala/P.2	94,656	SS/Gala/P.2	28,447	VA/Gala/M.26	12,029
SS/Gala/B.9	89,514	VA/Gala/M.26	27,379	VA/Jonagold/M.26	11,904
VA/Gala/M.26	88,780	SS/Jonagold/Mark	26,460	SS/Gala/P.2	11,895
VA/Gala/M.7	85,402	VA/Jonagold/M.26	26,371	CL/Gala/M.7	10,829
CL/Gala/M.7	76,351	SS/Gala/B.9	25,209	CL/Gala/M.26	10,803
CL/Gala/M.26	72,046	SS/Jonagold/M.9	24,998	CL/Jonagold/M.7	10,537
SS/Jonagold/Mark	52,521	VA/Gala/M.7	24,248	SS/Jonagold/Mark	10,172
SS/Jonagold/M.9	50,459	VA/Jonagold/M.7	24,059	VA/Delicious/M.7	9,829
VA/Jonagold/M.26	49,518	CL/Gala/M.7	23,933	CL/Jonagold/M.26	9,527
SS/Jonagold/B.9	48,789	CL/Jonagold/M.7	23,761	VA/Jonagold/M.7	9,475
VA/Jonagold/M.7	47,393	SS/Jonagold/B.9	23,757	SS/Gala/B.9	9,133
CL/Jonagold/M.7	44,921	CL/Gala/M.26	23,052	SS/Jonagold/M.9	9,084
SS/Jonagold/P.2	40,469	VA/Delicious/M.7	22,415	VA/Gala/M.7	8,959
CL/Jonagold/M.26	39,862	CL/Jonagold/M.26	21,195	CL/Delicious/M.7	8,910
VA/Delicious/M.7	12,346	CL/Delicious/M.7	20,182	SS/Jonagold/B.9	8,112
CL/Delicious/M.7	11,164	SS/Jonagold/P.2	18,557	SS/Jonagold/P.2	4,862
CL/Delicious/M.26	5,809	VA/Delicious/M.26	13,122	CL/Delicious/M.26	4,108
VA/Delicious/M.26	4,790	CL/Delicious/M.26	12,616	VA/Delicious/M.26	2,708
SS/Delicious/M.9	2,024	SS/Delicious/M.9	10,174	SS/Delicious/M.9	(13)
SS/Delicious/B.9	1,296	SS/Delicious/B.9	9,305	SS/Delicious/B.9	(706)

# **APPENDIX**

## **Detailed Budgets**

Table 15. Per-Acre Cost of Establishing a Freestanding Central Leader/Gala/M.26 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	1,764.00	----	----	----	----	----
Tree Training / Materials	----	169.72	2.48	127.60	181.16	6.20
Labor	412.50	328.62	362.67	374.55	413.76	391.05
Fertilizer	7.70	19.44	19.44	21.60	19.44	19.44
Chemicals	29.61	122.47	120.56	228.71	403.93	372.00
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	174.99	221.01	221.01	221.01	221.01	221.01
Other	32.50	----	----	----	----	----
Overhead	292.86	75.62	75.44	112.58	140.30	135.04
Interest	<u>223.53</u>	<u>41.27</u>	<u>36.40</u>	<u>47.76</u>	<u>58.24</u>	<u>48.56</u>
Nonharvest Var. Cost	4,197.69	1,078.15	963.00	1,258.81	1,562.84	1,318.30
<b>Harvest Costs</b>						
Picking	----	1.50	76.50	262.50	330.00	456.00
Hauling	----	0.25	12.75	43.75	55.00	76.00
Other Labor	----	10.53	12.70	12.70	23.59	23.66
Machinery Cost	----	2.77	8.68	8.68	16.07	16.07
Supervisor	----	<u>0.15</u>	<u>7.65</u>	<u>26.25</u>	<u>33.00</u>	<u>45.60</u>
Harvest Var. Cost	----	15.19	118.28	353.88	467.66	617.33
<b>Total Variable Cost</b>	4,197.69	1,083.82	1,081.27	1,613.67	2,011.02	1,935.62
<b>Fixed Costs</b>						
Machinery Cost	361.04	459.58	466.33	466.50	474.95	474.95
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	115.00	115.00	115.00	115.00	115.00
Int. on Estab. Cost <sup>b</sup>	----	<u>431.44</u>	<u>629.87</u>	<u>666.54</u>	<u>308.05</u>	----
Total Fixed Cost	596.04	1,171.02	1,376.20	1,413.04	1,063.00	754.95
<b>TOTAL COST</b>	4,793.73	2,254.84	2,457.47	3,026.71	3,074.02	2,690.57
Value of Production <sup>c</sup>	----	40.00	2,040.00	7,000.00	8,800.00	12,160.00
<b>NET COST</b>	4,793.74	2,214.84	417.47	(3,973.29)	(5,725.98)	(9,469.43)
<b>ACCUM. NET COST</b>	4,793.74	7,008.58	7,426.05	3,452.76	(2,273.22)	(11,742.65)

<sup>a</sup> 324 Imperial Gala trees and 32 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = .10, Year 3 = 5.1, Year 4 = 17.5, Year 5 = 22, Year 6 = 30.4. Total 6-year production = 75.10 bins. Price/bin = \$400.

Table 16. Per-Acre Cost of Establishing a Freestanding Central Leader/Gala/M.7 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	1,764.00	----	----	----	----	----
Tree Training / Materials	----	130.84	132.08	291.60	200.88	203.98
Labor	419.50	311.78	374.62	420.75	537.97	484.64
Fertilizer	7.70	19.44	19.44	21.60	19.44	19.44
Chemicals	33.40	171.44	240.85	494.59	510.37	510.68
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	174.99	221.01	221.01	221.01	221.01	221.01
Other	32.50	----	----	----	----	----
Overhead	293.68	75.82	99.70	133.77	177.80	157.24
Interest	<u>224.05</u>	<u>41.28</u>	<u>48.48</u>	<u>69.79</u>	<u>71.12</u>	<u>70.29</u>
Nonharvest Var. Cost	4,209.82	1,071.61	1,261.18	1,778.11	1,863.59	1,792.28
<b>Harvest Costs</b>						
Picking	----	1.50	114.00	93.00	505.50	333.00
Hauling	----	0.25	19.00	15.50	84.25	55.50
Other Labor	----	10.53	12.70	12.70	23.59	23.66
Machinery Cost	----	2.77	8.68	8.68	16.07	16.07
Supervisor	----	<u>0.25</u>	<u>11.40</u>	<u>9.30</u>	<u>50.55</u>	<u>33.30</u>
Harvest Var. Cost	----	15.19	165.78	139.18	679.96	461.53
<b>Total Variable Cost</b>	<b>4,209.82</b>	<b>1,086.80</b>	<b>1,426.96</b>	<b>1,917.29</b>	<b>2,543.55</b>	<b>2,253.81</b>
<b>Fixed Costs</b>						
Machinery Cost	361.21	459.58	466.33	466.30	474.95	474.95
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	115.00	115.00	115.00	115.00	115.00
Int. on Estab. Cost <sup>b</sup>	----	<u>432.51</u>	<u>631.40</u>	<u>609.51</u>	<u>680.00</u>	----
Total Fixed Cost	596.21	1,172.09	1,377.73	1,355.81	1,434.95	754.95
<b>TOTAL COST</b>	<b>4,806.03</b>	<b>2,258.89</b>	<b>2,804.69</b>	<b>3,273.10</b>	<b>3,978.50</b>	<b>3,008.76</b>
Value of Production <sup>c</sup>	----	40.00	3,040.00	2,480.00	13,480.00	8,880.00
<b>NET COST</b>	<b>4,806.03</b>	<b>2,218.89</b>	<b>(235.31)</b>	<b>793.10</b>	<b>(9,501.50)</b>	<b>(5,871.24)</b>
<b>ACCUM. NET COST</b>	<b>4,805.63</b>	<b>7,024.52</b>	<b>6,789.21</b>	<b>7,582.31</b>	<b>(1,919.19)</b>	<b>(7,790.43)</b>

<sup>a</sup> 324 Imperial Gala trees and 32 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = .10, Year 3 = 7.6, Year 4 = 6.2, Year 5 = 33.7, Year 6 = 22.2. Total 6-year production = 69.80 bins. Price/bin = \$400.

Table 17. Per-Acre Cost of Establishing a Freestanding Central Leader/Jonagold/M.26 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	1,764.00	----	----	----	----	----
Tree Training / Materials	----	130.84	3.72	120.36	122.84	64.80
Labor	390.06	310.53	336.60	348.02	365.97	445.83
Fertilizer	3.57	19.44	19.44	21.60	19.44	19.44
Chemicals	29.10	114.48	130.66	215.74	214.65	259.83
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	174.99	221.01	221.01	221.01	221.01	221.01
Other	32.50	----	----	----	----	----
Overhead	290.66	71.28	82.25	97.87	109.98	125.30
Interest	<u>222.26</u>	<u>38.87</u>	<u>35.54</u>	<u>45.62</u>	<u>46.27</u>	<u>48.56</u>
Nonharvest Var. Cost	4,167.14	1,006.45	954.22	1,195.22	1,225.16	1,309.77
<b>Harvest Costs</b>						
Picking	----	1.50	160.50	147.00	246.00	352.50
Hauling	----	0.25	26.75	24.50	41.00	58.75
Other Labor	----	10.53	12.70	12.70	23.59	23.66
Machinery Cost	----	2.77	8.68	8.68	16.07	16.07
Supervisor	----	<u>0.15</u>	<u>16.05</u>	<u>14.70</u>	<u>24.60</u>	<u>35.25</u>
Harvest Var. Cost	----	15.20	224.68	207.58	351.26	486.23
<b>Total Variable Cost</b>	4,167.14	1,021.65	1,178.90	1,402.80	1,576.42	1,796.00
<b>Fixed Costs</b>						
Machinery Cost	361.04	459.58	466.50	466.30	474.95	474.95
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	115.00	115.00	115.00	115.00	115.00
Int. on Estab. Cost <sup>b</sup>	----	<u>428.60</u>	<u>622.26</u>	<u>581.91</u>	<u>580.75</u>	<u>429.56</u>
Total Fixed Cost	596.04	1,168.18	1,368.76	1,328.21	1,335.70	1,184.51
<b>TOTAL COST</b>	4,763.18	2,189.83	2,547.66	2,731.01	2,912.12	2,980.51
Value of Production <sup>c</sup>	----	28.00	2,996.00	2,744.00	4,592.00	6,580.00
<b>NET COST</b>	4,763.18	2,161.83	(448.34)	(12.99)	(1,679.88)	(3,599.49)
<b>ACCUM. NET COST</b>	4,762.19	6,924.02	6,475.68	6,462.69	4,782.81	1,183.32

<sup>a</sup> 324 Nicobel Jonagold trees and 32 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = .10, Year 3 = 10.7, Year 4 = 9.8, Year 5 = 16.4, Year 6 = 23.5. Total 6-year production = 60.50 bins. Price/bin = \$280.



Table 18. Per-Acre Cost of Establishing a Freestanding Central Leader/Jonagold/M.7 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	1,764.00	----	----	----	----	----
Tree Training / Materials	----	130.84	2.48	98.44	205.84	200.88
Labor	390.06	269.61	365.97	391.71	497.31	490.71
Fertilizer	2.57	19.44	19.44	21.60	19.44	19.44
Chemicals	33.40	165.65	245.96	480.68	410.80	507.20
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	174.99	195.58	221.01	221.01	221.01	221.01
Other	32.50	----	----	----	----	----
Overhead	291.00	68.99	90.22	123.25	150.74	169.81
Interest	<u>222.46</u>	<u>38.73</u>	<u>42.13</u>	<u>59.35</u>	<u>65.14</u>	<u>71.14</u>
Nonharvest Var. Cost	4,170.98	988.84	1,112.21	1,521.04	1,695.28	1,805.19
<b>Harvest Costs</b>						
Picking	----	----	126.00	177.00	336.00	465.00
Hauling	----	----	21.00	29.50	56.00	75.50
Other Labor	----	----	12.70	12.70	23.59	23.66
Machinery Cost	----	----	8.68	14.13	16.07	16.07
Supervisor	----	----	<u>12.60</u>	<u>17.70</u>	<u>33.60</u>	<u>46.50</u>
Harvest Var. Cost	----	----	180.98	251.03	465.26	626.73
<b>Total Variable Cost</b>	<b>4,170.98</b>	<b>988.84</b>	<b>1,293.19</b>	<b>1,772.07</b>	<b>2,160.54</b>	<b>2,431.92</b>
<b>Fixed Costs</b>						
Machinery Cost	361.04	413.66	466.33	466.50	474.95	474.95
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	----	<u>429.03</u>	<u>618.17</u>	<u>644.78</u>	<u>630.73</u>	<u>384.51</u>
Total Fixed Cost	596.04	1,112.69	1,354.50	1,381.28	1,375.68	1,129.46
<b>TOTAL COST</b>	<b>4,767.02</b>	<b>2,101.53</b>	<b>2,647.69</b>	<b>3,153.35</b>	<b>3,536.22</b>	<b>3,561.38</b>
Value of Production <sup>c</sup>	----	----	2,352.00	3,304.00	6,272.00	8,680.00
<b>NET COST</b>	<b>4,767.02</b>	<b>2,101.53</b>	<b>295.69</b>	<b>(150.65)</b>	<b>(2,735.78)</b>	<b>(5,118.62)</b>
<b>ACCUM. NET COST</b>	<b>4,767.02</b>	<b>6,868.55</b>	<b>7,164.24</b>	<b>7,013.59</b>	<b>4,277.81</b>	<b>(840.81)</b>

<sup>a</sup> 324 Nicobel Jonagold trees and 32 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 3 = 8.4, Year 4 = 11.8, Year 5 = 22.4, Year 6 = 31.0. Total 6-year production = 73.60 bins. Price/bin = \$280.

Table 19. Per-Acre Cost of Establishing a Freestanding Central Leader/Delicious/M.26 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	1,764.00	----	----	----	----	----
Tree Training / Materials	----	129.60	129.6	84.24	174.96	6.20
Labor	412.50	269.61	295.35	280.43	306.57	311.12
Fertilizer	7.70	19.44	19.44	21.60	19.44	19.44
Chemicals	26.77	70.56	71.27	93.03	123.90	104.70
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	174.99	182.87	782.87	182.87	182.87	182.87
Other	32.50	----	----	----	----	----
Overhead	292.64	61.84	73.12	76.01	95.19	71.00
Interest	<u>223.40</u>	<u>33.47</u>	<u>35.39</u>	<u>33.92</u>	<u>39.97</u>	<u>32.26</u>
Nonharvest Var. Cost	4,194.50	867.39	1,532.04	897.10	1,067.90	852.59
<b>Harvest Costs</b>						
Picking	----	4.50	75.00	135.00	202.50	99.00
Hauling	----	0.75	12.50	22.50	33.75	16.50
Other Labor	----	10.53	12.70	12.70	23.60	23.66
Machinery Cost	----	2.77	8.68	8.68	16.07	16.07
Supervisor	----	<u>0.45</u>	<u>7.50</u>	<u>13.50</u>	<u>20.25</u>	<u>9.90</u>
Harvest Var. Cost	----	19.00	116.38	192.38	296.17	165.13
<b>Total Variable Cost</b>	<b>4,194.50</b>	<b>886.39</b>	<b>1,648.42</b>	<b>1,089.48</b>	<b>1,364.07</b>	<b>1,017.72</b>
<b>Fixed Costs</b>						
Machinery Cost	361.04	395.75	402.50	402.50	411.11	410.93
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	115.00	115.00	115.00	115.00	115.00
Int. on Estab. Cost <sup>b</sup>	----	<u>431.15</u>	<u>605.32</u>	<u>742.65</u>	<u>838.46</u>	<u>903.59</u>
Total Fixed Cost	596.04	1,106.90	1,287.82	1,425.15	1,529.57	1,594.52
<b>TOTAL COST</b>	<b>4,790.54</b>	<b>1,993.29</b>	<b>2,936.24</b>	<b>2,514.63</b>	<b>2,893.64</b>	<b>2,612.24</b>
Value of Production <sup>v</sup>	----	48.00	800.00	1,440.00	2,160.00	1,056.00
<b>NET COST</b>	<b>4,790.54</b>	<b>1,945.29</b>	<b>2,136.24</b>	<b>1,074.63</b>	<b>733.64</b>	<b>1,556.24</b>
<b>ACCUM. NET COST</b>	<b>4,790.54</b>	<b>6,735.83</b>	<b>8,872.07</b>	<b>9,946.70</b>	<b>10,680.34</b>	<b>12,236.58</b>

<sup>a</sup> 324 Red Chief Mercier Delicious trees and 32 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.30, Year 3 = 5.0, Year 4 = 9.0, Year 5 = 13.5, Year 6 = 6.6. Total 6-year production = 34.40 bins. Price/bin = \$160.

Table 20. Per-Acre Cost of Establishing a Freestanding Central Leader/Delicious/M.7 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>s</sup>	1,764.00	----	----	----	----	----
Tree Training / Materials	----	168.48	168.48	233.28	233.28	233.28
Labor	412.50	271.59	319.51	335.02	354.55	362.01
Fertilizer	7.70	19.44	19.44	21.60	19.44	19.44
Chemicals	27.43	74.10	90.42	149.50	202.61	124.06
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	174.99	182.87	182.87	182.87	182.87	182.87
Other	32.50	----	----	----	----	----
Overhead	292.69	65.32	78.54	99.01	121.49	101.45
Interest	<u>223.43</u>	<u>35.41</u>	<u>38.69</u>	<u>45.09</u>	<u>48.26</u>	<u>47.83</u>
Nonharvest Var. Cost	4,195.24	917.21	1,022.95	1,191.37	1,287.50	1,195.94
<b>Harvest Costs</b>						
Picking	----	4.50	72.00	180.00	327.00	136.50
Hauling	----	0.75	12.00	30.00	54.50	22.75
Other Labor	----	10.53	12.70	12.70	23.60	23.66
Machinery Cost	----	2.77	8.68	8.68	16.07	16.07
Supervisor	----	<u>0.45</u>	<u>7.20</u>	<u>180.00</u>	<u>32.70</u>	<u>13.65</u>
Harvest Var. Cost	----	19.00	112.58	411.38	453.87	212.63
<b>Total Variable Cost</b>	4,195.24	936.21	1,135.53	1,602.75	1,741.37	1,408.57
<b>Fixed Costs</b>						
Machinery Cost	361.04	395.75	402.50	402.68	411.11	410.93
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	115.00	115.00	115.00	115.00	115.00
Int. on Estab. Cost <sup>b</sup>	----	<u>431.22</u>	<u>609.88</u>	<u>757.50</u>	<u>841.14</u>	<u>820.94</u>
Total Fixed Cost	596.04	1,106.97	1,292.38	1,440.18	1,532.25	1,511.87
<b>TOTAL COST</b>	4,791.28	2,043.18	2,427.91	3,042.93	3,273.62	2,920.44
Value of Production <sup>c</sup>	----	48.00	768.00	1,920.00	3,488.00	1,456.00
<b>NET COST</b>	4,791.28	1,995.18	1,659.91	1,122.93	(214.38)	1,464.44
<b>ACCUM. NET COST</b>	4,791.28	6,786.46	8,446.37	9,569.30	9,354.92	10,819.36

<sup>a</sup> 324 Red Chief Mercier Delicious trees and 32 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.30, Year 3 = 4.8, Year 4 = 12.0, Year 5 = 21.8, Year 6 = 9.1. Total 6-year production = 48.00 bins. Price/bin = \$160.

Table 21. Per-Acre Cost of Establishing a Vertical Axis/Gala/M.26 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>s</sup>	2,825.00	----	----	----	----	----
Tree Training / Materials	858.58	1.86	3.72	4.96	99.96	3.72
Labor	1,068.61	437.25	534.93	476.85	711.81	612.81
Fertilizer	8.40	30.84	46.20	41.16	62.04	31.20
Chemicals	39.00	222.72	260.57	289.85	509.94	494.75
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	290.84	240.54	240.54	240.54	240.54	240.54
Other	23.75	----	----	----	----	----
Overhead	505.35	85.74	124.88	117.24	204.33	188.07
Interest	<u>363.88</u>	<u>45.58</u>	<u>54.73</u>	<u>51.54</u>	<u>77.12</u>	<u>69.45</u>
Nonharvest Var. Cost	7,243.41	1,164.53	1,390.57	1,347.14	2,030.74	1,765.54
<b>Harvest Costs</b>						
Picking	----	31.50	276.60	225.00	631.65	657.00
Hauling	----	5.25	46.10	37.50	105.28	109.50
Other Labor	----	14.52	29.04	28.38	58.08	58.08
Machinery Cost	----	9.97	19.92	19.92	39.86	39.86
Supervisor	----	<u>3.15</u>	<u>27.66</u>	<u>22.50</u>	<u>63.17</u>	<u>65.70</u>
Harvest Var. Cost	----	64.39	399.32	333.30	898.04	930.14
<b>Total Variable Cost</b>	<b>7,243.41</b>	<b>1,228.92</b>	<b>1,789.89</b>	<b>1,680.44</b>	<b>2,928.78</b>	<b>2,695.68</b>
<b>Fixed Costs</b>						
Machinery Cost	536.31	498.89	510.68	510.68	533.55	533.55
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	----	<u>721.32</u>	<u>890.44</u>	<u>538.10</u>	<u>268.03</u>	----
Total Fixed Cost	771.31	1,490.21	1,671.12	1,318.78	1,071.58	803.55
<b>TOTAL COST</b>	<b>8,014.72</b>	<b>2,719.13</b>	<b>3,461.01</b>	<b>2,999.22</b>	<b>4,000.36</b>	<b>3,499.23</b>
Value of Production <sup>c</sup>	----	840.00	7,376.00	6,000.00	16,844.00	17,520.00
<b>NET COST</b>	<b>8,014.72</b>	<b>1,879.13</b>	<b>(3,914.99)</b>	<b>(3,000.78)</b>	<b>(12,843.64)</b>	<b>(14,020.77)</b>
<b>ACCUM. NET COST</b>	<b>8,014.72</b>	<b>9,893.85</b>	<b>5,978.86</b>	<b>2,978.08</b>	<b>(9,865.56)</b>	<b>(23,886.33)</b>

<sup>a</sup> 514 Imperial Gala trees and 51 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 2.10, Year 3 = 18.44, Year 4 = 15.00, Year 5 = 42.11, Year 6 = 43.80. Total 6-year production = 121.45 bins. Price/bin = \$400.

Table 22. Per-Acre Cost of Establishing a Vertical Axis/Gala/M.7 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	-----	-----	-----	-----	-----
Trees <sup>s</sup>	2,825.00	-----	-----	-----	-----	-----
Tree Training / Materials	859.82	2.48	3.72	97.48	101.82	3.10
Labor	972.91	401.61	613.47	709.83	916.41	954.69
Fertilizer	8.40	30.84	46.20	36.24	62.04	31.20
Chemicals	43.44	284.80	441.68	531.43	537.77	536.50
Beehives	-----	-----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	289.86	240.54	240.54	240.54	240.54	240.54
Other	23.75	-----	-----	-----	-----	-----
Overhead	498.17	85.50	145.07	155.08	235.50	204.11
Interest	<u>359.07</u>	<u>48.07</u>	<u>68.81</u>	<u>79.14</u>	<u>92.56</u>	<u>96.94</u>
Nonharvest Var. Cost	7,140.42	1,193.84	1,684.49	1,974.74	2,311.64	2,192.08
<b>Harvest Costs</b>						
Picking	-----	5.70	272.85	176.55	762.60	519.00
Hauling	-----	0.95	45.47	29.42	127.10	86.50
Other Labor	-----	14.52	29.04	14.52	58.08	46.20
Machinery Cost	-----	9.97	19.92	9.97	39.86	29.89
Supervisor	<u>-----</u>	<u>0.57</u>	<u>27.29</u>	<u>17.66</u>	<u>76.26</u>	<u>51.90</u>
Harvest Var. Cost	-----	31.71	394.57	248.12	1,063.90	733.49
<b>Total Variable Cost</b>	<b>7,140.42</b>	<b>1,225.55</b>	<b>2,079.06</b>	<b>2,222.86</b>	<b>3,375.54</b>	<b>2,925.57</b>
<b>Fixed Costs</b>						
Machinery Cost	529.70	498.89	507.68	499.25	533.55	522.12
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>-----</u>	<u>711.46</u>	<u>941.31</u>	<u>628.29</u>	<u>530.41</u>	<u>-----</u>
Total Fixed Cost	764.70	1,480.35	1,718.99	1,397.54	1,333.96	792.12
<b>TOTAL COST</b>	<b>7,905.12</b>	<b>2,705.90</b>	<b>3,798.05</b>	<b>3,620.40</b>	<b>4,709.50</b>	<b>3,717.69</b>
Value of Production <sup>c</sup>	-----	152.00	7,276.00	4,708.00	20,336.00	13,840.00
<b>NET COST</b>	<b>7,905.12</b>	<b>2,553.90</b>	<b>(3,477.95)</b>	<b>(1,087.60)</b>	<b>(15,626.50)</b>	<b>(10,122.31)</b>
<b>ACCUM. NET COST</b>	<b>7,905.12</b>	<b>10,459.02</b>	<b>6,981.07</b>	<b>5,893.47</b>	<b>(9,733.03)</b>	<b>(19,855.34)</b>

<sup>a</sup> 514 Imperial Gala trees and 51 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.38, Year 3 = 18.19, Year 4 = 11.77, Year 5 = 50.84, Year 6 = 34.60. Total 6-year production = 115.78 bins. Price/bin = \$400.

Table 23. Per-Acre Cost of Establishing a Vertical Axis/Jonagold/M.26 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
Variable Costs, Nonharvest						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>s</sup>	2,825.00	----	----	----	----	----
Tree Training / Materials	859.82	1.24	3.72	71.78	101.82	4.34
Labor	992.05	352.11	443.19	433.95	499.29	535.59
Fertilizer	8.40	30.84	46.20	36.24	62.04	31.20
Chemicals	37.32	132.59	250.69	315.99	257.01	319.29
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	290.04	240.54	240.54	240.54	240.54	240.54
Other	23.75	----	----	----	----	----
Overhead	499.21	75.18	114.38	124.08	147.74	160.16
Interest	<u>359.81</u>	<u>40.66</u>	<u>49.09</u>	<u>53.03</u>	<u>56.46</u>	<u>58.08</u>
Nonharvest Var. Cost	7,155.40	973.16	1,272.81	1,400.61	1,489.90	1,474.20
Harvest Costs						
Picking	----	10.80	250.80	259.65	435.45	574.50
Hauling	----	1.80	41.80	43.27	72.58	95.75
Other Labor	----	14.52	29.04	29.04	46.20	46.20
Machinery Cost	----	9.97	19.92	19.92	29.89	29.89
Supervisor	<u>----</u>	<u>1.08</u>	<u>25.08</u>	<u>25.96</u>	<u>43.55</u>	<u>57.45</u>
Harvest Var. Cost	----	38.17	366.64	377.84	627.67	803.79
Total Variable Cost	7,155.40	1,011.33	1,639.45	1,778.45	2,117.57	2,277.99
Fixed Costs						
Machinery Cost	530.92	498.89	510.68	510.68	522.12	522.12
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>712.92</u>	<u>925.12</u>	<u>804.84</u>	<u>671.39</u>	<u>262.13</u>
Total Fixed Cost	765.92	1,481.81	1,705.80	1,585.52	1,463.51	1,054.25
TOTAL COST	7,921.32	2,493.14	3,345.25	3,363.97	3,581.08	3,332.24
Value of Production <sup>c</sup>	----	201.60	4,681.60	4,846.80	8,128.40	10,724.00
NET COST	7,921.32	2,291.54	(1,336.35)	(1,482.83)	(4,547.32)	(7,391.76)
ACCUM. NET COST	7,921.32	10,212.86	8,876.51	7,393.68	2,846.36	(4,545.40)

<sup>a</sup> 514 Nicobel Jonagold trees and 51 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.72, Year 3 = 16.72, Year 4 = 17.31, Year 5 = 29.03, Year 6 = 38.30. Total 6-year production = 102.08 bins. Price/bin = \$280.

Table 24. Per-Acre Cost of Establishing a Vertical Axis/Jonagold/M.7 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>s</sup>	2,825.00	----	----	----	----	----
Tree Training / Materials	858.58	1.24	3.72	97.48	101.82	3.10
Labor	990.73	369.27	536.91	529.65	838.53	627.99
Fertilizer	8.40	30.84	46.08	36.24	62.04	31.20
Chemicals	43.07	280.24	372.31	498.12	535.32	535.41
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	290.04	240.54	240.54	240.54	240.54	240.54
Other	23.75	----	----	----	----	----
Overhead	499.46	82.37	141.50	145.00	200.37	175.85
Interest	<u>359.93</u>	<u>45.95</u>	<u>60.30</u>	<u>67.37</u>	<u>87.50</u>	<u>72.64</u>
Nonharvest Var. Cost	7,158.96	1,150.45	1,526.36	1,739.40	2,191.12	1,811.73
<b>Harvest Costs</b>						
Picking	----	4.50	336.15	228.60	498.90	499.50
Hauling	----	0.75	56.03	38.10	83.15	83.25
Other Labor	----	14.52	46.20	29.04	29.04	46.20
Machinery Cost	----	9.97	29.89	20.31	19.92	29.89
Supervisor	<u>----</u>	<u>0.45</u>	<u>33.62</u>	<u>22.86</u>	<u>49.89</u>	<u>49.95</u>
Harvest Var. Cost	----	30.19	501.89	338.91	680.90	708.79
Total Variable Cost	7,158.96	1,180.64	2,028.25	2,078.31	2,872.02	2,520.52
<b>Fixed Costs</b>						
Machinery Cost	530.92	498.89	522.12	511.13	510.68	522.12
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>713.24</u>	<u>945.33</u>	<u>719.50</u>	<u>657.56</u>	<u>207.33</u>
Total Fixed Cost	765.92	1,482.13	1,737.45	1,500.63	1,438.24	999.45
TOTAL COST	7,924.88	2,662.77	3,765.70	3,578.94	4,310.26	3,519.97
Value of Production <sup>c</sup>	----	84.00	6,274.80	4,267.20	9,312.80	9,324.00
NET COST	7,924.88	2,578.77	(2,509.10)	(688.26)	(5,002.54)	(5,804.03)
ACCUM. NET COST	7,924.88	10,503.65	7,994.55	7,306.29	2,303.75	(3,500.28)

<sup>a</sup> 514 Nicobel Jonagold trees and 51 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.30, Year 3 = 22.41, Year 4 = 15.24, Year 5 = 33.26, Year 6 = 33.30. Total 6-year production = 104.51 bins. Price/bin = \$280.

Table 25. Per-Acre Cost of Establishing a Vertical Axis/Delicious/M.26 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
Variable Costs, Nonharvest						
Land Preparation	1,160.00	-----	-----	-----	-----	-----
Trees <sup>s</sup>	2,825.00	-----	-----	-----	-----	-----
Tree Training / Materials	858.58	1.24	370.62	192.48	92.52	133.64
Labor	992.05	316.47	457.05	428.67	551.43	543.51
Fertilizer	8.40	30.84	46.20	36.24	62.04	31.20
Chemicals	33.32	97.95	132.86	148.23	228.40	197.66
Beehives	-----	-----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	290.06	198.15	198.15	198.15	198.15	198.15
Other	23.75	-----	-----	-----	-----	-----
Overhead	498.80	61.52	126.41	111.91	153.96	116.04
Interest	<u>359.57</u>	<u>33.27</u>	<u>59.47</u>	<u>49.27</u>	<u>55.87</u>	<u>58.00</u>
Nonharvest Var. Cost	7,149.53	839.44	1,515.76	1,289.95	1,467.37	1,403.20
Harvest Costs						
Picking	-----	4.80	195.15	209.25	541.20	186.00
Hauling	-----	0.80	32.52	34.88	90.20	31.00
Other Labor	-----	14.52	29.04	29.04	29.04	14.52
Machinery Cost	-----	9.97	19.92	19.92	19.92	9.97
Supervisor	<u>-----</u>	<u>0.48</u>	<u>19.52</u>	<u>20.92</u>	<u>54.12</u>	<u>18.60</u>
Harvest Var. Cost	-----	30.57	296.15	314.01	734.48	260.09
Total Variable Cost	7,149.53	870.01	1,811.91	1,603.96	2,201.85	1,663.29
Fixed Costs						
Machinery Cost	531.02	427.97	439.76	439.76	439.76	428.33
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>-----</u>	<u>712.40</u>	<u>914.09</u>	<u>1,035.96</u>	<u>1,136.55</u>	<u>981.78</u>
Total Fixed Cost	766.02	1,410.37	1,623.85	1,745.72	1,846.31	1,680.11
TOTAL COST	7,915.55	2,280.38	3,435.76	3,349.68	4,048.16	3,343.40
Value of Production <sup>v</sup>	-----	51.20	2,081.60	2,232.00	5,772.80	1,984.00
NET COST	7,915.55	2,229.18	1,354.16	1,117.68	(1,724.64)	1,359.40
ACCUM. NET COST	7,915.55	10,144.73	11,498.89	12,616.57	10,891.93	12,251.33

<sup>a</sup> 514 Red Chief Mercier Delicious trees and 51 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.32, Year 3 = 13.01, Year 4 = 13.95, Year 5 = 36.08, Year 6 = 12.40. Total 6-year production = 75.76 bins. Price/bin = \$160.



Table 26. Per-Acre Cost of Establishing a Vertical Axis/Delicious/M.7 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	-----	-----	-----	-----	-----
Trees <sup>s</sup>	2,825.00	-----	-----	-----	-----	-----
Tree Training / Materials	857.34	1.24	133.64	98.72	101.20	95.00
Labor	1,018.45	301.29	367.29	335.61	666.27	340.89
Fertilizer	8.40	30.84	46.20	36.24	62.04	31.20
Chemicals	32.23	103.76	107.29	118.20	155.88	135.85
Beehives	-----	-----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	290.33	198.15	198.15	198.15	198.15	198.15
Other	23.75	-----	-----	-----	-----	-----
Overhead	500.72	60.65	94.92	94.92	145.70	89.73
Interest	<u>360.85</u>	<u>31.98</u>	<u>42.33</u>	<u>38.81</u>	<u>56.94</u>	<u>40.80</u>
Nonharvest Var. Cost	7,177.07	827.91	1,114.82	1,045.65	1,511.18	1,056.62
<b>Harvest Costs</b>						
Picking	-----	13.35	155.25	215.55	541.50	142.50
Hauling	-----	2.23	25.87	35.92	90.25	23.75
Other Labor	-----	14.52	29.04	29.04	46.20	29.04
Machinery Cost	-----	9.97	19.92	19.92	29.89	19.92
Supervisor	<u>-----</u>	<u>1.34</u>	<u>15.52</u>	<u>21.55</u>	<u>54.15</u>	<u>14.25</u>
Harvest Var. Cost	-----	41.41	245.60	321.98	761.99	229.46
<b>Total Variable Cost</b>	<b>7,177.07</b>	<b>869.32</b>	<b>1,360.42</b>	<b>1,367.63</b>	<b>2,273.17</b>	<b>1,286.08</b>
<b>Fixed Costs</b>						
Machinery Cost	532.84	427.97	439.76	439.76	451.20	439.76
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>-----</u>	<u>715.04</u>	<u>907.63</u>	<u>1,026.60</u>	<u>1,098.48</u>	<u>947.00</u>
Total Fixed Cost	767.84	1,413.01	1,617.39	1,736.36	1,819.68	1,656.76
<b>TOTAL COST</b>	<b>7,944.91</b>	<b>2,282.33</b>	<b>2,977.81</b>	<b>3,103.99</b>	<b>4,092.85</b>	<b>2,942.84</b>
Value of Production <sup>c</sup>	-----	142.40	1,656.00	2,299.20	5,776.00	1,520.00
<b>NET COST</b>	<b>7,944.91</b>	<b>2,139.93</b>	<b>1,321.81</b>	<b>804.79</b>	<b>(1,683.15)</b>	<b>1,422.84</b>
<b>ACCUM. NET COST</b>	<b>7,944.91</b>	<b>10,084.84</b>	<b>11,406.65</b>	<b>12,211.44</b>	<b>10,528.29</b>	<b>11,951.13</b>

<sup>a</sup> 514 Red Chief Mercier Delicious trees and 51 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 0.89, Year 3 = 10.35, Year 4 = 14.37, Year 5 = 36.10, Year 6 = 9.50. Total 6-year production = 71.21 bins. Price/bin = \$160.

Table 27. Per-Acre Cost of Establishing a Slender Spindle/Gala/M.9 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	4,245.00	----	----	----	----	----
Tree Training / Materials	1,191.96	6.20	9.30	9.30	112.76	3.10
Labor	1,005.71	561.00	674.12	694.52	865.46	791.54
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	44.40	219.73	267.69	373.51	512.91	642.73
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	----	----	----	----	----
Overhead	648.00	110.71	152.86	187.05	223.79	247.30
Interest	<u>451.80</u>	<u>55.35</u>	<u>65.99</u>	<u>70.15</u>	<u>88.09</u>	<u>81.85</u>
Nonharvest Var. Cost	9,289.29	1,402.47	1,667.48	1,817.41	2,277.97	2,241.48
<b>Harvest Costs</b>						
Picking	----	106.95	355.35	604.50	657.00	1,029.00
Hauling	----	17.82	59.23	100.75	109.50	171.50
Other Labor	----	29.04	43.56	58.08	58.08	72.60
Machinery Cost	----	19.92	29.89	39.86	39.86	49.81
Supervisor	----	<u>10.70</u>	<u>35.54</u>	<u>60.45</u>	<u>65.70</u>	<u>102.90</u>
Harvest Var. Cost	----	184.43	523.57	863.64	930.14	1,425.81
<b>Total Variable Cost</b>	<b>9,289.29</b>	<b>1,586.90</b>	<b>2,191.05</b>	<b>2,681.05</b>	<b>3,208.11</b>	<b>3,667.29</b>
<b>Fixed Costs</b>						
Machinery Cost	699.73	609.82	621.61	633.04	633.04	644.48
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	----	<u>917.35</u>	<u>965.23</u>	<u>476.70</u>	----	----
Total Fixed Cost	934.73	1,797.17	1,856.84	1,379.74	903.04	914.48
<b>TOTAL COST</b>	<b>10,224.02</b>	<b>3,384.07</b>	<b>4,047.89</b>	<b>4,060.79</b>	<b>4,111.15</b>	<b>4,581.77</b>
Value of Production <sup>c</sup>	----	2,852.00	9,476.00	16,120.00	17,520.00	27,440.00
<b>NET COST</b>	<b>10,224.02</b>	<b>532.07</b>	<b>(5,428.11)</b>	<b>(12,059.21)</b>	<b>(13,408.85)</b>	<b>(22,858.23)</b>
<b>ACCUM. NET COST</b>	<b>10,224.02</b>	<b>10,756.09</b>	<b>5,327.98</b>	<b>(6,731.23)</b>	<b>(20,140.08)</b>	<b>(42,998.31)</b>

<sup>a</sup> 772 Imperial Gala trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 7.13, Year 3 = 23.69, Year 4 = 40.30, Year 5 = 43.80, Year 6 = 68.60. Total 6-year production = 183.52 bins. Price/bin = \$400.

Table 28. Per-Acre Cost of Establishing a Slender Spindle/Gala/B.9 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	-----	-----	-----	-----	-----
Trees <sup>a</sup>	4,245.00	-----	-----	-----	-----	-----
Tree Training / Materials	1,191.96	6.20	11.78	9.92	251.72	3.10
Labor	1,096.13	482.46	744.74	643.70	861.50	734.12
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	44.11	215.78	241.80	344.76	490.64	504.43
Beehives	-----	-----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	-----	-----	-----	-----	-----
Overhead	655.07	99.12	150.21	160.29	229.29	200.29
Interest	<u>455.85</u>	<u>50.69</u>	<u>67.71</u>	<u>66.31</u>	<u>93.52</u>	<u>78.43</u>
Nonharvest Var. Cost	9,390.54	1,303.73	1,713.76	1,707.86	2,401.63	1,995.33
<b>Harvest Costs</b>						
Picking	-----	73.05	308.10	407.55	640.65	633.00
Hauling	-----	12.17	51.35	67.93	106.77	105.50
Other Labor	-----	14.52	29.04	43.56	43.56	43.56
Machinery Cost	-----	9.97	19.92	29.89	29.89	30.20
Supervisor	<u>-----</u>	<u>7.30</u>	<u>30.81</u>	<u>40.76</u>	<u>64.06</u>	<u>63.30</u>
Harvest Var. Cost	-----	117.01	439.22	589.69	884.93	875.56
Total Variable Cost	9,390.54	1,420.74	2,152.98	2,297.55	3,286.56	2,870.89
<b>Fixed Costs</b>						
Machinery Cost	699.73	598.39	610.17	621.61	621.61	621.97
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>-----</u>	<u>926.73</u>	<u>1,040.57</u>	<u>667.76</u>	<u>36.76</u>	<u>-----</u>
Total Fixed Cost	934.73	1,795.12	1,920.74	1,559.37	928.37	891.97
TOTAL COST	10,325.27	3,215.86	4,073.72	3,856.92	4,214.93	3,762.86
Value of Production <sup>c</sup>	-----	1,948.00	8,216.00	10,868.00	17,084.00	16,880.00
NET COST	10,325.27	1,267.86	(4,142.28)	(7,011.08)	(12,869.07)	(13,117.14)
ACCUM. NET COST	10,325.27	11,593.13	7,450.85	439.77	(12,429.30)	(25,546.44)

<sup>a</sup> 772 Imperial Gala trees and 77 pollinizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 4.87, Year 3 = 20.54, Year 4 = 27.17, Year 5 = 42.71, Year 6 = 42.20. Total 6-year production = 137.49 bins. Price/bin = \$400.

Table 29. Per-Acre Cost of Establishing a Slender Spindle/Gala/Mark Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	-----	-----	-----	-----	-----
Trees <sup>a</sup>	4,245.00	-----	-----	-----	-----	-----
Tree Training / Materials	1,191.96	6.20	8.68	7.44	111.52	3.10
Labor	987.89	556.38	637.16	640.40	709.70	711.02
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	41.63	181.12	202.53	324.41	414.00	413.86
Beehives	-----	-----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	-----	-----	-----	-----	-----
Overhead	646.39	101.87	143.82	183.96	197.71	212.14
Interest	<u>450.87</u>	<u>53.27</u>	<u>61.20</u>	<u>64.49</u>	<u>76.53</u>	<u>71.14</u>
Nonharvest Var. Cost	9,266.16	1,348.32	1,550.91	1,703.58	1,984.42	1,886.22
<b>Harvest Costs</b>						
Picking	-----	69.00	343.50	681.00	610.50	814.50
Hauling	-----	11.50	57.25	113.50	101.75	135.75
Other Labor	-----	14.52	46.20	58.08	46.20	72.60
Machinery Cost	-----	9.97	29.89	39.86	29.89	50.12
Supervisor	<u>-----</u>	<u>6.90</u>	<u>34.35</u>	<u>68.10</u>	<u>61.05</u>	<u>81.45</u>
Harvest Var. Cost	-----	111.89	511.19	960.54	849.39	1,154.42
<b>Total Variable Cost</b>	<b>9,266.16</b>	<b>1,460.21</b>	<b>2,062.10</b>	<b>2,664.12</b>	<b>2,833.81</b>	<b>3,040.64</b>
<b>Fixed Costs</b>						
Machinery Cost	699.73	598.39	621.61	633.04	621.61	644.48
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>-----</u>	<u>915.27</u>	<u>1,041.61</u>	<u>576.73</u>	<u>-----</u>	<u>-----</u>
Total Fixed Cost	934.73	1,783.66	1,933.22	1,479.77	891.61	914.48
<b>TOTAL COST</b>	<b>10,200.89</b>	<b>3,243.87</b>	<b>3,995.32</b>	<b>4,143.89</b>	<b>3,725.42</b>	<b>3,955.12</b>
Value of Production <sup>c</sup>	-----	1,840.00	9,160.00	18,160.00	16,280.00	21,720.00
<b>NET COST</b>	<b>10,200.89</b>	<b>1,403.87</b>	<b>(5,164.68)</b>	<b>(14,016.11)</b>	<b>(12,554.58)</b>	<b>(17,764.88)</b>
<b>ACCUM. NET COST</b>	<b>10,200.89</b>	<b>11,604.76</b>	<b>6,440.08</b>	<b>(7,576.03)</b>	<b>(20,130.61)</b>	<b>(37,895.49)</b>

<sup>a</sup> 772 Imperial Gala trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 4.60, Year 3 = 22.90, Year 4 = 45.40, Year 5 = 40.70, Year 6 = 54.30. Total 6-year production = 167.90 bins. Price/bin = \$400.

Table 30. Per-Acre Cost of Establishing a Slender Spindle/Gala/P.2 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees	4,245.00	----	----	----	----	----
Tree Training / Materials	1,191.96	6.20	7.44	7.44	112.76	3.10
Labor	969.41	506.88	630.56	658.88	670.10	666.80
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	42.72	196.62	224.57	317.88	403.44	387.69
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	----	----	----	----	----
Overhead	645.03	103.26	146.41	165.98	186.90	194.47
Interest	<u>450.09</u>	<u>51.49</u>	<u>61.84</u>	<u>65.69</u>	<u>74.42</u>	<u>67.25</u>
Nonharvest Var. Cost	9,246.63	1,313.93	1,568.34	1,698.75	1,922.58	1,794.27
<b>Harvest Costs</b>						
Picking	----	114.00	358.50	477.00	537.00	711.00
Hauling	----	19.00	59.75	79.50	89.50	118.50
Other Labor	----	14.52	46.20	46.20	46.20	55.11
Machinery Cost	----	7.16	29.89	29.89	29.89	37.28
Supervisor	<u>----</u>	<u>11.40</u>	<u>35.85</u>	<u>47.70</u>	<u>53.70</u>	<u>71.10</u>
Harvest Var. Cost	----	166.08	530.19	680.29	756.29	992.99
Total Variable Cost	9,246.63	1,480.01	2,098.53	2,379.04	2,678.87	2,787.26
<b>Fixed Costs</b>						
Machinery Cost	699.73	594.94	621.61	621.61	621.61	630.05
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>913.51</u>	<u>933.17</u>	<u>425.87</u>	<u>----</u>	<u>----</u>
Total Fixed Cost	934.73	1,778.45	1,824.78	1,317.48	891.61	900.05
TOTAL COST	10,181.36	3,258.46	3,923.31	3,696.52	3,570.48	3,687.31
Value of Production <sup>c</sup>	----	3,040.00	9,560.00	12,720.00	14,320.00	18,960.00
NET COST	10,181.36	218.46	(5,636.69)	(9,023.48)	(10,749.52)	(15,272.69)
ACCUM. NET COST	10,181.36	10,399.82	4,763.13	(4,260.35)	(15,009.87)	(30,282.56)

<sup>a</sup> 772 Imperial Gala trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 7.60, Year 3 = 23.90, Year 4 = 31.80, Year 5 = 35.80, Year 6 = 47.40. Total 6-year production = 146.50 bins. Price/bin = \$400.

Table 31. Per-Acre Cost of Establishing a Slender Spindle/Jonagold/M.9 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	4,245.00	----	----	----	----	----
Tree Training / Materials	1,193.20	6.20	11.16	8.06	112.76	3.10
Labor	1,097.45	572.88	717.02	605.42	749.96	770.42
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	44.54	221.70	232.15	339.14	476.23	397.53
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	----	----	----	----	----
Overhead	655.30	107.96	157.11	141.81	203.70	196.89
Interest	<u>455.99</u>	<u>55.10</u>	<u>65.67</u>	<u>64.12</u>	<u>80.66</u>	<u>75.71</u>
Nonharvest Var. Cost	9,393.90	1,413.32	1,680.63	1,641.43	2,098.27	1,918.61
<b>Harvest Costs</b>						
Picking	----	86.55	412.35	270.15	571.20	636.00
Hauling	----	14.42	68.72	45.03	95.20	106.00
Other Labor	----	14.52	29.04	29.04	58.08	58.08
Machinery Cost	----	9.97	19.92	19.92	39.86	39.86
Supervisor	<u>----</u>	<u>8.65</u>	<u>41.23</u>	<u>27.02</u>	<u>57.12</u>	<u>63.60</u>
Harvest Var. Cost	----	134.11	571.26	391.16	821.46	903.54
<b>Total Variable Cost</b>	<b>9,393.90</b>	<b>1,547.43</b>	<b>2,251.89</b>	<b>2,032.59</b>	<b>2,919.73</b>	<b>2,822.15</b>
<b>Fixed Costs</b>						
Machinery Cost	699.73	598.39	610.17	610.17	633.04	633.04
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>926.76</u>	<u>1,082.19</u>	<u>768.72</u>	<u>646.19</u>	<u>88.78</u>
Total Fixed Cost	934.73	1,795.15	1,962.36	1,648.89	1,549.23	991.82
<b>TOTAL COST</b>	<b>10,328.63</b>	<b>3,342.58</b>	<b>4,214.25</b>	<b>3,681.48</b>	<b>4,468.96</b>	<b>3,813.97</b>
Value of Production <sup>c</sup>	----	1,615.60	7,697.20	5,042.80	10,662.40	11,872.00
<b>NET COST</b>	<b>10,328.63</b>	<b>1,726.98</b>	<b>(3,482.95)</b>	<b>(1,361.32)</b>	<b>(6,193.44)</b>	<b>(8,058.03)</b>
<b>ACCUM. NET COST</b>	<b>10,328.63</b>	<b>12,055.61</b>	<b>8,572.66</b>	<b>7,211.34</b>	<b>1,017.90</b>	<b>(7,040.13)</b>

<sup>a</sup> 772 Nicobel Jonagold trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 5.77, Year 3 = 27.49, Year 4 = 18.01, Year 5 = 38.08, Year 6 = 42.40. Total 6-year production = 131.75 bins. Price/bin = \$280.

Table 32. Per-Acre Cost of Establishing a Slender Spindle/Jonagold/B.9 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	-----	-----	-----	-----	-----
Trees <sup>a</sup>	4,245.00	-----	-----	-----	-----	-----
Tree Training / Materials	1,193.20	5.58	11.16	8.68	112.76	4.34
Labor	1,104.05	559.02	713.06	618.62	800.12	774.38
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	43.01	200.56	232.15	368.72	496.57	434.20
Beehives	-----	-----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	-----	-----	-----	-----	-----
Overhead	655.70	100.99	149.70	148.55	193.58	208.98
Interest	<u>456.21</u>	<u>53.43</u>	<u>65.64</u>	<u>65.60</u>	<u>84.77</u>	<u>77.19</u>
Nonharvest Var. Cost	9,399.59	1,369.06	1,669.23	1,693.05	2,162.76	1,974.05
<b>Harvest Costs</b>						
Picking	-----	42.60	337.50	305.70	405.75	729.00
Hauling	-----	7.10	56.25	50.95	67.63	121.50
Other Labor	-----	14.52	29.04	29.04	58.08	58.08
Machinery Cost	-----	9.97	19.92	19.92	39.86	39.86
Supervisor	<u>-----</u>	<u>4.26</u>	<u>33.75</u>	<u>30.57</u>	<u>40.58</u>	<u>72.90</u>
Harvest Var. Cost	-----	78.45	476.46	436.18	611.90	1,021.34
<b>Total Variable Cost</b>	<b>9,399.59</b>	<b>1,447.51</b>	<b>2,145.69</b>	<b>2,129.23</b>	<b>2,774.66</b>	<b>2,995.39</b>
<b>Fixed Costs</b>						
Machinery Cost	699.73	598.39	610.17	610.17	633.04	633.04
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>-----</u>	<u>927.28</u>	<u>1,147.59</u>	<u>956.20</u>	<u>799.53</u>	<u>520.81</u>
Total Fixed Cost	934.73	1,795.67	2,027.76	1,836.37	1,702.57	1,423.85
<b>TOTAL COST</b>	<b>10,334.32</b>	<b>3,243.18</b>	<b>4,173.45</b>	<b>3,965.60</b>	<b>4,477.23</b>	<b>4,419.24</b>
Value of Production <sup>c</sup>	-----	795.20	6,300.00	5,706.40	7,574.00	13,608.00
<b>NET COST</b>	<b>10,334.32</b>	<b>2,447.98</b>	<b>(2,126.55)</b>	<b>(1,740.80)</b>	<b>(3,096.77)</b>	<b>(9,188.76)</b>
<b>ACCUM. NET COST</b>	<b>10,334.32</b>	<b>12,782.30</b>	<b>10,655.75</b>	<b>8,914.95</b>	<b>5,818.18</b>	<b>(3,370.58)</b>

<sup>a</sup> 772 Nicobel Jonagold trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 2.84, Year 3 = 22.50, Year 4 = 20.38, Year 5 = 27.05, Year 6 = 48.60. Total 6-year production = 121.37 bins. Price/bin = \$280.

Table 33. Per-Acre Cost of Establishing a Slender Spindle/Jonagold/Mark Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	4,245.00	----	----	----	----	----
Tree Training / Materials	1,191.96	6.20	8.68	8.68	114.00	3.72
Labor	987.89	556.38	643.76	678.68	817.94	716.96
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	44.47	220.57	245.19	394.65	473.62	397.53
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	----	----	----	----	----
Overhead	646.61	101.68	158.00	151.05	206.53	213.23
Interest	<u>451.00</u>	<u>54.91</u>	<u>63.58</u>	<u>70.02</u>	<u>84.18</u>	<u>71.08</u>
Nonharvest Var. Cost	9,269.35	1,389.22	1,616.73	1,785.96	2,171.23	1,877.48
<b>Harvest Costs</b>						
Picking	----	34.50	451.50	222.00	541.50	834.00
Hauling	----	5.75	75.25	37.00	95.47	139.00
Other Labor	----	14.52	46.20	58.08	58.08	72.60
Machinery Cost	----	9.97	29.89	39.86	39.86	49.81
Supervisor	<u>----</u>	<u>3.45</u>	<u>45.15</u>	<u>22.20</u>	<u>54.15</u>	<u>83.40</u>
Harvest Var. Cost	----	68.19	647.99	379.14	789.06	1,178.81
<b>Total Variable Cost</b>	9,269.35	1,457.41	2,264.72	2,165.10	2,960.29	3,056.29
<b>Fixed Costs</b>						
Machinery Cost	669.73	598.39	621.61	633.04	633.04	644.48
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>915.55</u>	<u>1,149.31</u>	<u>781.90</u>	<u>755.44</u>	<u>208.74</u>
Total Fixed Cost	904.73	1,783.94	2,040.92	1,684.94	1,658.48	1,123.22
<b>TOTAL COST</b>	10,174.08	3,241.35	4,305.64	3,850.04	4,618.77	4,179.51
Value of Production <sup>c</sup>	----	644.00	8,428.00	4,144.00	10,693.20	15,568.00
<b>NET COST</b>	10,174.08	2,597.35	(4,122.36)	(293.96)	(6,074.43)	(11,388.49)
<b>ACCUM. NET COST</b>	10,174.08	12,771.43	8,649.07	8,355.11	2,280.68	(9,107.81)

<sup>a</sup> 772 Nicobel Jonagold trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 2.30, Year 3 = 30.10, Year 4 = 14.80, Year 5 = 38.19, Year 6 = 55.60. Total 6-year production = 140.99 bins. Price/bin = \$280.



Table 34. Per-Acre Cost of Establishing a Slender Spindle/Jonagold/P.2 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	4,245.00	----	----	----	----	----
Tree Training / Materials	1,191.96	7.44	8.68	8.68	112.76	3.72
Labor	974.69	506.88	643.76	665.48	683.30	653.60
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	42.94	198.66	207.30	280.12	387.89	312.03
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	303.16	303.16	303.16	303.16	303.16
Other	23.75	----	----	----	----	----
Overhead	645.46	95.90	141.37	135.01	175.20	175.99
Interest	<u>450.33</u>	<u>51.82</u>	<u>62.07</u>	<u>65.07</u>	<u>74.76</u>	<u>64.21</u>
Nonharvest Var. Cost	9,252.80	1,310.18	1,560.70	1,637.24	1,908.87	1,684.51
<b>Harvest Costs</b>						
Picking	----	31.50	307.50	196.50	415.50	574.50
Hauling	----	5.25	51.25	32.75	69.25	95.75
Other Labor	----	14.52	46.20	29.04	46.20	58.08
Machinery Cost	----	9.97	29.89	19.92	29.89	39.86
Supervisor	<u>----</u>	<u>3.15</u>	<u>30.75</u>	<u>19.65</u>	<u>41.55</u>	<u>57.45</u>
Harvest Var. Cost	----	64.39	465.59	297.86	602.39	825.64
<b>Total Variable Cost</b>	<b>9,252.80</b>	<b>1,374.57</b>	<b>2,026.29</b>	<b>1,935.10</b>	<b>2,511.26</b>	<b>2,510.15</b>
<b>Fixed Costs</b>						
Machinery Cost	669.33	598.39	621.61	610.17	621.61	633.04
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>914.06</u>	<u>1,145.27</u>	<u>994.36</u>	<u>1,007.10</u>	<u>705.96</u>
Total Fixed Cost	904.33	1,782.45	2,036.88	1,874.53	1,898.71	1,609.00
<b>TOTAL COST</b>	<b>10,157.13</b>	<b>3,157.02</b>	<b>4,063.17</b>	<b>3,809.63</b>	<b>4,409.97</b>	<b>4,119.15</b>
Value of Production <sup>c</sup>	----	588.00	5,740.00	3,668.00	7,756.00	10,724.00
<b>NET COST</b>	<b>10,157.13</b>	<b>2,569.02</b>	<b>(1,676.83)</b>	<b>141.63</b>	<b>(3,346.03)</b>	<b>(6,604.85)</b>
<b>ACCUM. NET COST</b>	<b>10,157.13</b>	<b>12,726.15</b>	<b>11,049.32</b>	<b>11,190.95</b>	<b>7,844.92</b>	<b>1,240.07</b>

<sup>a</sup> 772 Nicobel Jonagold trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 2.10, Year 3 = 20.50, Year 4 = 13.10, Year 5 = 27.70, Year 6 = 38.30. Total 6-year production = 101.70 bins. Price/bin = \$280.

Table 35. Per-Acre Cost of Establishing a Slender Spindle/Delicious/M.9 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	4,245.00	----	----	----	----	----
Tree Training / Materials	1,191.96	4.34	106.56	1.86	102.84	2.48
Labor	1,086.23	384.45	536.51	446.69	451.31	491.57
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	39.16	133.74	135.42	149.95	176.57	169.14
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	248.57	248.57	248.57	248.57	248.57
Other	23.75	----	----	----	----	----
Overhead	653.90	78.43	119.48	106.37	133.43	108.85
Interest	<u>455.18</u>	<u>40.00</u>	<u>53.24</u>	<u>43.80</u>	<u>50.11</u>	<u>47.19</u>
Nonharvest Var. Cost	9,373.85	1,035.85	1,394.14	1,176.96	1,334.63	1,239.60
<b>Harvest Costs</b>						
Picking	----	50.40	212.70	235.80	417.60	214.50
Hauling	----	8.40	35.45	39.30	69.60	34.75
Other Labor	----	14.52	29.04	29.04	29.04	29.04
Machinery Cost	----	9.97	19.92	19.92	19.92	19.92
Supervisor	<u>----</u>	<u>5.04</u>	<u>21.27</u>	<u>23.58</u>	<u>41.76</u>	<u>21.45</u>
Harvest Var. Cost	----	88.33	318.38	347.64	577.92	319.66
<b>Total Variable Cost</b>	<b>9,373.85</b>	<b>1,124.18</b>	<b>1,712.52</b>	<b>1,524.60</b>	<b>1,912.55</b>	<b>1,559.26</b>
<b>Fixed Costs</b>						
Machinery Cost	669.73	507.04	518.83	518.53	518.83	518.83
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>924.96</u>	<u>1,130.93</u>	<u>1,253.64</u>	<u>1,346.95</u>	<u>1,310.40</u>
Total Fixed Cost	904.73	1,702.00	1,919.76	2,042.17	2,135.78	2,099.23
<b>TOTAL COST</b>	<b>10,278.58</b>	<b>2,826.18</b>	<b>3,632.28</b>	<b>3,566.77</b>	<b>4,048.33</b>	<b>3,658.49</b>
Value of Production <sup>c</sup>	----	537.60	2,268.80	2,515.20	4,454.40	2,288.00
<b>NET COST</b>	<b>10,278.58</b>	<b>2,288.58</b>	<b>1,363.48</b>	<b>1,051.57</b>	<b>(406.07)</b>	<b>1,370.49</b>
<b>ACCUM. NET COST</b>	<b>10,278.58</b>	<b>12,567.16</b>	<b>13,930.64</b>	<b>14,982.21</b>	<b>14,576.14</b>	<b>15,946.63</b>

<sup>a</sup> 772 Red Chief Mercier Delicious trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 3.36, Year 3 = 14.18, Year 4 = 15.72, Year 5 = 27.84, Year 6 = 14.30. Total 6-year production = 75.40 bins. Price/bin = \$160.

Table 36. Per-Acre Cost of Establishing a Slender Spindle/Delicious/B.9 Apple Orchard.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	\$	\$	\$	\$	\$	\$
<b>Variable Costs, Nonharvest</b>						
Land Preparation	1,160.00	----	----	----	----	----
Trees <sup>a</sup>	4,245.00	----	----	----	----	----
Tree Training / Materials	1,191.96	4.34	105.32	100.36	102.84	2.48
Labor	1,086.89	393.03	485.69	442.07	434.81	450.65
Fertilizer	12.24	46.32	69.36	54.72	46.80	46.80
Chemicals	39.01	132.91	134.50	145.57	176.57	160.65
Beehives	----	----	25.00	25.00	25.00	25.00
Irrigation Charge & Elec.	100.00	100.00	100.00	100.00	100.00	100.00
Machinery Cost	406.43	248.57	248.57	248.57	248.57	248.57
Other	23.75	----	----	----	----	----
Overhead	653.94	79.75	113.34	117.42	130.99	94.57
Interest	<u>455.21</u>	<u>40.40</u>	<u>50.62</u>	<u>47.83</u>	<u>49.03</u>	<u>44.80</u>
Nonharvest Var. Cost	9,374.43	1,045.32	1,332.40	1,281.54	1,314.61	1,173.52
<b>Harvest Costs</b>						
Picking	----	57.90	192.00	277.95	405.75	105.00
Hauling	----	9.65	32.00	46.33	67.63	17.50
Other Labor	----	14.52	29.04	29.04	29.04	29.04
Machinery Cost	----	9.97	19.92	19.92	19.92	19.92
Supervisor	<u>----</u>	<u>5.79</u>	<u>19.20</u>	<u>27.80</u>	<u>40.58</u>	<u>10.50</u>
Harvest Var. Cost	----	97.83	292.16	401.04	562.92	181.96
<b>Total Variable Cost</b>	<b>9,374.43</b>	<b>1,143.15</b>	<b>1,624.56</b>	<b>1,682.58</b>	<b>1,877.53</b>	<b>1,355.48</b>
<b>Fixed Costs</b>						
Machinery Cost	669.73	507.04	518.83	518.53	518.83	518.83
Land Interest	165.00	165.00	165.00	165.00	165.00	165.00
Land Taxes	70.00	105.00	105.00	105.00	105.00	105.00
Int. on Estab. Cost <sup>b</sup>	<u>----</u>	<u>925.01</u>	<u>1,125.49</u>	<u>1,259.67</u>	<u>1,328.68</u>	<u>1,298.71</u>
Total Fixed Cost	904.73	1,702.05	1,914.32	2,048.20	2,117.51	2,087.54
<b>TOTAL COST</b>	<b>10,279.16</b>	<b>2,845.20</b>	<b>3,538.88</b>	<b>3,730.78</b>	<b>3,995.04</b>	<b>3,443.02</b>
Value of Production <sup>c</sup>	----	617.60	2,048.00	2,964.80	4,328.00	1,120.00
<b>NET COST</b>	<b>10,279.16</b>	<b>2,227.60</b>	<b>1,490.88</b>	<b>765.98</b>	<b>(332.96)</b>	<b>2,323.02</b>
<b>ACCUM. NET COST</b>	<b>10,279.16</b>	<b>12,506.76</b>	<b>13,997.64</b>	<b>14,763.62</b>	<b>14,430.66</b>	<b>16,753.68</b>

<sup>a</sup> 772 Red Chief Mercier Delicious trees and 77 pollenizers.

<sup>b</sup> Interest rate = 9%

<sup>c</sup> Yield in 900-lb. bins/acre: Year 2 = 3.86, Year 3 = 12.80, Year 4 = 18.53, Year 5 = 27.05, Year 6 = 7.00. Total 6-year production = 69.24 bins. Price/bin = \$160.