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Economic analysis of four apple orchard technologies under three marketing alternatives

J. Richard Bacon

To the Graduate Council:

I am submitting herewith a thesis written by J. Richard Bacon entitled "Economic analysis of four apple orchard technologies under three marketing alternatives." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

S. Darrell Mundy, Major Professor

We have read this thesis and recommend its acceptance:

John R. Brooker, Robert P. Jenkins, Dennis Deyton

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

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Date September 26, 1985

ECONOMIC ANALYSIS OF FOUR APPLE ORCHARD TECHNOLOGIES

UNDER THREE MARKETING ALTERNATIVES

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

J. Richard Bacon

December 1985

DEDICATION

The author wishes to dedicate this thesis to his wife, Martha Moretz Bacon, and to his parents, James and Mary Bacon, and to his father-in-law and mother-in-law, Gerald and Lydia Moretz, for their love, sacrifice, perseverance, and support through joy and sadness.

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ABSTRACT

Agricultural research in Tennessee and surrounding states has generally been geared primarily toward traditional agriculture. A farmer, in evaluating a specialty crop like applies as an alternative enterprise is then faced with the problem of acquiring timely data that are relevant to his/her situation and assimulating the information into a format that is flexible enough to accept and evaluate various technologies and markets.

Therefore, this study determined the resource requirements for 12 apple orchard-market combinations. They consisted of one standard, two semi-dwarf, and one dwarf orchard, each differentiated by tree density and rootstocks with each operating under the conditions found in the wholesale, farmers, and pick-your-own markets. The net returns over time from each orchard-market combination were compared and analyzed. Also, selected economic characteristics of each orchard-market combination were compared to alternative agricultural enterprises.

A computerized spreadsheet was used to develop the orchard-market budgets. All inputs and prices were obtained by personal interviews with farmers, farm chemical and implement dealers, and university and extension personnel. All applicable orchard and marketing operations were performed in accordance with recommended practices.

The 12 orchard-marketing combinations were economically evaluated utilizing six approaches. They consisted of undiscounted returns, breakeven analysis, benefit-cost ratios, accumulated net present values, internal rates of return, and annuity values.

Using the six comparison criteria, the Standard orchard was consistently ranked as having the least earning potential and the Dward orchard was consistently ranked as having the greatest. The two Semi-dwarf orchards gave mixed results. However, most of the comparative criteria indicated the more intensive Semi-dwarf II orchard had more earning potential than the less intensive Semi-dwarf I orchard.

The six comparison criteria consistently ranked the Wholesale market as having the least earning potential and the Pick-Your-Own market consistently had the greatest, followed closely by the Farmers market.

The Standard orchard and the Wholesale market were the most sensitive to economic changes. The Dwarf orchard and the Pick-Your-Own market were the least sensitive to a change in the economy such as in interest rates.

Generally, the net returns per hour of labor and per acre for the apple orchard-marketing combinations were competitive when compared to alternative agricultural enterprises. Also, the annual labor requirements per acre for the orchard-marketing combinations were competitive with the alternative enterprises.

Potential producers wanting to maximize profits should consider a semi-dwarf or dwarf orchard. A standard orchard should only be considered by growers wishing to direct market a variety not found on dwarfing rootstocks. Growers should be aware that even though the economic risks seem to decrease as the complexity and intensiveness of the orchard changes from the Standard to the Dwarf orchards, literature indications are that the technological risks seem to increase. All other things being the same, the degree of earning potential from an apple orchard is dependent on how the apples are marketed.

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CHAPTER I

THE PROBLEM, OBJECTIVES, AND LITERATURE REVIEW

1. INTRODUCTION

Potential apple producers have to face a high degree of risk and uncertainty in planning and implementing an orchard due to changes in technological and economical conditions. A decision made today can influence income for more than 20 years. A grower not only has to make short run estimates of operating inputs, yields, and prices, but he/she also has to make the long run prediction of marketing trends, prices, and innovations.

Often the technological and economical changes within the apple industry occur so rapidly that it is frequently difficult to fully evaluate the effects over the life of an orchard, before being usurped by something else. This is especially perplexing for Tennessee farmers, who, from 1976 to 1982 realized an annual average total net income per farm of only $4693 in 1982 dollars. During the same time period the average size of the Tennessee farms decreased from 143 acres in 1979 to 141 acres today (72).

When faced with smaller acreage and crops with low returns per acre, farmers are often attracted to crops with high returns per acre like apples. This attraction is dimmed when they realize there is a high initial investment, a required higher level of management skills, and usually several years before there is a positive cash flow. Coupled with this is the chance of losing those first critical harvests to bad weather or low returns from low product prices; consequently, many shy away from orchard crops and turn to off-farm employment and/or more traditional farm enterprises.

This helps to explain that even though there is a renewed interest in the Tennessee fruit industry, the 26% increase since 1978 in the number of commercial apple trees in the state occurred largely within existing orchards (73).

2. HISTORICAL PERSPECTIVE

The Tennessee apple industry is an old one. Yet, it is considered an infant industry in the state. In 1892, apples were being shipped from Tennessee. Early apples brought $3.00 per bushel, yielding the grower a net profit of $10.00 per tree (94).

D. G. Godwin, 1892 Tennessee Commissioner of Agriculture, commented "Nowhere do peaches and summer apples attain a more luscious sweetness than in Tennessee" (94, pp. 4-5).

The number of apple trees in the state by 1899 totaled 7,714,053 with a production of 5,387,802 bushels (57). Today, the number of commercial apple trees in the state total 152,053 with a 1983 production of 195,238 bushels at a season average price of $7.56 per bushel (73).

In spite of the almost eight million trees in the state, a large number relative to many surrounding states, Tennessee was not considered a significant apple-producing region. Central Tennessee was only mentioned briefly as an early apple producer in Folgers' 1921 book, "Commercial Apple Industry of North America." However, the mountains of North Carolina and north Georgia, the Ozark region of Arkansas, Kentucky, and Virginia were mentioned as leading apple regions of the United States (29).

An overview of the Tennessee apple industry is provided by the "Tennessee Horticulture," the monthly newsletter published by the Tennessee Horticulture Society. The January 1927 issue reported that even though most Tennessee producers had a good crop only a small portion of them were able to sell their apples at a profit. This statement was followed shortly by a report on Ozark apple growers being happy with the Memphis market because Tennessee producers never supplied it (75). In 1963, Tennessee growers supplied only 3.6% of the apples to the Memphis Market and 4.5% to the Nashville market (91). This is still largely the case today. In 1980, Tennessee producers supplied Memphis with 2% of its apples and Nashville with none according to unload data (100).

In 1925, producers complained that the local markets would not handle their fruit. When this complaint was investigated, the rejection was found to be due to poor grading and packing by the producers. The author remarked that Tennessee producers had never sold a crop, but had merely let someone buy it (77).

The 1926 season found that the producers in one county spent enough money on commissions to have built a cooperative packing operation and hired a sales manager. The reasons given for not forming cooperative efforts like this one were ". . . envy, jealousy, suspicion, distrust, unwillingness to sacrifice opinions, everybody wanting to be the BIG BOSS, unfair and unjustified criticisms, loss of rebates, and side commission on the part of a few growers" (76). Even today this statement would describe many situations in the Tennessee apple industry.

Some producers in 1928 were having disease problems with Yellow Transparents, a popular apple variety at the time. The information to deal with the problem came from the Senior Pathologist of the United States Bureau of Plant Industry and not from The University of Tennessee (78). Much of the information presented by the Tennessee Horticultural Society came from sources outside the state. In June 1929, a paper presented to the New Jersey Horticultural Society was reprinted concerning the state of the industry. It warned of over production, encouraged higher quality and better promotion (79). Today the U. S. apple industry faces these same problems and more (19).

From 1914 to 1929, the average price at the farm for apples was above the pre-World War I price only three years. Between 1910 and 1925, there was a reduction in the total number of trees in the United States by 40% (80). This reduction in the total number of trees continued from 1930 until the 1950's and 60's for many states as shown in Figure 1.

In the first 20 years of this century the eastern apple grower produced apples in conjunction with livestock and other crops.

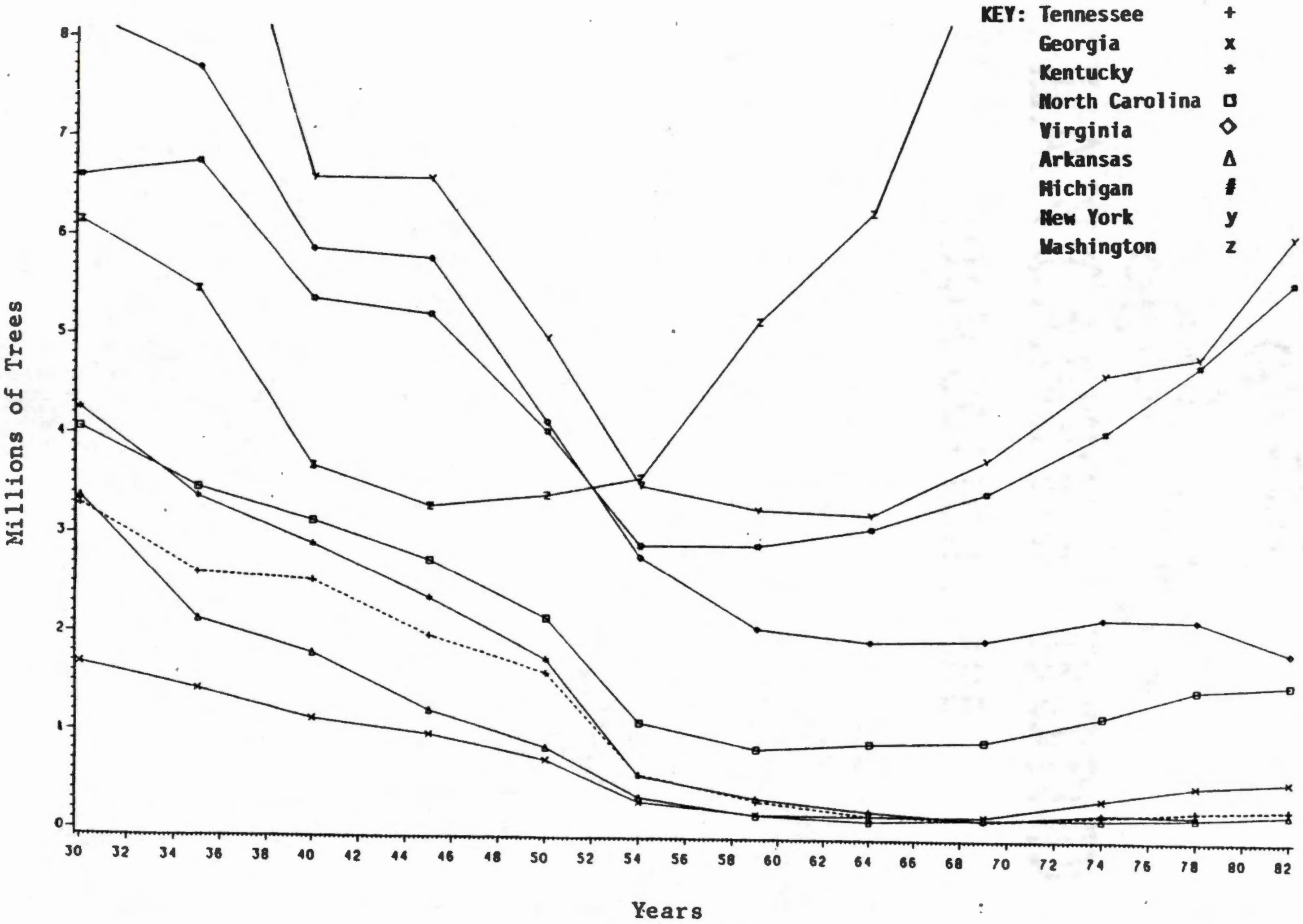

Figure 1. Total apple trees for selected states.

Source: United States Department of Commerce. 1930-1982. Bureau of the Census. <u>Census of Agriculture</u>. Government Printing Office, Washington, D. C.

During the same period, the Washington state apple growers were becoming intensive, scientific one-crop producers (44). They worked cooperatively to develop a marketing strategy that today is unrivaled in the apple industry.

By 1942, eastern producers were being outbid by Washington state on apples for the military in the Southeast. This occurred even though eastern growers produced four times the apples of Washington state (81).

The eastern growers lacked unity. Washington state had hired and trained personnel to look out for all their growers' interests. For example, only 10% of Virginia's producers that year agreed to an assessment of one cent per bushel for promotion. Only half of this was ever collected. This was in contrast to Washington where every grower was assessed two cents per bushel for promotion. The advertisements took the form of billboards, retail banners, magazine and newspaper ads, and radio was used extensively. The result was the sale of Washington state apples in eastern retail outlets more than doubled (81). Eastern producers, including Tennessee growers, have been trying to catch up ever since.

Not all Tennessee growers were without a strategy. One East Tennessee grower, in the fall of 1941, observed that the market was flooded with off-grade apples. He put his No. 1 and fancy grades on sale in the Knoxville market as soon as they were ready. His sound, off-grade apples were put into cold storage. The stored first grade fruit came on the market as the last of his fancies were sold. As soon as the lower grade apples had moved out, he introduced his freshly stored second-grade apples which met the demand the higher-priced stored top-grades could not (82).

Between the early 1900's and the 1940's Tennessee shifted its production emphasis from early apples to fall apples. By 1946, the most popular apple varieties were as shown in Table 1. Since then there has been little change.

Table 1. Popular apple varieties in Tennessee for selected years.

	1946	1961	1984
1.	'Golden Delicious'	'Golden Delicious'	'Red Delicious'
2.	'Red Delicious'	'Red Delicious'	'Golden Delicious'
3.	'Stayman'	'Stayman'	'Jonathan'
4.	'Grimes Golden'	'Lodi'	'Winesap'
5.		'Starkrimson'	'Stayman'

Source: Tennessee Department of Agriculture, 1984, Tennessee Crop Reporting Service, 1984 Tennessee Commercial Apple and Peach Tree Survey (Nashville, Tennessee); Tennessee Horticulture Society, Inc., May 1946, Tennessee Horticulture, J. C. McDaniel, Editor; Tennessee Horticulture Society, Inc., October 1961, Tennessee Horticulture, A. N. Pratt, Editor, Tennessee State Department of Agriculture (Nashville, Tennessee), 39(10):2-5.

The push by growers had been on for a number of years to narrow the technical and economic gap between the eastern producers and those in Washington state. The growers plan of action in Tennessee, as well as other eastern states, was the removal of marginal orchards. Even with the heavy removal of trees and the low rate of replacement, production remained rather constant. However, the low rate of replacement in the early 1950's was becoming a concern. Only one eastern state out of 10 had new plantings equaling the removal rate (85).

Eastern producers had been anticipating Washington state to discontinue or drastically reduce production for 50 years due to its high cost of production and transportation to eastern markets. However, the producers from Washington state continued to improve their market share due to a high quality product, excellent packaging, and a relentless promotional program. They have showed no signs of a weakening competitive position (85).

The high quality of Washington apples was due to better cultural practices than those employed in the East. With the introduction of new technology and improved methods like power pruning and chemical thinning, the East was able to produce a better product at a lower cost (85).

The eastern growers were still at a competitive disadvantage. They packed their apples in baskets and not the more popular tray pack box. Eastern growers stayed in business because of the close proximity to the market and the processors who took the poorer apples. For example about 40% of the 1953 eastern crop went to processing (85).

The end of 1953 brought with it the realization that per capita apple consumption had dropped 50% since the early 20's.

Oranges had replaced apples and recapturing that market would be difficult (86). By 1983 per capita consumption of apples had improved to 29.91 pounds with the per capita consumption of oranges being only slightly higher at 31.94 (104).

By the early 1950's optimism was returning to the East. Retailers and wholesalers alike expressed renewed confidence in the quality and packing of eastern applies (85).

The introduction of the super market revolutionized the retailing of food. By the 1950's, Tennessee growers were being urged to acquaint themselves with this new form of marketing (84). By the mid-1960's, however, Tennessee producers were still inefficient. Yields per acre were down and production costs per acre were up. The growers did not meet the quality standards set by the grocery chains. This forced on-the-farm, or farmer market sales. Many found this quite profitable (91).

There was a general lack of interest among growers to acquire the knowledge and to make the long term commitment necessary to become successful in the wholesale market. Of many of those with interest and perseverance, capital constraints often prevented them from getting started (91).

The Tennessee apple industry did not begin a revival until the early 1970's. The renewed growth in Tennessee was behind that of Virginia, North Carolina, and Georgia, but ahead of Kentucky and Arkansas as shown in Figure 1, page 5. However, when only commercial orchards are considered, Tennessee produced less than all its local serious competitors since 1973 as shown in Table 2. But the prices received by Tennessee producers have been consistently good compared to its neighbors as shown in Figure 2. The relatively higher prices in Tennessee could be caused by a higher number of apples sold at the farm or farmers market level, which generally commanded a higher price than wholesale. For Tennessee growers to be competitive in the larger wholesale market, growers have to be quality and price competitive. This would likely mean a lower price than many growers are used to receiving.

Because of the pressures to produce a better apple at a lower cost, a general trend developed toward farms devoted chiefly to growing apples and higher tree density orchards. The trend toward more specialization is illustrated in the average number of trees per farm producing apples. A general decline occurred until the ealry 1950's in the average number of trees per farm as shown in Table 3. The upturn began in the 1950's and continued until 1978 when a sudden increase in the number of farms with small young plantings occurred. Many of these small farms did not survive. By 1982, plantings increased and reversed the momentary downturn. However, Tennessee, Virginia, and Georgia continued the downturn into 1982.

Tennessee had slightly more trees per farm than North Carolina in 1930. By 1935, North Carolina had moved ahead of Tennessee and continued to widen the gap each year.

Table 2. Annual apple production for commercial orchards of 100+ trees of bearing age for selected states.

State							Year								
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Tennessee	10.4	10.4	9.0	9.4	9.2	3.1	7.0	10.0	8.0	10.0	8.0	10.0	8.0	11.0	4.5
Arkansas	7.1	9.1	7.7	8.6	8.6	6.0	13.0	22.5	11.0	24.0	13.0	24.0	10.0	23.0	10.0
Kentucky	19.1	20.9	16.4	19.6	14.1	9.8	14.4	22.0	14.0	22.0	15.0	21.0	19.0	21.0	12.0
Georgia	NA	NA	NA	NA	NA	NA	NA	NA	13.0	22.0	22.0	35.0	36.0	45.0	15.0
North Carolina	169.8	204.0	223.0	185.0	245.0	210.0	295.0	315.0	265.0	270.0	324.0	362.0	410.0	375.0	135.0
Virginia	413.0	472.0	463.0	490.0	420.0	400.0	378.4	430.0	212.0	290.0	515.0	470.0	420.0	420.0	430.0

Source: United States Department of Agriculture, 1968-1982, Crop Reporting Board, Commercial Apples, Government Printing Office, (Washington, D. C.).

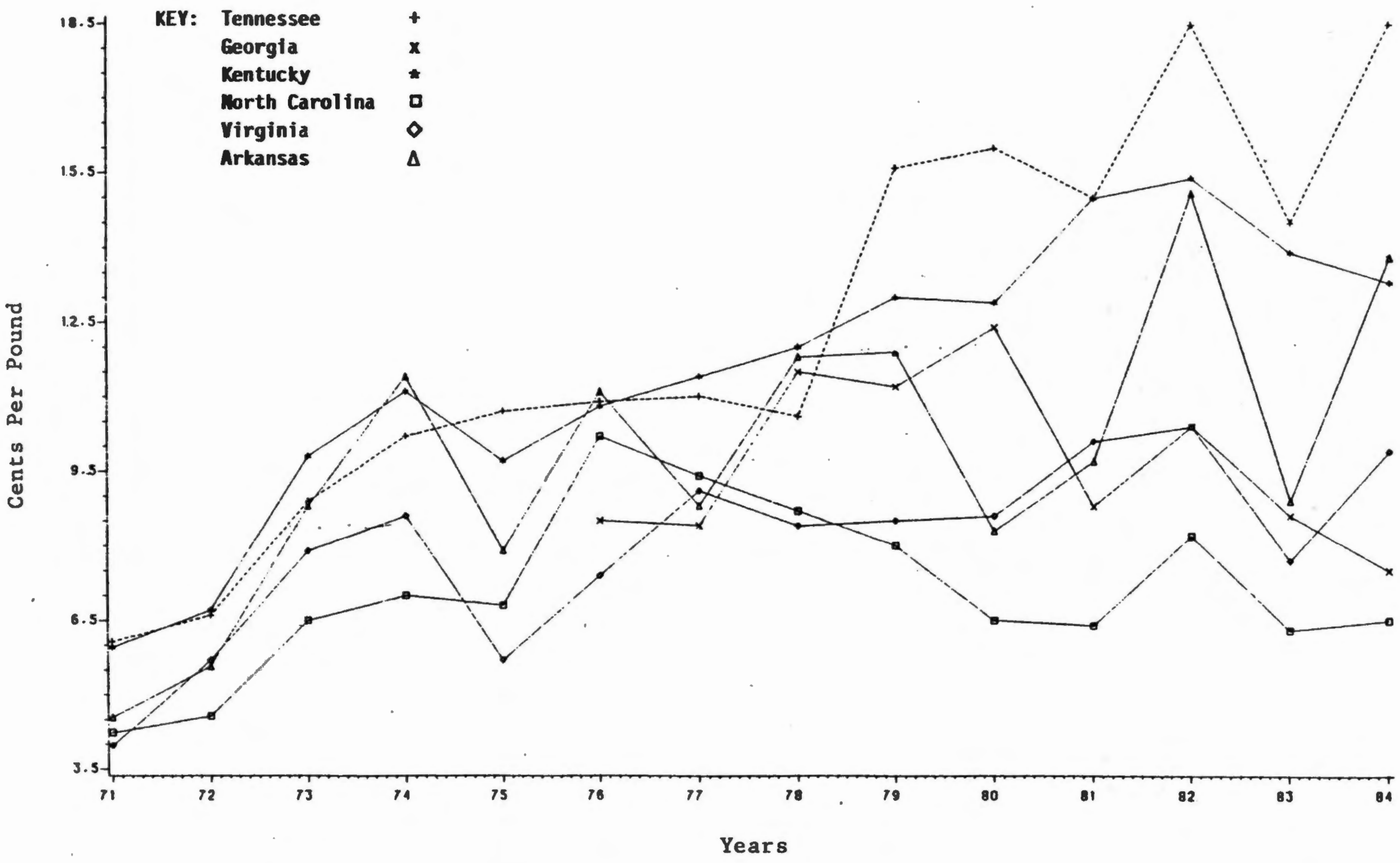

Figure 2. Average seasonal prices received by apple producers in selected states.

Source: United States Department of Agriculture. 1971-1984. Economic Research Service. <u>Fruit Outlook and Situation</u>. Government Printing Office, Washington, D. C.

Table 3. Average number of trees per farm for selected states and years.

Yr.	TN	GA	NC	VA	KY	AR	WA	MI	NY
'30	29.8	30.7	29.7	85.5	36.1	64.3	157.9	59.5	98.0
'35	23.3	24.4	24.9	70.9	28.5	40.8	123.2	52.9	92.2
'40	21.5	19.6	23.1	70.3	25.2	31.1	94.2	62.6	106.9
'45	17.0	15.5	20.5	58.3	20.3	27.8	81.3	60.7	122.8
'50	16.2	14.9	21.7	62.3	17.8	21.9	95.3	66.1	130.9
'54	26.5	28.6	55.7	190.9	32.8	38.4	346.0	201.1	325.1
'59	31.1	23.4	79.9	280.8	37.7	48.2	661.2	307.7	470.5
'64	36.9	38.5	157.8	438.1	46.0	60.4	984.6	517.3	742.3
'69	356.5	704.9	1227.9	2292.9	323.1	889.8	2633.1	1490.5	2316.5
'74	487.1	1811.2	1465.5	2831.3	554.1	1205.7	3230.3	1983.3	3238.8
'78	207.0	682.4	920.4	1401.3	175.0	287.7	3327.0	1645.6	2295.8
'82	194.4	594.9	1015.7	1319.9	NA	408.6	4265.9	2005.8	2949.2

Source: United States Department of Commerce, 1930-1982, Bureau of the Census, Census of Agriculture, Government Printing Office (Washington, D.C.).

The trend toward higher tree densities is illustrated in Table 4. The increase in the average number of trees per planted acre over time has occurred among all rootstocks and varieties.

Dwarfing rootstock began to receive more attention in the mid-1950's, though not yet recommended by researchers (88). By the early 1960's, a price-cost squeeze was forcing producers to choose between dwarfing rootstocks and standard rootstocks before there was enough experience in the state to justify the switch (89).

Finally, in December 1962, the Tennessee Horticulture Society went on record as opposed to dwarf trees for commercial orchards (90). The reasons given were based on Vermont experiences. The decision on choice of rootstock was further complicated with the introduction of spur types on various rootstocks. While Tennessee debated the issue of dwarfing rootstocks, one-third of all trees planted between 1959 and 1966 were of dwarfing rootstocks (92).

In the next to the last issue of "Tennessee Horticulture" in June 1968, the future apple orchard was described as having dwarfed rootstock spaced close together to form a hedgerow (93). Today dwarfing rootstocks comprise 76.4% of the total trees in Tennessee commercial orchards (73).

Perleberg (59) indicated in 1981 that the center of the U. S. apple industry was moving south. The quality of the northern mountain-grown apple does not have the advantage it had 40 years ago.

Table 4. Average number of trees per planted acre for selected states and years.

Yr.	State								
	TN	GA	NC	VA	KY	AR	WA	MI	NY
'69	45.9	74.3	62.6	49.7	59.2	63.5	99.3	50.3	47.8
'74	66.1	94.1	71.6	63.2	79.4	75.9	118.1	62.0	61.9
'78	68.8	98.0	74.6	67.4	66.9	73.2	139.4	66.5	63.8
'82	73.0	114.0	82.1	61.7	NA	91.9	158.4	80.2	77.6

Source: United States Department of Commerce, 1930-1982, Bureau of the Census, Census of Agriculture, Government Printing Office (Washington, D. C.).

3. THE ECONOMIC PROBLEM

Low Income

A long standing goal of agricultural policy-makers has been to improve the income of farmers. Farmer income opportunity cost has been compared to the semiskilled or skilled worker in the non-farm sector of the economy (38,113). In 1983, total net income per farm in Tennessee was $4,274 (72), while personal per capita income for the average Tennessean was $8,906. The per capita income for blue-collar workers in the United States was $7,272 while the per capita disposable income in 1983 for all Americans was $9,377 (106).

Farmers find themselves faced with six possible alternatives to addressing the problem of low income. They can, in highly generalized terms, (1) improve their present agricultural technology, (2) shift from low return per acre to high return per acre crops, (3) acquire more land, (4) work off the farm, (5) leave the farm, or (6) go on public assistance (63,113).

Management and Marketing Skills

The upgrading of technology and the shift to high-return crops like apples requires a higher level of management and marketing skills. Management skills are often the distinguishing characteristics between low- and high-income farms (117,16).

To improve the management and marketing skills necessary to grow high-value crops will require the cooperative efforts of agricultural professionals working with producers. One study found the use of recommended practices were positively and significantly related to farm sales volume (56,16).

The marketing conditions that currently exist will not meet the needs of the producer when a shift in technology or an expansion in production occurs. This market situation leads to the realization that poor marketing structures may limit productivity and, without increased production, certain markets will not develop (16).

At present, direct marketing strategies have been employed by many apple growers in the state. Direct marketing is often limited because of the demand of the local market. The wholesale market presents several obstacles to producers. A wholesaler wants apples of consistent quality at a competitive price from producers that are willing to sell to him/her even though at times a better price may be obtained elsewhere. He/she also wants a steady supply over an extended period of time at an adequate volume in a prepacked container (7). Most Tennessee growers would have difficulty meeting all these demands.

4. THE RESEARCH PROBLEM

The competitive advantage of an agricultural enterprise is affected by research. Therefore, agricultural research is an externality that can cause a shift in the crops produced in an area (22).

Agricultural research in Tennessee, like many states, has been geared toward traditional agriculture. The bulk of the research has targeted livestock and row-crop enterprises. Of the 400 publications available through The University of Tennessee Agriculture Extension Service, only 2.5% had any direct commercial application to fruit growers and only 1.5% were directly relevant to apples while 6.5% were relevant to beef. Of the 280 publications available through The University of Tennessee Agriculture Experiment Station, only 2% had any direct commercial application to fruit growers and only 1% were directly relevant to apples while 11% were relevant to beef.

With the increased interest in specialty crops, potential producers are faced with the basic problem of acquiring the fundamental data information necessary to plan an apple orchard. The apple industry is changing so rapidly that relevant data from replicated trial plants are often difficult to obtain. A second problem is the assimilation of data into an enterprise budget flexible enough to test different technologies and markets in terms of discounted net returns.

The purpose of this study was to develop the framework necessary to address these problems, while helping growers make better economic decisions in the production and marketing of apples.

5. SCOPE AND OBJECTIVES OF THE STUDY

Enterprise budgets were developed for four orchard technologies. Each technology was distinguished by rootstock and tree density. One standard, two semi-dwarf, and one dwarf orchard were evaluated while operating under the conditions of a wholesale, farmers, and pick-your-own market. The technologies and markets covered the relevant spectrum for producers in the state of Tennessee.

The specific objectives of this study were:

1. To determine the resource requirements on a per acre basis for each orchard technology operating under the three marketing conditions.

2. To compare the net returns of each orchard technology and associated markets in terms of undiscounted returns, breakeven points, benefit-cost ratios, net present values, internal rates of return, and annuity values, and to determine how sensitive each technology was to economic change.

3. To determine how well each apple orchard-market combination compared to alternative enterprises.

6. LITERATURE REVIEW

Any discussion of apple orchard systems will invariably deal with the technical as well as the economic aspects of production and marketing. The literature was reviewed with both aspects in mind.

Technological

Of the technological considerations, tree density, rootstocks, yield, and quality were the most important.

Tree Density

An orchard system is often described in terms of tree density. Heinicke (35) defined the low-density orchard as having less than 100 trees per acre and taking 15 to 20 years to reach full production. He defined the medium-density to be 100 to 200 trees per acre and taking 9 to 15 years to reach full production. The high-density system was defined to be between 200 and 500 trees per acre and taking 6 to 9 years to reach full production. Finally, he defined the ultra high-density system as having over 500 trees per acre and only taking 4 to 7 years to reach full production.

Others have defined the low-density system as having from 75 to 300 trees per acre, medium-density as having 200 to 600 trees per acre, high-density as having 400 to 1000 trees per acre, and ultra high-density systems as simply having more than 700 trees per acre (11,26,50,30). Still other simply referred to the low-, medium-, and high-density orchard systems as standard, semi-dwarf, and dwarf orchards, respectively (23,24,25,109,30).

Morris (47) indicated that the amount of detailed care for young trees increases as density increases. Heinicke (35) stated that high-density orchards are not a "work-free" way of producing fruit. Westwood (115) recommends that only the best growers consider the high-density systems. Norton (51) suggests that the medium-density system is more adaptable to a wider spectrum of managers and is less sensitive to income-influencing factors.

Tree density has an effect upon the efficiency of an orchard. Mullins (49) reported an increase in yield per acre but a decrease in yield per tree as density increases. The important thing, as L. Tukey (97) reported, is to increase tonnage per acre because the preharvest production costs are about the same regardless of yield.

Dwarf trees really become significant, according to H. B. Tukey (96), when their earlier fruiting is multiplied by the increased number of trees per acre. Emerson (28) reported that the increased number of trees per acre alone accounted for large increases in yield-per-acre in the early life of an orchard. He further stated that higher yields should continue due to the increased bearing surface per acre from smaller trees. Perry (58) reported very little reduction in cropping efficiency either from close planting or vigorous growth as a result of increased competition.

Morris (47) pointed out, however, that recommending an optimum tree density is difficult. Therefore, in determining the spacing for apple trees, six factors have to be considered:

1. Cultivar vigor,
2. Rootstocks,
3. Soil type, fertility, and cropping history,
4. Training method,

5. Pruning, and

6. Management skill level (52).

Carlson (12) has developed a "handy guide for apple tree spacing" shown in Table 5.

Rootstocks

Once a planting system has been selected, it must be matched to a rootstock and a soil. If a mistake is made here it can never be corrected short of starting over (51). Much research into rootstocks has been done. Westwood (115) indicated that the research has been directed toward growth control, environmental adaptability, disease and insect resistance, yield efficiency, anchorage, and propagation. Rootstocks range from the large seedling tree to the dwarf M27. Very little research has been done on M27 in the United States. This rootstock has future possibilities that will be discussed later.

In Tennessee, research on rootstocks has produced mixed results. Mullins (48) reported that the dwarfing varieties of M9 and M7 had short life spans, living only 10 to 13 years at the Plateau Experiment Station. The semi-dwarf rootstocks of MM106 and MM111 have done well along with standard rootstocks. Deyton (21) indicated that the M9 planting at the West Tennessee Experiment Station were doing well, but stressed that the orchard was still less than 10 years old.

Table 5. A handy guide for apple tree spacing.

Rootstock		Vigor Group[a] A	B	C	D
		(approx. in-row spacing, in feet)			
Very dwarf	M. 27	2	4	6	8
Dwarf	EM 9	4	6	6-8	8
	M. 26	6-8	8-10	10-12	12-14
	Mark	6-8	8-10	10-12	12-14
Semi-dwarf	EM 7	10	12	14-16	18-20
	M. 7a, EMLA	10-12	12-14	16	20
Moderately Vigorous	MM 106	12-14	14-16	16-20	20-24
	MM 111	14	16	20	24
Vigorous	Seedling	16	20	24	28

[a]Group A (low) = 'Delicious,' 'Discovery,' 'Jonamac,' 'Spur Golden'

Group B (moderate) = 'Akane,' 'Empire,' 'Gala,' 'Golden Delicious,' 'Hawaii,' 'Macoun,' 'Melrose,' 'Paulared,' 'Prima,' 'Spartan,' 'Summerred,' 'Tydeman's Red.'

Group C (vigorous) = 'Buckley Giant,' 'Chehalis,' 'Granny Smith,' 'King Jonagold,' 'Lodi, 'Red Delicious' (nonspur type), 'Yellow Transparent.'

Group D (very vigorous) = 'Graventein,' 'Mutsu,' 'Northern Spy,' 'Yellow Newtown.'

Source: Robert F. Carlson, March 1984, "A Handy Guide for Apple Tree Spacing," American Fruit Grower, 104(3):64.

Cain (10) believed that the shorter lifetime of the smaller dward trees is an advantage because of the dynamic aspects of the industry. The standard rootstocks tend to fix a producer in a particular technology for 20 to 40 years. Another advantage of dwarfing rootstocks is they tend to be more efficient in production. The yield per square foot of tree is consistently greater. The smaller trees, when properly spaced, reach maximum production and produce more bushels per acre than the standard tree (10). This eliminated the possibility of the longer-lived standard tree from overtaking the smaller trees in lifetime production on a per-acre basis. According to Cain the standard tree simply could not live long enough to catch up. Table 6 and Figure 3 show the major characteristics of the more common rootstocks.

The rootstocks of the next century will be smaller and more productive according to Preston (60). One of the rootstocks under study is M27. It is a miniature tree, and when planted five by two feet in research plots has yielded over 1100 and 1700 bushels per acre in its second and third years out. At this spacing, there would be 5555 trees per acre (31).

Yield

As noted earlier, yields are partially a function of tree density and rootstocks. Larger yields are possible as density increases and trees get smaller. In Tennessee standard rootstock from five to eight years of age at 20' x 20' and 20' x 10' spacing yielded yielded 138 and 195 bushels to the acre, respectively. Similarly,

Table 6. Major characteristics of the more common rootstocks.

Size	Rootstock	Anchorage	Soil Adoptabibity	General Characteristics
Full Size (standard)	Seedling	very good	All types.	Best survival with least attention.
	MM 104	---do---	All types, avoid wet site.	Susceptible to crown rot.
	MM 111	---do---	All types, tolerates dry or sandy soil.	Drought resistant.
Semi-standard (3/4 standard)	M2	good	Most soils adequate, avoid extremes of sandy, heavy, or wet soil.	Fairly resistant to crown rot, watch for nematode problems.
	MM 106	very good	All types, avoid wet sites.	Susceptible to collar rot and fire blight.
Semi-dwarf (1/2 standard)	M7	good	Avoid light soils	Needs to be supported, winter hardy, produces root suckers.
	M26	good to fair	Use on better soils, avoid extremely light soil.	May need support, hardy, early heavy yielder, use only in intensive management systems.
Dwarf (1/4 standard)	M 9	fair to poor	Use on best soil, avoid light soil.	Must be supported, irrigation recommended, early heavy yielder, use only in intensive management systems.
Extreme dwarf (1/10 standard)	M 27	---do---	Use on best soils.	Non suckering, less susceptible to fire blight.

Sources: Dennis E. Deyton, 1984, Unpublished data and personal consultation, Department of Plant and Soil Science, The University of Tennessee (Knoxville); Norman F. Childers, 1983, Modern Fruit Science, Ninth Edition, Horticultural Publications (Gainesville, Florida); Don R. Heinicke, January 1975, High Density Apple Orchards--Planning, Traning, and Pruning, USDA Agricultural Research Service, Agricultural Handbook No. 458, US Government Printing Office (Washington, D. C.).

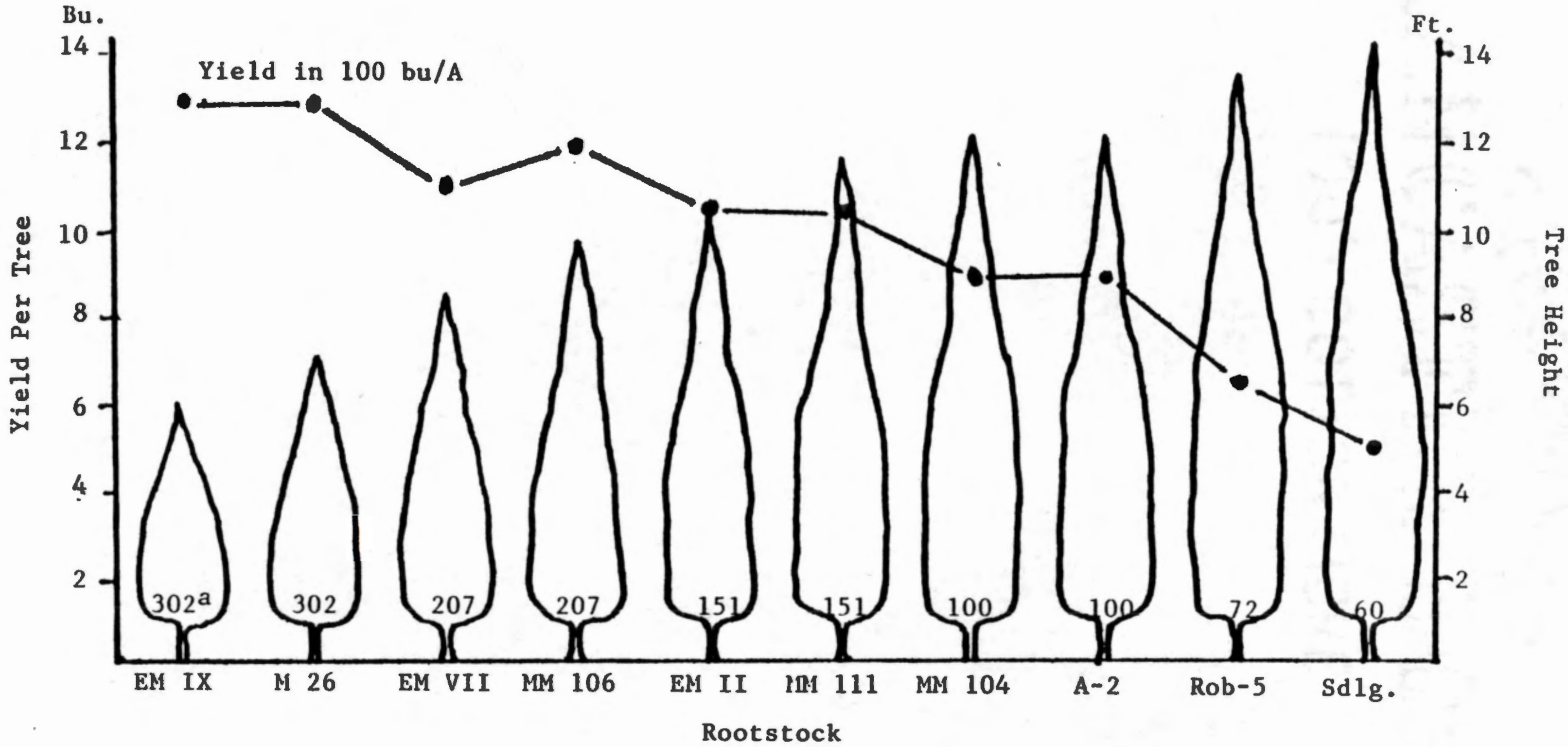

Figure 3. Tree size and yield by the 10th year from different rootstocks and trees/acre.

[a]Trees per acre for the various rootstocks appear on the tree figure for each rootstock.

Source: Norman F. Childers (1983). Modern Fruit Science. Ninth Edition, Horticultural Publications, Gainesville, Florida; Robert F. Carlson, Michigan State University, who did the original work in this area.

semi-dwarfing rootstocks at 20' x 20', as opposed to 20' x 10' spacing, resulted in a yield of 185 and 341 bushels per acre, respectively, for MM106 and 170 and 416 bushels per acre, respectively, for MM111 (49). Fourth-year yields, at the West Tennessee Experiment Station, of 'Smoothee' on M9 produced 600, 530, and 430 bushels per acre at densities of 908, 605, and 454 trees per acre, respectively (21). Preliminary results from North Carolina (108) indicated that higher densities induced heavier yields per acre in the early years and the gap narrowed as the trees grew and filled their allotted space. But the accumulated totals per acre still favored the higher densities as shown in Table 7. Perry (58) demonstrated that the highest total production was the result of the highest densities.

Westwood (115) demonstrated that the yield potential of M9 rootstocks were dependent on spacing and the highest yields in the early years as well as the later years came from the highest densities as shown in Table 8. Westwood (114) showed the average yield of the commercial orchard was far below its potential. In the heavy crop year of 1975 the average yield of a commercial orchard was only one-sixth that of the Westwoods M9 study in the third six-year period.

H. B. Tukey (96,30) reported a 10-year study of 'Golden Delicious' on seedling, M7, and M9 rootstocks. Seedling trees at 48 per acre produced 1,488 bushels per acre, while M7 produced 3,752 bushels per acre with 134 trees per acre, and M9 at 726 trees per

Table 7. Yields for 'Red Delicious' and 'Golden Delicious' apples on various rootstocks and at different spacings.

Rootstock	Spacing	Yields 1973		Yields 1978		Total Yields 72-80	
		GD[a]	RD[b]	GD[a]	RD[b]	GD[a]	RD[b]
	(feet)	(bushels per acre)					
Seedling	6	52.0	4.8	781.7	769.6	3525.2	2528.4
	9	15.7	.24	849.4	636.5	3317.6	2108.4
	12	15.5	.73	982.5	624.4	3340.6	1908.5
	15	5.8	.43	709.1	418.7	2697.3	1391.0
	18	6.5	.24	718.7	384.8	2258.3	1120.9
MM 111	4	138.9	21.0	994.6	897.8	4478.8	3516.7
	6	112.8	23.7	810.7	987.4	4020.2	3183.6
	9	23.0	4.1	1055.1	801.0	4577.2	3044.6
	12	23.7	2.7	873.6	953.5	3619.1	2659.3
	15	17.9	1.2	643.7	653.4	3097.6	2137.4
MM 106	4	157.3	33.4	1224.5	1026.1	4702.1	3563.5
	6	158.5	23.2	1018.8	977.7	·428.1	3089.0
	9	40.4	4.6	1176.1	786.5	3779.9	2743.5
	12	25.4	2.8	1132.6	692.2	3830.9	2078.1
	15	21.0	1.9	827.6	563.9	2708.1	1889.9

[a] 'Golden Delicious.'

[b] 'Red Delicious.'

Source: Dick Unrath and J. D. Obermiller, 1984, Mountain Horticulture Crops Research Station, Unpublished data and personal consultations (Fletcher, North Carolina).

Table 8. Effect of in-row spacing on yield of apples on M9 rootstock planted in rows 15 feet apart.

Variety	In-row Spacing	Annual Yield[a] First 6-yrs.	Second 6-yrs.	Third 6-yrs.	Total 18-yr. Yield
	(feet)	--------(bu./ac.)-------			
'Starking Delicious'	4	148.7	1176.9	1399.9	16,293
	6	133.8	1096.1	1304.4	15,189
	8	119.0	820.0	1115.2	12,342
'Golden Delicious'	4	342.0	1442.4	2094.5	23,325
	6	276.2	1285.2	1943.7	21,115
	8	191.2	1261.8	1956.5	20,499

[a]Converted to English from metric.

Source: Melvin N. Westwood, 1978, Temperate-Zone Pomology, W. H. Freeman and Co. (San Francisco, California).

acre produced 5,082 bushels per acre. L. D. Tukey (98) in Pennsylvania reported 'Golden Delicious' on a M9 trellis system at 726 trees per acre averaged 1,018 bushels per acre at full production.

Quality

Brooker (7) reported quality was the number one factor influencing a wholesalers decision to purchase growers apples. Simmons (67) indicated quality was the key to a successful marketing strategy. The major factors of quality are color or grade, size, and soluble solids or sugar. Heinicke (35) reported studies indicating as tree size decreases so did the unproductive shaded area of the tree. The unproductive portion of a tree went from 24% to 8% as the size of the tree went from seedling to dwarf. Also more sunlight was associated with increased fruit size and soluble solids. Childers (13) showed improved sunlight penetration can be achieved through proper pruning techniques. Westwood (115), reporting on work done by Schrader in 1931, indicated the amount of light reaching the fruit was directly related to fruit size and color as seen in Table 9. H. B. Tukey (96), Downy (26), and Norton (50) showed improvements in fruit color and size can be achieved as tree size is reduced, due to better light and spray penetration (30). Funt (30) suggested fruit size and grade are the lowest for low-density orchards. Norton (50,30) reported a 47% packout for U. S. Extra Fancy on seedling rootstock and a 88% packount for semi-dwarf

Table 9. Relationship between sunlight and fruit size.

Fruit Measurement	Amount of Light Reaching Fruit (as % of full sun)			
	100%	81%	61%	39%
Diameter (CM)	7.1	7.0	6.9	6.6
Volume (CM^3)	187	180	172	150
Size (as % of control)	(100)	96	92	80
Percent Usual Red Color	57	28	10	1

Source: Melvin N. Westwood, 1978, Temperate-Zone Pomology, W. H. Freeman and Co. (San Francisco, California).

rootstocks. Westwood (114) indicated with confidence that color was not reduced as a result of higher densities. With 'Golden Delicious' on M9 at a four-foot spacing, a higher grade resulted with a slightly lower soluble solids content than at lower densities. However, no differences occurred for the 'Starking Delicious.' Preliminary results from the M9 experiments in West Tennessee revealed that the size of the fruit increased as density increased as shown in Table 10 (21).

A large part of an apple is water. Without adequate water, size can be adversely affected. Beukes (3) indicated a marked interaction between fruit size and irrigation. Delver (18) reported 10 to 30% larger fruit weights resulting from irrigation in dry years. Daniels (17) reported up to a 21% increase in peach yields from irrigation during a wet year.

Economic

Income

In seeking the improvement of farm income in Tennessee, Atkinson (1), in 1966, showed that a minimum of 168.3 acres of cotton would be needed to return $5,000 to the farm operators labor and management. Eagan (27) suggested, in 1969, a one-man farm would need a gross income of $10,000 to $19,999 to produce a $3,000 net income. And a two-man swine operation would require gross sales of $21,206 and $38,891 to return a net income of $3,000 and $6,000, respectively.

Table 10. Effect of spacing on yield of three apple cultivars trained to a three-wire trellis at the West Tennessee Experiment Station, 1982.

Variety	Trees/AC	Yield per acre					
		#88[a]	#100[a]	#125[a]	#150[a]	Bag[b]	Total
	(number)	(bushels)					
'Jones'	908	127	66	50	16	9	268
	605	79	63	45	19	14	220
	454	57	53	51	24	11	194
'Smoothee'	908	50	7	19	8	8	92
	605	42	5	7	3	3	60
	454	35	9	6	4	2	56
'Red Chief'	908	171	71	57	29	24	353
	605	121	44	40	21	14	241
	454	79	31	30	17	11	168

[a]Number indicates the number of apples per bushel.

[b]Smaller apples of greater than 150 to the bushel.

Source: Dennis E. Deyton, 1984, Unpublished data and personal consultation, Department of Plant and Soil Science, The University of Tennessee, Knoxville.

Keller (39), in 1972, reported a minimum capital investment, at a zero equity level, of $110,000 to $1,664,000 was required to return $7,000 to operator capital, labor, and management from beef enterprises. The investment required at the 100% equity level ranged from $63,000 to $182,000. When all feasible enterprises were considered the capital requirements at the zero equity level ranged from $39,000 to $274,000 and the 100% equity level ranged from $33,000 to $106,000. When all enterprises were considered, the amount of land required to achieve the $7,000 income target level varied from 60 to 291 acres at the zero equity level and from 30 to 118 acres at the 100% equity level.

Demand

Before any industry is targeted for expansion, a knowledge of its elasticity of demand is important. The own price elasticity measures the response in quantity demanded of a product to a change in its own price. From the price elasticities the revenue elasticities can be derived by the formula $Er = 1 + 1/Ep$. This relationship between the price and revenue elasticities will hold regardless of the demand schedule (33).

Hallberg (33) indicated that fresh market apple elasticities changed during different seasons of the year as shown in Table 11 and Figures 4 and 5. Season I covers the harvest season of September-November, Season II covers regular cold storage from December-February, Season III covering March-May and Season IV covering

Table 11. Fresh market apple price elasticities of demand for different seasons of the year in the Appalachian region.

	Appalachian Region, '73/'74		
	Elasticity		
Season	Retail Level	Packer Level	Farm Level
I. Sept.-Nov.	-3.650	-2.639	-1.825
II. Dec.-Feb.	-3.802	-2.747	-1.887
III. March-May	-5.291	-3.831	-2.545
IV. June-Aug.	-13.333	-9.615	-6.452

Source: M. C. Hallberg, T. A. Brewer, and D. F. Steadman, May 1978, Economics of the Appalachian Apple Industry, College of Agriculture, Bulletin 817, The Pennsylvania State University, University Park.

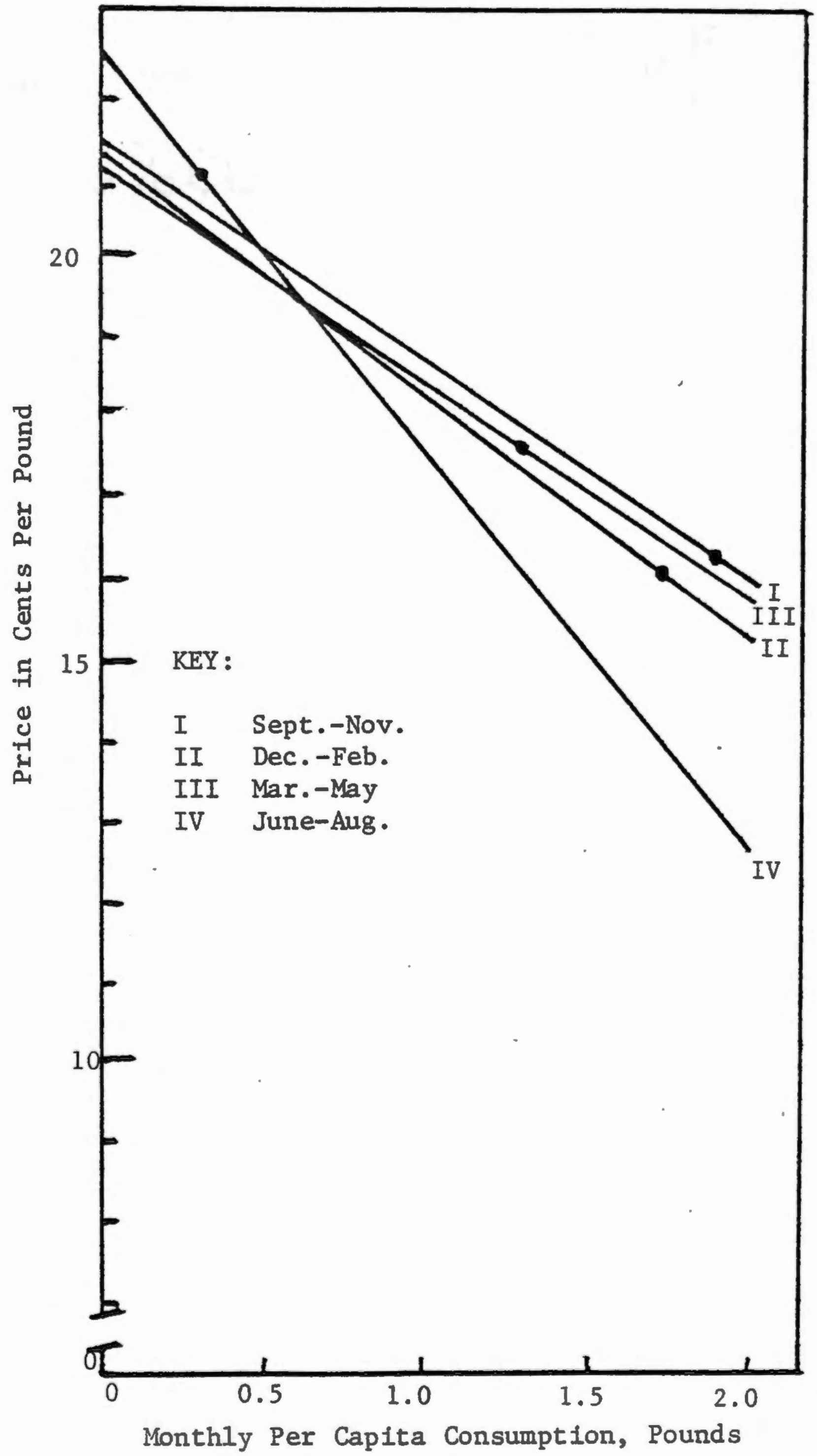

Figure 4. Seasonal retail demand for fresh apples, Appalachian region, 1963/64-1973/74 mean.

Source: M. C. Hallberg, T. A. Brewer, and D. F. Steadman. May 1978. Economics of the Appalachian Apple Industry. College of Agriculture. Bulletin 817. The Pennsylvania State University, University Park.

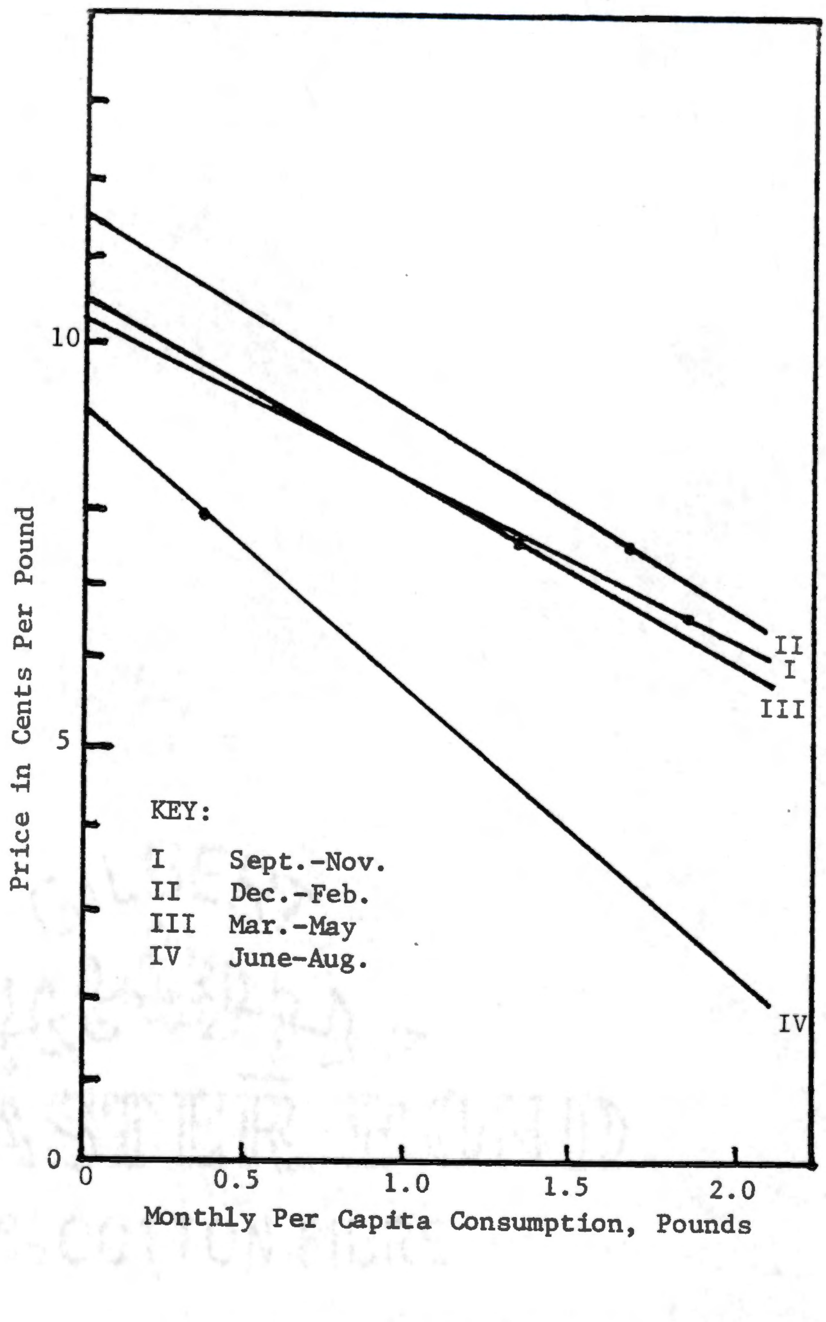

Figure 5. Seasonal demand for fresh apples at the grower level, Appalachian region, 1973/74.

Source: M. C. Hallberg, T. A. Brewer, and D. F. Steadman May 1978. Economics of the Appalachian Apple Industry. College of Agriculture. Bulletin 817. The Pennsylvania State University, University Park.

June-August includes the controlled atmosphere (CA) storage periods. The seasonal elasticities increase dramatically from Season I through Season IV. This suggests that any policy that encourages expansion would improve farm income especially if the surpluses of Season I could be held over to Seasons III and IV.

Hallberg (33) estimated the elasticity of demand for processing apples in the 1972/74 season at -2.299. This resulted in a demand for fresh apples at the farm level being less elastic than processing apples for the first two seasons.

Costs and Returns

The costs and returns of an orchard differ among planting systems due to the different technologies employed. In the establishment of an orchard, Doran (23,24,25,30) estimated for Washington state in 1972 for the first three years the cumulative cost for a low-density orchard of 108 trees per acre at $952, or $8.81 per tree. A medium-density orchard of 268 trees per acre was estimated to cost $1511, or $5.64 per tree, to establish. The high-density trellis orchard of 544 trees per acre was estimated to cost $2,599, or $4.78 per tree.

Downy (26,30), in 1974, estimated for New York a three-year cumulative cost for a low-density orchard of 121 trees per acre to be $1,356, or $11.21 per tree. A medium-density orchard of 218 trees per acre was estimated to cost $1,575, or $7.22 per tree, to establish. The high-density trellis orchard cost was based on a two-year establishment, with 454 trees per acre at a cost of $2,429, or $5.35 per tree. A ultra-high density spindle system of 792 trees per acre was estimated to cost $3,659 for two years, or $4.62 per tree.

In 1974, Funt (30) estimated for Pennsylvania a low-density orchard cost of $843.21 for the first three years at 66 trees per acre, or $12.78 per tree. A medium-density orchard of 181 trees per acre was estimated to cost $1,188.39, or $6.33 per tree. The high-density trellis system of 605 trees per acre cost $2,435.12 for two years establishment, or $4.02 per tree. The high-density spindle system of 792 trees per acre had an establishment period of one year and a cost of $2,897.26, or $3.66 per tree.

Price (61), in 1980, estimated the establishment cost for a low-density orchard with irrigation for Arkansas to be $1,219.83, or $12.20 per tree. Hinman (37) estimated, for Washington in 1981, a three-year establishment cost for a medium-density orchard of 284 trees per acre at $4,371.10, or $15.39 per tree.

Redding (62), in 1983, estimated the first five-year establishment cost in Georgia for a low-density semi-dwarf system of 150 trees per acre to cost $2,750, or $18.33 per tree. A trellised high-density dwarf system with 700 trees per acre cost $9,000 per acre for the first three years or, $12.86 per tree.

Smith (68) in 1981 estimated for Georgia a three-year establishment cost for a low-density orchard of 100 trees per acre at $3,705 or $37.05 per tree. In 1982 for North Carolina (54), an orchard with 100 trees per acre was estimated to cost $4,505.14 per acre, or $45.05 per tree for the first three years. A 1983 estimate in Tennessee (70) projected an orchard with 113 trees per acre to cost $1,040.55 per acre, or $9.21 per tree, for a three-year establishment period.

Once an orchard gets into full production, the preharvest cost will be relatively stable, but the harvest cost will vary according to yields (99,30). A New York low-density orchard of 121 trees per acre in 1972 had an annual bearing cost per acre varying from $471 to $650, the medium-density orchard cost varied from $560 to $990, while the ultra high-density system varied from $1,030 to $1,381 per acre per year (26,30).

Funt (30) indicated that as density increased, the cost per acre increased but cost per bushel decreased. But both net returns per acre and per bushel increased as tree density increased as seen in Table 12. However, McKibbon (45) indicated the total cost per acre was less for dwarfing rootstocks than for standard rootstocks, and the cost per bushel was greater for dwarfing than for standard rootstocks. The net returns per acre and per bushel followed the same pattern as the cost, with greater net returns per acre for the standard and greater net returns per bushel for the dwarfing rootstocks.

Kelsey (40,41) suggested in Michigan that a standard and semi-dward orchard yielding 700 bushels per acre would have a total cost per bushel of $1.31 and $1.25, respectively. Whitaker (116) in New

Table 12. Thirty-six year total cost and net return per acre and per bushel for 'Red Delicious' and 'Golden Delicious' apples at various densities.

Fresh Market System and Variety	Per Acre Total Cost	Per Acre Net Return	Per Bushel Cost	Per Bushel Net Return
	----(dollars)----		----(dollars)--	
Low Density				
'Golden Delicious'	24,299	22,454	.92	.86
'Red Delicious'	19,703	20,944	1.16	1.23
Medium Density				
'Golden Delicious'	30,914	43,976	.76	1.09
'Red Delicious'	23,530	41,147	.93	1.64
High Density Trellis				
'Golden Delicious'	37,663	55,655	.80	1.18
'Red Delicious'	31,670	64,499	.92	1.86
High Density Spindle				
'Golden Delicious'	41,001	64,174	.77	1.21
'Red Delicious'	35,147	78,464	.86	1.92

Source: Richard Clair Funt, November 1974, An Economic Analysis of Several Apple Orchard Systems in Pennsylvania, Unpublished Doctoral Dissertation, Department of Horticulture, The Pennsylvania State University, University Park.

York indicated the returns to land for orchard systems having 27, 121, and 218 trees per acre were $93, $245, and $436, respectively.

Markets

The two marketing questions facing producers are:

1. When do I sell my apples?
2. How do I sell my apples?

The first question was alluded to under the subheading "Demand" but is really beyond the scope of this study. For the second question, as far as this study is concerned, the grower has three alternatives, the wholesale market, farmers market, and pick-your-own market.

Recent studies suggested that apples were purchased by 94% of all families. A 30% increase in the per capita consumption of fresh apples and juice over the past five years has occurred (20). Derr (20) indicated that apples in the supermarket represented 9% to 12% of all produce sales. Furthermore, apples represented 30% of the gross profit from the produce department and the produce department contributed 29.7% to total store net profit during the time of his study.

For Tennessee apple producers to capture a larger share of this market through the wholesale outlet, overcoming the market access barrier caused by high-volume buyers doing business chiefly with well established high-volume producers will be required (8). Brooker (8) indicated that 15% of Tennessee wholesalers purchased apples from Southeastern growers, while Georgia wholesalers purchased 41%. The

Tennessee Valley Authority (TVA) (95) rated the expansion prospects of the Tennessee apple industry into the regional and national markets as poor. The reasons given were grower inability to satisfy commercial demands due to a short season and a lack of cold storage facilities.

Brooker (7) showed that the factors a wholesaler considers before purdhasing from a new supplier are grower ability to provide a product of consistent quality at the right price even though, at times, a higher price can be obtained elsewhere. The wholesaler further wants a grower that can supply apples over six months of the year with a volume averaging 533 bushels per delivery in a prepackaged form. The least important considerations are how close a producer is to other supply sources and whether the grower is the only source of supply.

The initiative has to be taken by the producer, either through an agent or personally, to convince the wholesaler to take his product. Only 13% of produce handlers in Tennessee consider apples as one of their top three products (7).

The apple wholesale market, from the growers' perspective, is not as well developed in Tennessee as in other states. Therefore, many producers have turned to direct marketing.

TVA (95) suggested that on a scale of one to three with one being the highest the prospects for marketing apples through a farmers market was a two. Brooker (5) indicated that increased production in an area would be the result of a farmers market. Farmers reported in

Louisiana that their revenue had increased as a result of the farmers market (5).

Bell (2) listed some of the reasons why communities often get behind a farmers market as a way to:

1. Pave the way for redevelopment,
2. Permit local farmers to sell their products to local consumers and wholesalers,
3. Improve traffic flow,
4. Allow the local government to help the local farmers,
5. Preserve a historical landmark,
6. Permit cooperation between local governments,
7. Reduce crime,
8. Provide a cheap source of food for the poor and elderly, and
9. Eliminate the hucksters on the street.

As far as really helping the poor and elderly, Brooker (4) reported that 71.6% of the shoppers at the Shelby County Farmers' Market had an income over $10,000 in 1975. Furthermore, only 10.4% of the shoppers were over 60. The major reasons shoppers went to the Memphis farmers market was, in decreasing order--quality, quantity, price, a recreational outing, and the market was at a convenient location (4).

Brooker (9) revealed that farmers in the mid-south region of the U. S. felt their current farmers market had some weaknesses. They suggested the major problems were too few shoppers, unfair competition, over-crowded conditions, and poor market location.

Some producers prefer to market their produce through a Pick-Your-Own (PYO) operation. TVA (94) suggested that the prospects for marketing apples in Tennessee through a PYO operation are good. Brooker (6) indicated that producers in Tennessee went to PYO marketing because there was often a lack of labor. Furthermore, greater profits were possible and the farmers felt that consumer demand was consistent. PYO operations were preferred by some due to the complexity of other forms of marketing and the acreage and time requirements were too high for other markets. And some just preferred to work at home.

Sams (64) suggested the advantages and disadvantages of a PYO as follows:

1. Advantages
   - A. Those with limited land can maximize profits.
   - B. Reduces the need for harvest labor.
   - C. Grower receives cash for his produce.
   - D. The customer does the grading, packing, and shipping.
   - E. Prices are more easily established and maintained.
   - F. Net income is just as good or even better than other forms of marketing.
2. Disadvantages
   - A. Requires top management and use of proven technical information.
   - B. There is an increased need for insurance and use of safety requirements.

C. Work long hours during harvest season including weekends and holidays.

D. Weather can keep customers away and spoil the crop.

E. Changing customer attitudes can result in losses.

Crocker (15) describes the typical PYO customer as 40-59 years old from a two-member family with an average annual income of over $15,000. The reasons given for shopping a PYO operation offering peaches were price, quality, recreation, greater value, and convenience, in that order (15). Sabota (64) indicated the top reasons consumers choose a PYO operation were quality, availability, price, and distance. Recreation and transportation cost were the least important. Sabota (64) reported that 85.2% of PYO customers drove 10 miles but were willing to drive 20. Brooker (6) indicated 90% of the PYO operations were within 20 miles of the nearest city.

Promotion at the wholesale and farmers market level are usually a cooperative effort. The individual promotional effort of a PYO market is geared to meet the individual needs of the operation. If business is good then word of mouth and road signs are all that are needed (64). Crocker (15) suggested that for peaches, word of mouth and road signs were most often used by PYO operators. Brooker (6) indicated that when some mass media advertising was used, it usually took the form of newspaper or radio adds of less than five runs.

Any expansion of the Tennessee PYO markets will occur largely through established operations. This will occur by acreage expansion, increasing the product mix and availability, and improving demand through promotion (6).

CHAPTER II

PROCEDURE

1. INTRODUCTION

Although a farmer may have several business objectives or goals, one goal that is usually assumed is that the farmer desires to maximize net returns or "profits." Each producer controls a bundle of resources consisting of land, labor, capital, and management skill. Each of these resources has a cost associated with it. The goal of each farmer then is to arrange these resources into a least-cost combination that will maximize profit (22).

In an isoquant-isocost analysis with a two-variable factor production function as an example, each level of production has a least-cost combination of resources for a given set of input prices. When the least-cost points for all production levels are connected by a line, an expansion path is formed. The quest for economic efficiency at each output level in this two-factor relationship is met when the marginal rate of substitution (MRS) is equal to the negative inverse input price ratio at the least-cost combination. The MRS is defined as the amount of one resource that must be decreased to keep a constant output when another input is increased by one unit (22).

The most profitable output is determined by proceeding out the expansion path until the value added by the last unit of output equals its combined cost for a given and constant set of input and output prices. From the input viewpoint, net value product or "profit" will be maximized when the marginal value product (MVP) of an input or factor equals its cost (marginal factor cost). From the output perspective, profit will be maximized when the marginal cost of that last output unit equals the marginal revenue derived from that unit (22).

Marginal value product must equal marginal factor cost for all inputs simultaneously for all variable inputs in the production function. For each input, the marginal physical product must be less than the average physical product with both decreasing. For net value product to be maximized this must occur in Stage II of the production function and all the resource combinations of equal production (an isoquant) form a curve that is convex to the origin. Being in Stage II, or the zone of rational action, is consistent with the requirements of diminishing returns (22).

The preceding theoretical foundation applies in general to all agricultural enterprises with a single production period. However, for polyperiodic production processes like apples, profit maximization has to be determined over a period of years. Discounting the future revenues to a present value for each year the orchard is operated becomes necessary. A potential producer will invest in an orchard if the accumulated present value of the revenues is greater than the accumulated present value of the costs. Therefore, the criteria for profit maximization for an annual enterprise is also valid for a polyperiodic enterprise in a static environment (22).

The above analysis is complicated further by the dynamic aspects of risk and uncertainty. The inability of a farmer to predict the future with perfect certainty then becomes a central issue. Therefore, a producer makes decisions in the face of risk and uncertainty.

Risk is associated with random outcomes of a production process where the probability distribution is known. Uncertainty, however, is associated with random outcomes of a production process where the probability distribution is unknown.

Under conditions of uncertainty where a farmer lacks objective information concerning the probabilities of certain outcomes, he/she will likely devise a subjective opinion regarding the probability of possible outcomes (22). From these circumstances expected profits over time will be determined. They may not be the absolute maximum but they will be the result of a rational attempt to achieve a maximum perhaps coupled with other goals such as the desire for income stability. Quantitatively dealing with risks and uncertainties in apple production were beyond the scope of this study. However, meeting the stated objectives of this study would be necessary if one was to attempt a dynamic quantitative analysis of apple production.

2. BUDGET APPROACH

An enterprise budgeting approach that recognized the polyperiodic nature of apple production was utilized as a model or plan for analysis. For apples, the planning horizon of the model had to cover the life of the orchard and had to be flexible enough for evaluating various technologies.

Therefore, enterprise budgets were developed for each of four orchard systems under each of three marketing alternatives by utilizing V*Plan, a computerized spreadsheet. The spreadsheet analysis provided a smorgasboard approach where it was possible to pick and choose and add or delete the elements of the budget. This provided a very flexible format that enabled a sensitivity analysis of any change made in the budget.

For example, with the computerized spreadsheet, the enterprise budgets were organized to allow producer choices from among a list of recommended inputs. This permitted the selection of the amount and timing of inputs to fit the production and marketing requirements and to observe the effects on net returns (or equivalent measure) instantly. Hundreds of combinations of land, labor, and capital could be tried with the effects on "profit" or net returns being immediately available. V*Plan is a software package that "is very large, elastic, erasable, and two-sided" (110, p. 1-1).

3. ORCHARD SYSTEMS

One standard, two semi-dwarf, and one dwarf orchard systems were developed for comparative analysis (Table 13). No variety was specified for any of the systems. Each orchard system was assumed to have a life span of 20 years.

Table 13. Description of orchard systems.

System	Rootstock	Tree Spacing (feet)	Trees Per Acre	Tree Height (feet)
Standard	Seedling	30 x 25	38	23.5
Semi-dwarf I	Semi-dwarf	20 x 10	218	12
Semi-dwarf II	Semi-dwarf	20 x 6	363	14
Dwarf	Dwarf	12 x 4	908	8

For the Standard system, a seedling rootstock was selected, having 58 trees per acre on a 30' x 25' grid. This system is patterned after the typical standard orchard.

For the two semi-dwarf systems, MM106, MM111, or a similar semi-dwarf rootstock was assumed. The Semi-dwarf I orchard had 218 trees per acre spaced at 20' x 10'. This system was patterned after an experimental planting at the Plateau Experiment Station in Crossville, Tennessee. The Semi-dwarf II orchard had 363 trees per acre spaced at 20' x 6'. This system was patterned after an experimental plot at the Mountain Horticulture Crops Research Station in Fletcher, North Carolina.

The Dwarf system had 908 trees per acre on M9 rootstock spaced at 12' x 4'. This system was modeled after an experimental plot at the West Tennessee Agricultural Experiment Station in Jackson, Tennessee.

Once an orchard reached its assumed maturity, all inputs and outputs were averaged over the remaining life of the orchard in order to simplify the analysis. The operation of each orchard system was divided into pre-harvest annual operations and annual harvest and marketing operations. The three alternative harvest and marketing operations, consisting of the Wholesale, Farmers, and Pick-Your-Own markets, shared the same pre-harvest operations for each of the orchard systems.

4. COST ASSUMPTIONS

Input prices for 1984 were obtained by personal interviews with farm supply and equipment dealers and university and extension personnel from Tennessee and North Carolina. Costs are presented for each orchard system and market type for the year production and costs were assumed constant for the remaining life of each orchard in Appendixes A through D. The full production year was assumed for the Standard, Semi-dwarf I, Semi-dwarf II, and Dwarf orchards to be the tenth, seventh, sixth, and fifth year, respectively. However, the Semi-dwarf II orchards budget was not assumed constant until the eighth year because of additional tree training requirements. Several assumptions were necessary in order to derive and/or synthesize some of the components that were used in calculating the results in Chapter III.

Site Development

Each orchard system was assumed to be established in sod. The rows were laid out by hand, sprayed with herbicide, subsoiled, and the holes for the trees were custom dug at $0.30 per hole. The tree chosen for the Standard orchard was four to six feet tall and costing $4.75 each with no quantity discount available on a per acre basis. A tree two to three feet in height was chosen for the Semi-dwarf and Dwarf orchards costing $3.35 and $3.25, respectively. A quantity discount was available on a per acre basis for the higher density orchards reducing the cost per tree.

Fertilizers and Sprays

All fertilizers, herbicides, insecticides, fungicides, and growth regulators were applied in accordance with the recommendations of the Tennessee Agricultural Extension Service (69). The one exception was the modification of the tree-row volume equation used for determining spray application rates. The formula used to determine the gallons per acre is as follows:

$$GPA = (\text{Tree height} \times \text{Tree width} \times 30.54)/(\text{Row width}), \ (43) \quad [1]$$

The semi-dwarf and dwarf orchards were chemically stripped of their fruit the year before official production began. This procedure was performed to allow the trees to develop additional root support before the effects of production slowed the process.

Rodent Control and Pollination

Damage from rodents can be very costly. To minimize the damage, each tree was equipped with a tree guard. Also, vole baiting stations, consisting of a roofing shingle baited with poison, were placed throughout the orchards.

To help insure proper pollination, bees were employed at the rate of one hive per acre for each of the four orchard systems. The bees were used starting the year production began.

Pruning and Training

The Standard orchard was assumed to have free-standing trees pruned and trained to a modified central leader form and reaching their maximum size of 23.5 feet high by 19.5 feet wide by the tenth year. Two sets of four spreaders were used on each tree, the first set being used the second year.

The semi-dwarf orchards were assumed to have free-standing trees pruned and trained to a central leader form. Three sets of four spreaders were used on each tree, beginning with the first set the second year. As the trees grew the lower spreaders were moved up the trees. The Semi-dwarf I orchard reached its maximum size of 12 feet high by 10 feet wide at the sixty year. The Semi-dwarf II orchard was assumed to reach its maximum size of 14 feet high and 12 feet wide by the seventh year.

The Dwarf orchard was pruned and trained to a four-wire trellis system. The size of the trees was restricted to a height of 8 feet and a width of 6 feet by their fourth year.

Pneumatic pruners were used on the standard and semi-dwarf orchards. Only hand pruning and training were used on the Dwarf orchard.

Irrigation

All systems were assumed to have overhead and drip irrigation. Irrigation helped stabilize and maintain fruit quality and size. The amount of irrigation labor requirements for each orchard system was 20% of total irrigation equipment hours. This time accounted for maintenance, checking lines, and cleaning filters. Drip irrigation was used every year while irrigation for frost protection was used once production began. Drip irrigation costs, as assumed in Table 14, varied directly with tree density per acre because water line and emitter requirements for drip irrigation varied directly with density.

Labor

Labor for each orchard system was divided into machinery, hand, and supervisory labor. The labor rate for each type of labor was based on the same hourly rate plus FICA taxes and Workman's Compensation insurance as shown in Table 15. The amount of labor required per machine hour was based on Tennessee Extension recommendations of 1.25 times the machine hours (111).

Machinery and Equipment

All machinery and equipment costs were developed in accordance with procedures for enterprise budgeting used by the Tennessee Agricultural Extension Service (111). Varied and fixed cost per hour were figured according to the following general formulas:

$$\text{VC/Hr.} = (\text{Repairs} + \text{Fuel} + \text{Oil \& filters})/\text{Annual hours} \qquad [2]$$

where

$$\text{Repairs} = (\text{New cost} \times \%\ \text{Repairs})/\text{Expected life in hours}$$

Table 14. Irrigation cost per hour for four orchard systems.

Apple Orchard System	Frost		Drip	
	Fixed Cost	Variable Cost	Fixed Cost	Variable Cost
Standard	13.44	2.68	2.96	2.66
Semi-dwarf I	13.44	2.68	3.35	2.76
Semi-dwarf II	13.44	2.68	3.37	2.74
Dwarf	13.44	2.68	4.19	2.89

Source: H. N. Walch, 1984, Unpublished data and personal consultations, Department of Agricultural Economics and Resource Development, The University of Tennessee, Knoxville.

Table 15. Wage rate for orchard labor.

All Labor	Wage Rate	FICA[a] (7.00%)	Workmen's[b] Compensation (3.65%)	Total
			(dollars)	
Hourly Rate	4.00	.28	.15	4.43

[a]United States Social Security Administration, 1984, Personal Communication, Knoxville, Tennessee.

[b]Tennessee Department of Commerce and Insurance, 1984, Rating Section, Personal Conversation, Knoxville, Tennessee.

Fuel = (Estimated hours x Consumption rate x Fuel cost)

Oil & Filters = Fuel costs x .1 or .06, depending on horsepower, and,

FC/Hr. = (Depreciation + Insurance + Housing + Interest)/Annual hours [3]

where

Depreciation = New cost/Expected life in years

Insurance = ((New cost/2)(.012))

Housing = (Estimated square feet of storage x .193)

Interest = ((New cost/2)(Interest rate)), (111).

Some items were figured in units different than hours but the general formulas were still applicable.

Each piece of machinery or equipment was assumed to be leased to the apple enterprise by the farm and each had alternative enterprise uses elsewhere on the farm. A detailed look at the fixed and variable costs are shown in Appendix E.

The amount of elapsed time required for a particular piece of machinery to service an acre was done in accordance with Tennessee Agricultural Extension procedures (111). The elapsed time in hours per acre was determined by the following general formula:

Elapsed Time = 1/((SWE)/8.25) [4]

where

S = Speed in miles per hour

W = Effective width in feet

E = Field efficiency.

The comparative time requirements for machinery needs in hours per acre for each orchard system is illustrated in Table 16.

Interest

The interest rate of 12% not only represented an expense but also an opportunity cost. A producer was assumed to obtain a line of credit for variable expenses in October of each year and draw on that credit as needed. The interest charge for a particular month was compounded at 1/12 of the interest rate on the total amount to date. Principal and interest was due in September of each year. The interest on fixed cost was based on the average investment. The result of the interest charged within a year was to bring all monthly charges up to a single point in time to be expressed properly in present value terms. No debt was carried over from year to year. This would have resulted in double counting when discounted.

Land

Because the soil requirements of various apple rootstocks vary, the land charge was assumed to be the average rental rate of all agricultural land in Tennessee, which in 1984 was $48.10 (102). An alternative approach not used in this study would be the opportunity cost on the value of the land if invested elsewhere. The 1984 average value of farmland per acre in Tennessee was $951.00 (102). At a 12% annual opportunity cost, the land charge would be $114.12.

Table 16. Machinery elapsed time per acre per orchard system.

Machine	Operation	Standard	Semi-dwarf I	Semi-dwarf II	Dwarf
		(hours per acre)			
Air Blast Sprayer	Spray	.15	.23	.23	.38
Bulldozer	Subsoil	.24	.37	.37	.61
Mower/Chopper	Mow	.49	.56	.56	.90
Mower/Chopper	Chop Brush	.98	1.11	1.13	1.80
Sprayer/w Boom	Spray	.23	.34	.34	.29
Spreader	Spread Fertilizer	.11	.17	.17	.27

Wholesale Market

Each bushel of apples was custom harvested and packed at the rate of $.60 and $3.50, respectively (108). Off-grade apples (culls) were sent to a processor by the packer. The apples were hand-harvested from ladders into picking sacks for the Standard and Semi-dwarf orchards. No ladders were needed for the Dwarf orchard. A brokerage fee was charged at the rate of $.25 per bushel.

Farmers Market

Apples were custom harvested at $.60 per bushel as in the Wholesale market. Again, ladders were used for the Standard and Semi-dwarf orchards, while none were used for the Dwarf orchard.

A compact type of juicing and grading and packing equipment was chosen with the small producer in mind. This marketing model permitted the producer to utilize this equipment for custom work and/or for other fruits and vegetables up to the seasonal capacity of the equipment. Alternative uses for this equipment reduced the negative impact of the high investment cost on the apple enterprise. Under these conditions it cost the producer $1.79 to pack a bushel of apples.

Culls (off grade) and small apples were processed into juice. A continuous press was chosen which needed only one person to operate while two laborers were needed to bottle the juice. The juice was not filtered or pasteurized. Under these conditions, cost to the producer to juice a bushel of apples was $.66.

The producer marketed his/her apples from September through December. The cost of the Farmers market was shared, on a per acre basis, among 10 enterprises or products. The shared cost included the trip to and from the market, marketing labor, and equipment charges at the market. The charge to apples for the market space was 2% of total sales. Under these conditions it cost the producer $.63 per bushel to market his apples.

One of the difficulties in an analysis of this type is the linear nature of the model which makes compensation for economies of size difficult. Under the Farmers market alternative, the charges for travel and labor at the market remained relatively constant within a range, regardless of the acreage produced. For example, in this model, as the costs on a per acre basis are multiplied to obtain a desired orchard size the marketing cost shared on a 1/10 per acre basis is pushed beyond the value of one and begins to over charge the market once 10 acres are exceeded.

Pick-Your-Own Market

The Pick-Your-Own customers were assumed to be taken to the area to be harvested by tractor and wagon. In the Standard and Semi-dwarf orchards a fruit picker consisting of a metal frame and canvas bag on the end of a long pole was used to harvest the fruit that was out of reach. No one was permitted to climb trees. The trees in the Dwarf orchard were short enough to permit harvesting without pole harvesters. Customers were given one-half bushel picking bags for harvesting and taking the apples home.

Fifty hours of supervisory labor were required per acre. This was done to provide assistance to the customers in the proper and safe methods of harvesting and to answer questions. In this model, 50 hours were charged against each acre once production began.

The advertising budget was assumed to be 2% of total sales. No media were specified. Additional liability insurance was assumed at the rate of $25.00 per $1,000 of sales (112). A 200-square foot facility was used for checking customers in and out.

5. YIELD AND PRICE ASSUMPTIONS PER MARKET

Estimates of yield per acre were assumed to be the average of red and golden apples for all systems. The Standard orchard yields were based on estimates done by Funt (30) from northeastern states. The yield per acre was in terms of yield per tree times the tree density.

Each of the Semi-dwarf orchards yields were based on the estimated yields used by the Agricultural Extension Service at North Carolina State University (55). The differences between the Semi-dwarf orchards were based on the assumption that yield per acre would be constant for a given row spacing once the allotted growing space was filled. Also, as tree density increased, earlier yields were greater. The Semi-dwarf II orchard, due to its greater density, filled this space quicker and also had greater yields in the earlier years than the Semi-dwarf I orchard. The Dwarf orchard yields were based on research conducted by Westwood (115) on a dwarf orchard system similar in design to the Dwarf orchard in this study. The annual yields in metric tons per hectare were converted to bushels per acre. Yields were avaraged from year five through 20 instead of six year blocks as Westwood used. Table 17 gives the estimated annual yield used in each orchard system for selected years.

The prices received by growers were based on the wholesale prices received by growers in North Carolina. North Carolina wholesale prices were averaged for seven sizes of US Fancy grade from 1979 through 1983 (53). The average price per year for each size was stated in terms of a 1982-1983 value by use of producer price index.

The Farmers market apple prices were assumed to be $2.00 higher than wholesale apple prices. The Pick-Your-Own market price per bushel was based on the Farmers market 125-count apple size and was constant regardless of size or grade. The culls from the Wholesale market were sold to a processor for $2.75 a bushel. The Farmers market small apples and culls were turned into juice at the rate of 3.5 gallons per bushel. Each gallon was sold for $3.50 making the apple price equivalent of the Farmers market culls $12.25 per bushel.

The assumed percentage of total production of each size and its corresponding price per market are shown in Table 18. Even though in Chapter I a relationship between tree size and density were shown to affect fruit size and quality, no distinctions were made among systems in the budgets of this study.

Table 17. Estimated annual yield per acre having economic value for four orchard systems.

	Tree Age								
System	3	4	5	6	7	8	9	10	11	20 Yr. Totals
	(bushels per acre)									
Standard	-	-	75	130	165	225	295	330	700	8200
Semi-dwarf I	-	100	225	425	1050	1050	1050	1050	1050	15450
Semi-dwarf II	-	200	550	1050	1050	1050	1050	1050	1050	16500
Dwarf	100	400	1450	1450	1450	1450	1450	1450	1450	23000

Table 18. The price per bushel and percentage of total production of each apple size by market alternative.

Size (count/bu)	Market	Price (dollars per bu.)	Percentage of Total Production (percent)
72's	Fresh:		
	Wholesale	$11.50	15.0
	Farmers	13.50	15.0
80's	Wholesale	11.50	15.0
	Farmers	13.00	15.0
88's	Wholesale	10.50	15.0
	Farmers	12.50	15.0
100's	Wholesale	10.00	15.0
	Farmers	12.00	15.0
113's	Wholesale	10.00	7.5
	Farmers	11.50	7.5
12/3 lb. Bags	Wholesale	7.75	5.0
All	Pick-Your-Own	11.00	100.0
Culls	Processed:		
	Wholesale	2.75	20.0
Juice Culls	Farmers	12.25	25.00

6. ECONOMIC ANALYSIS

Various analytical approaches were available for evaluating and comparing the orchard-marketing system. Because no one approach usually gives a definitive answer, six analytical approaches were chosen to achieve a consensus on an accept/reject criterion regarding which orchard-marketing system holds the greater economic promise. The analysis was conducted by utilizing the analytical approaches: undiscounted returns, breakeven, benefit-cost, net present value, internal rate of return, and annuity value.

Undiscounted Returns

The undiscounted returns approach utilize the results as is, that is, no adjustments are made for the time value of money. The Tennessee Agricultural Extension Service currently evaluates poly-periodic enterprises, such as apples, by undiscounted means in its planning budgets (70). The decisions to plant many of the orchards in Tennessee were made on this criterion. Therefore, the undiscounted returns approach is also used in this study.

Breakeven

Two breakeven points were sought for each orchard-marketing system. The first was the year accumulated returns exceeded accumulated costs. The second breakeven point was the number of acres required in production for each production-marketing system just to cover the discounted total fixed cost over the life of an orchard. Under these conditions all machinery and equipment costs were charged to the apple enterprise. To properly reflect the acres required to breakeven, the assumption that the machinery and equipment had alternative enterprise uses was temporarily relaxed.

The general formula for the calculation of the breakeven acreage was as follows:

$$BEA = (TFC/P - VC)/Q \qquad [5]$$

where

BEA = Acreage at which all costs are just covered,

TFC = Total fixed cost,

P = Price per bushel,

VC = Variable cost per bushel, and

Q = 20 years of production per acre (16).

All of the values are in 20-year present value terms. The total fixed costs for each production-marketing system were determined as they occurred throughout the life of the orchards.

Benefit-Cost

Another popular criterion for comparative analysis is the benefit-cost (B/C) ratio. The desired result of this approach is to choose the enterprise with the highest B/C ratio. The formulation for the B/C ratio for each production-marketing system was as follows:

$$B/C = \sum_{t=1}^{n} (B_t/(1 + r)^t) / \sum_{t=1}^{n} (C_t/(1 + r)^t) \qquad [6]$$

where

B_t = Annual gross returns in year t,

C_t = Annual total cost in year t,

r = Discount rate, and

n = Life of the orchard in years (66).

Net Present Value

The net present value (NPV) approach discounts the annual net returns of each year in the life of an orchard back to an equivalent value in year one. Therefore, many consider NPV a superior planning tool. One only has to choose the appropriate discount rate. Summing the annual NPV's gives the 20-year NPV or accumulated net present value (ANPV) of an orchard over its entire life. Under this criterion, a potential producer would compare the orchard-marketing combinations and choose the one with the highest ANPV. The formula for the ANPV for each orchard-marketing system was as follows:

$$ANPV = \sum_{t=1}^{n} R_t(1 + r)^t \qquad [7]$$

where

R_t = Net returns in year t,

r = Discount rate

n = Life of the orchard in years (55).

In addition to observing the ANPV's over the life of an orchard, the ANPV's at earlier ages were also calculated. This is of interest because the relative profitability of an orchard can be altered due to changes in supply and demand over time. Therefore, an orchard or market that is more profitable in the early years is likely to be more desirable, especially considering the effects of risks.

Also, the response of each orchard and market to a change in the discount rate was calculated. The interest rate within the annual budget for each orchard was reduced to zero to observe the effects on the ANPV as the discount rate changed. The discount rate was varied from 3% to several percentage points past the point where each orchard ANPV went to zero under each market. With this variation in the discount rate an interest elasticity coefficient was calculated with the form:

$$E = (\%\ \text{change in ANPV})/(\%\ \text{change in r}) \qquad [8]$$

where

ANPV = Accumulated net present value, and

r = Discount rate.

An orchard or market that was less affected by changes in the interest rate would have a lower interest elasticity and by implication, would be less subject to certain risk.

Internal Rate of Return

The internal rate of return (IRR) was considered to be as good an analytical tool as the net present value criteria. The method popularized by John Maynard Keynes is considered inferior by most economists today (66). Yet it remains a popular tool in business analysis for accept/reject and ranking decisions. Therefore, it was considered in this study.

The formula for IRR is the same as equation 7 except the r becomes the discount rate such that when increased forces the ANPV to equal zero. The discount rate thereby becomes the IRR at the point the ANPV equals zero. Each IRR was calculated utilizing this equation in an iterative process with the aid of a computer program written by Morgan Gray (32) as shown in Appendix F.

Annuity

Perhaps one of the most difficult decisions a potential apple producer faces is the removal of land from current production to establish an orchard. He/she is usually faced with the task of comparing alternative enterprises of unequal lives. The net present value method falls short of the mark when it is required to evaluate mutually exclusive enterprises with varying life spans (42).

The annuity value, sometimes called annualized average net returns, overcomes this problem by placing alternative enterprises on an equal footing utilizing the following formula:

$$\text{Value of Annuity} = \text{ANPV}\ (r/1 - (1 + r)^{-n}) \qquad [9]$$

where

ANPV = Accumulated net present value,

r = Interest rate, and

n = Life of orchard in years (55).

With the annuity value, the net returns per acre of an annual enterprise are directly comparable with the net returns of a polyperiodic enterprise.

Through the use of annuity values the net returns from five fruit, six vegetable, five row-crop, and four livestock enterprises operating in selected markets were compared to the apple orchard-marketing systems of this study. The data necessary for the comparisons were selected from the enterprise budgets produced by the Tennessee Agricultural Extension Service (70,71). The five fruit enterprises were polyperiodic production systems, therefore, their net returns were stated in terms of annuity values. The remaining enterprises were assumed to be of an annual nature, because no establishment period was specified in the budgets.

CHAPTER III

RESULTS

1. INTRODUCTION

The comparison of costs and returns for various apple orchard technologies and marketing strategies can be a harrowing experience because of the complexities of the polyperiodic systems and the need to evaluate and compare systems across several economic choice criteria. This chapter presents the analysis and results for each orchard system and its associated markets utilizing undiscounted results and budgetary breakeven points, benefit cost ratios, net present values, internal rates of return, and annuity values.

Several issues must be considered by the reader before drawing any conclusions from the analysis to follow. First, under the assumption of Chapter II, many of the costs in the enterprise budgets developed for this study were averaged over the life of the investment. Also taxes were ignored. When dealing with multiperiod enterprises the time value of money must be considered. This type of analysis is many times done on income after taxes and on actual net cash flow as in true capital budgeting. However, not to consider the time value of money on an enterprise budget that not only includes explicit and implicit charges and opportunity cost would also be a mistake. The static linear nature of the orchard models plus the fact that risk and uncertainty are not considered tends to bias the results toward the higher density plantings. The reader must be cautioned that the analysis that follows is partial in nature, but the results from it have merit for planning purposes.

Second, the results of the Dward orchard cannot be accepted with the same degree of confidence as the results of the Standard or Semi-dwarf orchards. Most of the data and experience with the higher density orchards were not based on actual situations found in Tennessee. Some Tennessee data were available, but they only covered the early years of the life of an orchard.

Finally, some technological problems must be solved before high density orchards can meet the assumptions used in this study. For example, one problem is the short life span of full dwarf rootstocks under Tennessee conditions to date (48).

2. UNDISCOUNTED COSTS AND RETURNS

Annual costs and returns differed among each orchard and associated markets. Generally, costs, gross returns, and net returns increased as tree density increased and as a producer shifted from the Wholesale to the direct forms of marketing. The undiscounted costs, gross returns, and net returns per acre and per bushel for the life of each orchard system and market are shown in Table 19.

Orchard Systems

The Standard orchard had the lowest costs and returns due to lower yields and tree density for each market alternative. The

Table 19. Estimated undiscounted costs and returns for 12 orchard-marketing combinations over a 20-year orchard life.

Orchard-Market System	Per Acre Total Costs	Per Acre Total Returns	Per Acre Net Returns	Per Bushel Total Costs	Per Bushel Total Returns	Per Bushel Net Returns
	(dollars per acre)			(dollars per bushel)		
Standard:						
Wholesale	69,560.06	71,955.01	2,394.94	8.48	8.78	.30
Farmers	71,539.98	101,680.00	30,140.02	8.72	12.40	3.68
Pick-Your-Own	50,318.03	90,183.00	39,981.97	6.12	11.00	4.88
Semi-dwarf I:						
Wholesale	96,663.91	135,573.76	38,909.76	6.26	8.78	2.52
Farmers	96,945.48	191,580.00	94,734.52	6.27	13.40	6.13
Pick-Your-Own	56,701.06	169,950.00	113,249.08	3.67	11.00	7.33
Semi-dwarf II						
Wholesale	110,780.43	144,787.50	34,007.08	6.71	8.78	2.06
Farmers	109,821.46	204,600.00	94,778.54	6.66	12.40	5.74
Pick-Your-Own	67,791.82	181,500.00	113,708.20	4.11	11.00	6.89
Dwarf:						
Wholesale	138,450.72	207,967.50	69,316.78	5,84	8.78	2.94
Farmers	138,195.90	293,880.00	155,684.10	5.83	12.40	6.57
Pick-Your-Own	75,402.28	260,700.00	185,297.72	3.18	11.00	7.82

Semi-dwarf I orchard had lower costs and returns than the Semi-dwarf II orchard. Generally, as density and per acre costs increased the cost per bushel decreased for each marketing method. However, the cost per bushel for the Semi-dwarf II orchard was higher than the Semi-dwarf I orchard. The increased cost of the Semi-dwarf II orchard was the trade-off for the higher density and earlier production. It barely paid off relative to the Semi-dwarf I orchard in terms of net returns per acre for the Farmers market and Pick-Your-Own market, but not at all for the Wholesale market. However, the net returns per bushel for the Semi-dwarf II orchard were consistently lower for all marketing alternatives than the corresponding returns of the Semi-dwarf I orchard. The Dwarf orchard had the earliest yields and highest costs and returns of all the systems. Yet, its total costs and net returns per bushel were the lowest and greatest, respectively.

Markets

The orchards operating in the Wholesale market had the lowest net returns for any orchard-market combination studied (Table 19). Net returns for the Farmers market with the Standard orchard were 12.6 times greater than the same orchard with Wholesale marketing. The net returns for the Semi-dwarf I, Semi-dwarf II and Dwarf orchards under the Farmers market scenario were 2.4, 2.8, and 2.2 times greater, respectively, than the same orchards operating in the Wholesale market.

The total cost for each orchard system operating in the Wholesale and Farmers markets were very close (Table 19). The obvious advantage of the Farmers market over the Wholesale market was the higher average price received per bushel for the Farmers market. The Pick-Your-Own market consistently had the lowest costs and highest net returns across all orchard systems.

Labor

The labor requirements per acre increased as tree density increased for each orchard-market combination, as shown in Table 20. For each orchard alternative the Wholesale market had the lowest labor requirements per acre while the Farmers market had the highest. In the Wholesale market, the apples were custom packed, thereby reducing the labor requirements over the Farmers market, but making relatively small changes in total costs between the markets (Tables 19 and 20). When land and labor are limited resources, it is of great value to know how alternative enterprises compare in terms of labor needs per acre. Also, the net returns per hour of labor are helpful in determining land-labor combinations. This will be discussed later in this chapter under the annuity section.

Generally, the apple orchard-marketing systems were competitive, in terms of labor requirements per acre, with most of the alternative enterprises. The notable exceptions were snapbeans and most of the livestock and rowcrop enterprises. Table 21 compares the labor requirements per acre of each orchard and associated

Table 20. Total labor requirements for 12 orchard-market combinations over a 20-year orchard life.

Orchard-market Combination	Total Labor (hours/acre)	Trees Density (trees/acre)
Standard:		53
Wholesale	973.3	
Farmers	3372.9	
Pick-Your-Own	1658.1	
Semi-dwarf I;		218
Wholesale	1301.1	
Farmers	4875.4	
Pick-Your-Own	1933.8	
Semi-dwarf II:		363
Wholesale	1818.9	
Farmers	5553.0	
Pick-Your-Own	2436.9	
Dwarf:		908
Wholesale	2297.4	
Farmers	7206.5	
Pick-Your-Own	2873.2	

Table 21. Average annual labor requirements for various agricultural enterprise-marketing combinations.

Enterprise	Market	Labor Requirements (hours/acre)
Apple:		
Standard	Wholesale	48.7
	Farmers	168.6
	Pick-Your-Own	82.9
Semi-dwarf I	Wholesale	65.1
	Farmers	243.8
	Pick-Your-Own	96.7
Semi-dwarf II	Wholesale	90.9
	Farmers	277.7
	Pick-Your-Own	121.8
Dwarf	Wholesale	114.9
	Farmers	360.3
	Pick-Your-Own	143.7
Fruits:		
Peaches	Wholesale	81.5
Grapes	Fresh	136.1
Blue Berries	Pick-Your-Own	136.8
Blackberries, thornless	Pick-Your-Own	181.1
Strawberries	Wholesale	187.2
	Pick-Your-Own	184.7
Vegetables:		
Sweet Corn	Fresh	39.7
Snapbeans	Fresh	11.5
	Processing	8.3
Broccoli	Fresh	36.5
Okra	Fresh	218.1
	Processing	220.4
Tomatoes, East Tenn.	Fresh	551.8
Sweet Potatoes	Fresh	99.6

Table 21. (Continued)

Enterprise	Market	Labor Requirements (hours/acre)
Row Crops:		
Burley Tobacco	Wholesale	318.4
Cotton	Wholesale	5.4
Corn, min. till.	Wholesale	1.8
Soybeans, no till.	Wholesale	1.2
Wheat	Wholesale	2.0
Livestock:		
Dairy	Wholesale	40.0
Hog, Farrow-to-Finish	Wholesale	1.2
Feeder Steer	Wholesale	4.9
Beef, cow-calf	Wholesale	.2

Source: Tennessee Agricultural Extension Service, January 1984, Planning Budgets for Fruits and Vegetables: A Supplement to the Farm Planning Manual, Publication EC 890 (The University of Tennessee, Knoxville); Tennessee Agricultural Extension Service, January 1985, Agricultural Economics and Resource Development, Crop and Livestock Budgets for 1985, Info No. 77 (The University of Tennessee, Knoxville).

marketing system to other agricultural enterprises under selected marketing conditions.

3. BREAKEVEN ANALYSIS

Often one of the first concerns a potential grower has about a particular orchard system is the breakeven year, which is the year that accumulated returns surpass accumulated costs. The breakeven year is shown for each market and orchard system in Table 22. The shortcoming of this approach is it only considers the costs and returns in the early years of an orchard and ignores the remaining years. Growers seek this information because the decision being considered is in a climate of uncertainty where safety has a high priority (46).

A more meaningful breakeven point is the number of acres required to just cover the discounted total fixed cost of an orchard. The Standard orchard required the greatest acreage in all marketing alternatives and the Dwarf orchard, the least. Table 23 shows the breakeven acreage for each orchard under each market along with the corresponding discounted costs and returns.

Breakeven acreage can be affected by changes in average price or variable cost per bushel. The sensitivity of an orchard to relatively small changes in price or variable cost per bushel should alert a producer to the possible economic risks associated with a particular orchard-market combination.

Table 22. Year accumulated returns exceeded accumulated costs for 12 orchard-market combinations.

Orchard Systems	Breakeven Year by Marketing Alternatives		
	Wholesale	Farmers	Pick-Your-Own
Standard	18	12	11
Semi-dwarf I	8	7	7
Semi-dwarf II	7	6	6
Dwarf	6	5	5

Table 23. The 20-year present value for costs, prices and returns, and the acreage required to breakeven for 12 orchard-market combinations.

Orchard-Market System	Total Fixed Costs	Variable Cost/bu.	Price	Returns per Bushel above Variable Cost	Breakeven Acreage
	(dollars/acre)	----------(dollars/bu.)----------			(acres)
Wholesale:					
Standard	133,401.16	1.71	1.82	.11	147.89
Semi-dwarf I	136,198.23	1.46	2.23	.77	11.45
Semi-dwarf II	136,202.69	1.66	2.39	.73	11.31
Dwarf	117,461.42	1.67	2.58	.91	5.61
Farmers:					
Standard	213,962.26	1.62	2.65	1.03	25.33
Semi-dwarf I	227,335.82	1.22	3.16	1.94	7.58
Semi-dwarf II	227,340.31	1.38	3.38	2.00	6.89
Dwarf	212,180.24	1.33	3.64	2.31	3.99
Pick-Your-Own:					
Standard	109,839.91	1.25	2.35	1.10	12.18
Semi-dwarf I	110,122.24	.85	2.80	1.95	3.32
Semi-dwarf II	110,126.73	.99	3.00	2.01	3.66
Dwarf	88,781.65	.93	3.23	2.30	1.68

Figure 6 illustrates by example the general relationship between the discounted returns above variable cost per bushel and breakeven acreage for the Standard orchard operating in each of the markets of this study. The other orchard-market combinations are illustrated in Appendix D, Figures 9-11.

The orchard most sensitive to this change was the Standard orchard operating in the Wholesale market. A 10-cent reduction in the discounted return per bushel above variable cost changed the breakeven acreage from 147.9 acres to 1626.8 acres (Table 24) with the returns per bushel above variable costs being $.11 as shown in Table 23. Similarly, a 1.6, 1.5, and .6 acreage change, occurred due to a 10-cent drop, associated with the breakeven point (in Table 23) for the Semi-dwarf I, Semi-dwarf II, and Dwarf orchards, respectively (Table 25). The Wholesale market was the most sensitive to changes in the discounted returns above variable cost with the Pick-Your-Own market being the least sensitive as shown in Tables 25-27.

Breakeven analysis does not take into account economies or diseconomies of size. The reader needs to recall at this point that the assumption regarding alternative uses of equipment was relaxed only for determining the breakeven acreage.

The Standard orchard at the Wholesale breakeven acreage is overworking some of the existing capital and any additional capital needs would increase the total fixed cost. Any strain on existing capital might also cause variable cost to increase. Likewise, the Dwarf orchard in the Wholesale market is under-utilizing capital at

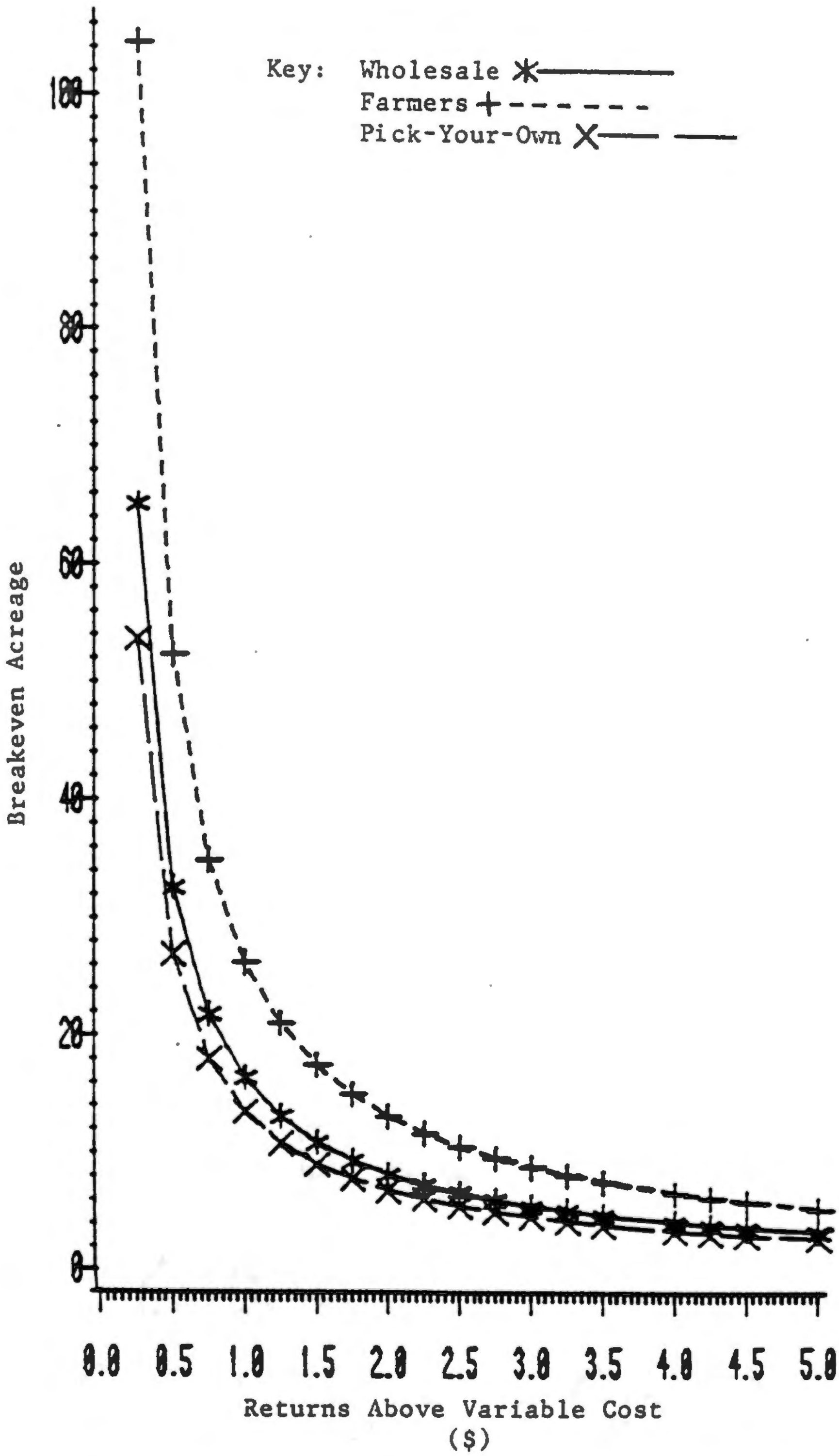

Figure 6. Relationship between the discounted returns above variable cost per bushel and breakeven acreage for the Standard orchard with three marketing alternatives.

Table 24. Sensitivity of the Standard orchard operating in the Wholesale market to a change in the 20-year present value returns per bushel above variable costs.

Present Value Returns Per Bushel Above Valuable Cost (dollars/bu.)	Standard-Wholesale Combination: Breakeven Acreage (acres)	Standard-Wholesale Combination: Marginal Breakeven Acreage (acres)
.01	1626.8	813.4
.02	813.4	217.1
.03	542.3	135.6
.04	406.7	81.3
.05	325.4	54.3
.06	271.1	38.7
.07	232.4	29.0
.08	203.4	22.6
.09	180.8	18.1
.10	162.7	14.8
.11	147.9[a]	12.3
.12	135.6	10.5
.13	125.1	8.9
.14	116.2	7.7
.15	108.5	6.8
.16	101.7	6.0
.17	95.7	5.3
.18	90.4	4.8
.19	85.6	4.3
.20	81.3	

[a]Breakeven acreage for the Standard-Wholesale Combination at its estimated returns above variable cost per bushel (from Table 23).

Table 25. Sensitivity of four orchard systems operating in the Wholesale market to a change in the 20-year present value returns per bushel above variable cost.

Present Value Returns Per Bushel Above Variable Cost	Wholesale Market							
	Standard		Semi-dwarf I		Semi-dwarf II		Dwarf	
	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]
	(acres)							
.10	162.7		88.1		82.5		51.1	
		81.4		44		41.2		25.6
.20	81.3[c]		44.1		41.3		25.5	
		27.1		14.7		13.8		8.5
.30	54.2		29.4		27.5		17.0	
		13.5		7.4		6.9		4.2
.40	40.7		22.0		20.6		12.8	
		8.2		4.4		4.1		2.6
.50	32.5		17.6		16.5		10.2	
		5.4		2.9		2.7		1.7
.60	27.1		14.7		13.8		8.5	
		3.9		2.1		2.0		1.2
.70	23.2		12.6		11.8		7.3	
		2.9		1.6		1.5		.9
.80	20.3		11.0[c]		10.3[c]		6.4	
		2.2		1.2		1.1		.7
.90	18.1		9.8		9.2		5.7	
		1.8		1.0		.9		.6
1.00	16.3		8.8		8.3		5.1[c]	
		1.5		.8		.8		.5
1.10	14.8		8.0		7.5		4.6	
		1.2		.7		.6		.3

Table 25. (Continued)

Present Value Returns Per Bushel Above Variable Cost	Wholesale Market							
	Standard		Semi-dwarf I		Semi-dwarf II		Dwarf	
	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]
	(acres)							
1.20	13.6		7.3		6.9		4.3	
		1.1		.5		.6		.4
1.30	12.5		6.8		6.3		3.9	
		.9		.5		.4		.3
1.40	11.6		6.3		5.9		3.6	
		.8		.4		.4		.2
1.50	10.8		5.9		5.5		3.4	
		.6		.4		.3		.2
1.60	10.2		5.5		5.2		3.2	
		.6		.3		.3		.2
1.70	9.6		5.2		4.9		3.0	
		.6		.3		.3		.2
1.80	9.0		4.9		4.6		2.8	
		.4		.3		.3		.1
1.90	8.6		4.6		4.3		2.7	
		.5		.2		.2		.1
2.00	8.1		4.4		4.1		2.6	

[a] BEA is breakeven acreage.

[b] MBEA is marginal breakeven acreage.

Table 25. (Continued)

[c]Approximate breakeven acreage for each orchard system at its estimated returns above variable cost per bushel (from Table 23).

Table 26. Sensitivity of four orchard systems operating in the Farmers market to a change in the 20-year present value returns per bushel above variable cost.

Present Value Returns Per Bushel Above Variable Cost	Farmers Market							
	Standard		Semi-dwarf I		Semi-dwarf II		Dwarf	
	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]
	(acres)							
.25	104.4		58.9		55.1		36.9	
		52.2		29.5		27.5		18.4
.50	52.2		29.4		27.6		18.5	
		17.4		9.9		9.2		6.2
.75	34.8		19.6		18.4		12.3	
		8.7		4.9		4.6		3.1
1.00	26.1		14.7		13.8		9.2	
		5.2		2.9		2.8		1.8
1.25	20.9[c]		11.8		11.0		7.4	
		3.5		2.0		1.8		1.2
1.50	17.4		9.8		9.2		6.2	
		2.5		1.4		1.3		.9
1.75	14.9		8.4		7.9		5.3	
		1.9		1.0		1.0		.7
2.00	13.0		7.4[c]		6.9		4.6	
		1.4		.9		.8		.5
2.25	11.6		6.5		6.1[c]		4.1	
		1.2		.6		.6		.4
2.50	10.4		5.9		5.5		3.7[c]	
		.9		.5		.5		.3
2.75	9.5		5.4		5.0		3.4	
		.8		.5		.4		.3
3.00	8.7		4.9		4.6		3.1	
		.7		.4		.4		.3

Table 26. (Continued)

Present Value Returns Per Bushel Above Variable Cost	Farmers Market							
	Standard		Semi-dwarf I		Semi-dwarf II		Dwarf	
	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]	BEA[a]	MBEA[b]
	(acres)							
3.25	8.0		4.5		4.2		2.8	
		.5		.3		.3		.2
3.50	7.5		4.2		3.9		2.6	
		.5		.3		.3		.2
3.75	7.0		3.9		3.6		2.4	
		.5		.2		.2		.1
4.00	6.5		3.7		3.4		2.3	
		.4		.2		.2		.1
4.25	6.1		3.5		3.2		2.2	
		.3		.2		.1		.1
4.50	5.8		3.3		3.1		2.1	
		.3		.2		.1		.1
4.75	5.5		3.1		3.0		2.0	
		.3		.2		.1		.1
5.00	5.2		2.9		2.9		1.9	

[a]BEA is breakeven acreage.

[b]MBEA is marginal breakeven acreage.

[c]Approximate breakeven acreage for each orchard system at its estimated returns above variable cost per bushel (from Table 23).

Table 27. Sensitivity of four orchard systems operating in the Pick-Your-Own market to a change in the 20-year present value returns per bushel above variable cost.

Present Value Returns Per Bushel Above Variable Cost	Pick-Your-Own Standard BEA[a]	Standard MBEA[b]	Semi-dwarf I BEA[a]	Semi-dwarf I MBEA[b]	Semi-dwarf II BEA[a]	Semi-dwarf II MBEA[b]	Dwarf BEA[a]	Dwarf MBEA[b]
	(acres)							
.25	53.6		28.5		26.7		15.4	
		26.8		14.2		13.4		7.7
.50	26.8		14.3		13.3		7.7	
		8.9		4.8		4.4		2.6
.75	17.9		9.5		8.9		5.1	
		4.5		2.4		2.2		1.2
1.00	13.4		7.1		6.7		3.9	
		2.7		1.4		1.4		.8
1.25	10.7[c]		5.7		5.3		3.1	
		1.8		.9		.9		.5
1.50	8.9		4.8		4.4		2.6	
		1.2		.7		.6		.4
1.75	7.7		4.1		3.8		2.2	
		1.0		.5		.5		.3
2.00	6.7		3.6[c]		3.3		1.9	
		.7		.4		.3		.2
2.25	6.0		3.2		3.0[c]		1.7	
		.6		.3		.3		.2
2.50	5.4		2.9		2.7		1.5[c]	
		.5		.3		.3		.1
2.75	4.9		2.6		2.4		1.4	
		.4		.2		.2		.1
3.00	4.5		2.4		2.2		1.3	
		.4		.2		.2		.1

Table 27. (Continued)

Present Value Returns Per Bushel Above Variable Cost	Pick-Your-Own: Standard BEA[a]	Standard MBEA[b]	Semi-dwarf I BEA[a]	Semi-dwarf I MBEA[b]	Semi-dwarf II BEA[a]	Semi-dwarf II MBEA[b]	Dwarf BEA[a]	Dwarf MBEA[b]
	(acres)							
3.25	4.1		2.2		2.0		1.2	
		.3		.2		.1		.1
3.50	3.8		2.0		1.9		1.1	
		.3		.1		.1		.1
3.75	3.5		1.9		1.8		1.0	
		.2		.1		.1		.0
4.00	3.3		1.8		1.7		1.0	
		.2		.1		.1		.1
4.25	3.1		1.7		1.6		.9	
		.2		.1		.1		.0
4.50	2.9		1.6		1.5		.9	
		.1		.1		.1		.1
4.75	2.8		1.5		1.4		.8	
		.1		.1		.1		.0
5.00	2.7		1.4		1.3		.8	

[a]BEA is breakeven acreage.

[b]MBEA is marginal breakeven acreage.

[c]Approximate breakeven acreage for each orchard system at its estimated returns above variable cost per bushel (from Table 23).

its breakeven acreage. For example, the life of the tractors used in all the orchards were assumed to be 600 hours per year for ten years. The Standard orchard in the Wholesale market utilized the tractor 34.5 hours per acre. At the 147.9 acre breakeven point the annual hourly requirements would be 5097.8, greatly exceeding the annual machine capacity assumptions of the model. The Dwarf orchard in the Wholesale market, on the other hand, utilized the tractor only 29.9 hours per acre. At the 5.6 acre breakeven point the annual hourly requirements would be 167.7, which is still an under-utilization of the assumed annual capacity of the tractor.

Over-mechanization is a situation facing many farmers today. Apple producers operating in a wholesale or farmers market have to decide whether to have their apples custom graded and packed or do the job themselves on the farm. If grading and packing equipment along with the cold storage facility were charged totally against an apple enterprise, how many acres would a farmer need in production to break even, when custom work was available? Equation 5 in Chapter II can answer this question. The price in the model is the price per bushel for custom grading and packing. The total fixed cost and the variable cost per bushel are those of the Farmers market.

Under the model conditions of the Wholesale and Farmers markets the equation would read \$206,547/(\$3.50 - 2.19) = 157,670 bushels. This represents the minimum number of bushels required over the life of an orchard to justify grading and packing ones own apples when custom work was available. Since the assumed usable lifetime production was 8,200 bushels per acre for the Standard orchard, 15,450 bushels for the Semi-dwarf I, 16,500 bushels for the Semi-dwarf II orchard, and 23,000 bushels for the Dwarf, the acreage required to justify the Farmers market scenario would be 19.2, 10.2, 9.6, and 6.7, respectively, for each orchard system. A producer with any of these orchard systems, who is considering packing and grading and cold storing of his/her own apples and having less than the above stated acreage, would be better off having the apples custom packed. The fixed costs that were unique only to the Pick-Your-Own market option were so low that there were no minimum acreage requirements, given the fixed cost in common with the other marketing alternatives.

4. BENEFIT-COST RATIO

The benefit-cost (B/C) ratio generally became greater as the technical complexity of the orchard systems changed from the Standard to the Dwarf orchard under each marketing alternative. Also, the B/C ratio increased within an orchard system as a producer went from the Wholesale to the Farmers and Pick-Your-Own markets. The B/C ratio for each orchard system and associated markets are shown in Table 28.

The B/C ratio poses a serious problem for decision makers when comparing two or more alternative enterprises. Often an enterprise that is smaller in scope will have a higher B/C ratio than a larger project and still have a lower total discounted net return (66).

Table 28. Discounted returns and costs per acre, and the benefit-cost ratio for 12 orchard-market combinations over the 20-year life of an orchard.

Orchard System	Markets: Wholesale			Markets: Farmers			Markets: Pick-Your-Own		
	Discounted Gross Returns	Discounted Costs	B/C[a] Ratio	Discounted Gross Returns	Discounted Costs	B/C[a] Ratio	Discounted Gross Returns	Discounted Costs	B/C[a] Ratio
	(dollars)								
Standard	14928.51	17575.36	.85	21734.77	18511.36	1.17	19280.84	13745.07	1.40
Semi-dwarf I	34507.51	27638.21	1.25	48762.74	27803.83	1.75	43257.27	17644.63	2.45
Semi-dwarf II	39461.96	32525.42	1.21	55763.91	32996.72	1.69	49467.98	21497.25	2.30
Dwarf	59248.12	44117.75	1.34	83723.83	44290.53	1.89	74271.14	26330.48	2.82

[a] Benefit-Cost.

This occurred between the Semi-dwarf I and Semi-dwarf II orchard systems. The Semi-dwarf I orchard consistently had lower discounted returns and costs, and a higher B/C ratio for each marketing alternative than the Semi-dwarf II orchard, as shown in Table 28. However, the Semi-dwarf II orchard had discounted net returns that were higher in the Farmers and Pick-Your-Own markets. The discounted net returns for the Semi-dwarf II-Wholesale combination were lower than the Semi-dwarf I-Wholesale combination (Table 29).

5. ACCUMULATED NET PRESENT VALUE

The Accumulated Net Present Values (ANPV) for the Standard orchard in each market were substantially lower than for the Semi-dwarf and Dwarf orchards in each market (Table 30). Even though the Standard orchard had lower total cost per acre, its yields began later and were lower than any of the other orchard systems.

Generally, the ANPV increased as the orchard systems under each marketing alternative changed from the Standard to the Dwarf orchard, that is, as tree density became greater. Also, the ANPV increased substantially within an orchard system as a producer went from the Wholesale to the Farmers and Pick-Your-Own markets. Even though the total costs of the Wholesale and Farmers markets for each orchard system were very close (Table 28), the great difference in ANPV between the two was caused by the higher apple prices assumed in the Farmers market.

Table 29. Benefit-cost ratios and discounted net returns for two semi-dwarf orchards with three marketing alternatives.

Orchard Systems	Markets: Wholesale B/C[a] Ratio	Wholesale Discounted Net Returns (dollars)	Farmers B/C[a] Ratio	Farmers Discounted Net Returns (dollars)	Pick-Your-Own B/C[a] Ratio	Pick-Your-Own Discounted Net Returns (dollars)
Semi-dwarf I	1.25	6889.73	1.75	20931.92	2.45	25612.64
Semi-dwarf II	1.21	6364.57	1.69	22767.18	2.30	27970.73

[a]Benefit-Cost.

Table 30. The 20-year accumulated net present values per acre for 12 orchard-market combinations.

Orchard System	Twenty-Year Accumulated Net Present Value		
	Markets		
	Wholesale	Farmers	Pick-Your-Own
	(dollars)		
Standard	-2227.32	3224.33	5535.77
Semi-dwarf I	6889.73	20931.92	25612.64
Semi-dwarf II	6364.57	22767.18	27970.73
Dwarf	15130.36	39433.30	47940.66

ANPV in Early Years

Apple producers are aware that the relative profitability of an orchard can change before its assumed life is ended. This change can be a result of many causes such as, for example, a shift in the total supply schedule of a particular variety, or apples in general, caused by a change in total plantings within a specified region. Technological innovations can result in improved production at a lower cost while rendering certain orchards obsolete and relatively unprofitable. Also, changes in consumer preferences and tastes, income or demographic changes along with many other variables may alter the demand schedule for a particular variety of apple. Any of these circumstances can result in an orchard becoming unprofitable at an early stage in its productive life (30). Because the odds of any of these changes occurring increase with time, an orchard that is more profitable, in ANPV terms, in the early years is likely to be more desirable, all other things being equal.

Higher ANPV's are associated in the early years with the Semi-dwarf and Dwarf orchards for each marketing alternative, or the Farmers and Pick-Your-Own markets for each orchard alternative as shown in Table 31. Therefore, any risk or uncertainty associated with any change to the orchard or market alternative that is beyond the control of the producer would be less for the Semi-dwarf and Dwarf orchards or the Farmers and Pick-Your-Own markets.

Table 31. The accumulated net present values per acre for 12 orchard-market combinations for selected orchard ages.

Orchard-Market Combination	Accumulated Net Present Values (per acre)			
	5 Years	10 Years	15 Years	20 Years
Wholesale:				
Standard	-2433.09	-3914.94	-2838.26	-2227.32
Semi-dwarf I	-3701.95	1234.55	4842.49	6889.73
Semi-dwarf II	-3723.72	1790.42	4708.68	6364.57
Dwarf	-3400.37	6407.36	11972.53	15130.36
Farmers:				
Standard	-2531.98	-3080.66	941.85	3224.33
Semi-dwarf I	-3449.82	8187.42	16318.26	20931.92
Semi-dwarf II	-2381.30	11103.72	18544.87	22767.18
Dwarf	384.97	21052.02	32779.06	39433.30
Pick-Your-Own:				
Standard	-2367.91	-2157.57	2747.07	5535.77
Semi-dwarf I	-3048.03	10690.65	20210.70	25612.64
Semi-dwarf II	-1803.52	14129.78	22960.14	27970.73
Dwarf	1929.05	26281.55	40099.81	47940.66

Discount Rate and ANPV

Fluctuations in the interest rate over the past decade have heightened concern among apple growers. The ability of an orchard-marketing combination to weather unfavorable changes in the interest rate is a desirable feature. Figure 7 illustrates by example the general relationship between the discount rate and ANPV for the Standard orchard for each respective market. The other orchard-marketing systems are illustrated in Appendix E, Figures 12-14.

From Figure 7 the reader can see that a given change in the discount rate will result in the Wholesale market suffering less in dollar terms than any of the other markets. This view in absolute terms of the graph is not the best way of judging the effects of a change in the discount rate. A more appropriate measure is to observe the changes in percentage terms by the use of an interest elasticity coefficient defined as a percentage change in the ANPV divided by percentage change in the discount rate. Tables 32-34 show the ANPV, marginal ANPV, and the interest elasticity coefficient associated with various discount rates for each orchard system and market.

Once again the Standard orchard at each respective market and the Wholesale market for each respective orchard were the most sensitive to a change in the discount rate (Tables 32-34). Although the marginal ANPV generally increased, the interest elasticity coefficients decreased as the technical complexity of the orchards changed

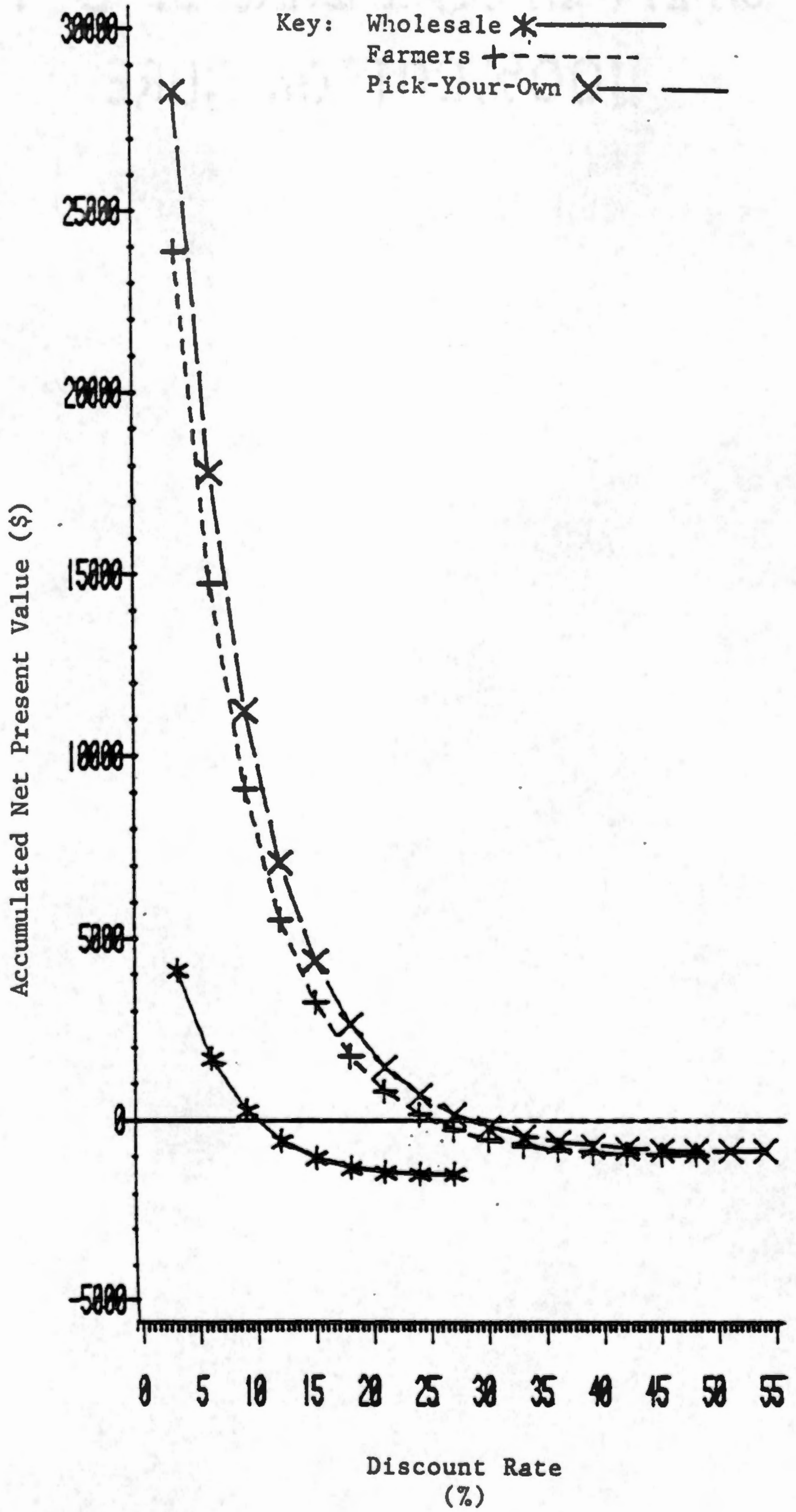

Figure 7. Relationship between the discount rate and ANPV for the Standard orchard with three marketing alternatives.

Table 32. Sensitivity of four orchard systems operating in the Wholesale market to a change in the discount rate measured by regional ANPV[a] and an interest elasticity coefficient.

	Wholesale Market											
	Standard			Semi-dwarf I			Semi-dwarf II			Dwarf		
Discount Rate	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity
(Percent)	(dollars)											
3	4097.35			30065.99			28210.74			52565.42		
		2437.42	1.27		10083.66	.60		9119.09	.58		16302.39	.56
6	1659.93			19982.33			19091.65			36263.03		
		1422.80	3.75		6581.60	.99		6037.12	.94		10877.38	.88
9	237.13			13400.73			13054.53			25385.65		
		825.52			4389.72	1.37		4091.44	1.30		7440.68	1.20
12	-588.39[b]			9011.01			8963.09			17944.97		
					2985.71	1.79		2832.51	1.69		5207.52	1.53
15				6025.30			6130.58			12737.45		
					2066.61	2.28		1998.82	2.14		3721.05	1.88
18				3958.69			4131.76			9016.40		
					1452.61	2.92		1434.61	2.73		2708.96	2.30
21				2506.08			2697.15			6307.44		
					1034.67	3.90		1045.01	3.61		2005.12	2.84
24				1471.61			1652.13			4302.32		
					745.21	5.77		770.93	5.18		1505.95	3.61
27				726.20			881.20			2794.37		
					541.54	11.29		574.79	9.19		1145.46	4.89
30				184.66			306.41			1650.91		
33				-211.48[b]			-125.81[b]			770.13		
											683.48	18.34
36										86.65		
											564.37	
39										-447.72[b]		

[a]ANPV = Accumulated Net Present Value.

[b]Once ANPV becomes negative the interest elasticity becomes meaningless in this study. Therefore, no values are calculated when negative ANPV's occur.

Table 33. Sensitivity of four orchard systems operating in the Farmers market to a change in the discount rate measured by marginal ANPV[a] and an interest elasticity coefficient.

	Orchard Systems in Farmers Market											
	Standard			Semi-dwarf I			Semi-dwarf II			Dwarf		
Discount Rate	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity
(Percent)	(dollars)											
3	23865.48			72182.17			74315.55			119487.18		
6	14746.50	9118.98	.72	49438.94	22743.23	.57	51958.08	22357.47	.54	84485.37	35001.81	.52
9	9080.96	5665.54	1.19	34495.10	14943.84	.89	37077.76	14880.32	.84	61041.67	23443.70	.81
12	5504.23	3576.73	1.72	24445.23	10049.87	1.19	26924.36	10153.40	1.11	44927.92	16113.75	1.06
15	3215.04	2289.19	2.36	17540.17	6905.06	1.48	19835.10	7089.26	1.36	33583.78	11344.14	1.30
18	1733.42	1481.62	3.29	12701.82	4838.35	1.76	14779.81	5055.29	1.61	25419.98	8163.80	1.52
21	766.49	966.93	5.03	9250.55	3451.27	2.04	11150.17	3674.64	1.85	19426.23	5993.75	1.74
24	132.36	634.13	10.58	6748.74	2501.81	2.35	8387.50	2717.67	2.09	14945.47	4480.76	1.96
27	-283.80[b]	416.16		4908.81	1839.93	2.68	6346.13	2041.37	2.36	11541.04	3404.43	2.19
30				3538.16	1370.65	3.08	4791.40	1554.73	2.65	8916.67	2624.37	2.44
33				2505.45	1032.71	3.59	3592.66	1198.74	3.00	6867.43	2094.24	2.73
36				1719.61	785.84	4.28	2658.33	934.33	3.44	5248.94	1618.49	3.07
39				1116.49	603.12	5.32	1923.12	735.21	4.01	3957.73	1291.21	3.51
42				650.22	466.27	7.12	1339.77	583.35	4.83	2918.47	1039.26	4.08
45				287.59	362.63	11.21	873.58	466.19	6.11	2075.49	842.98	4.89
48				4.21	283.38	30.11	498.73	374.85	8.47	1387.07	688.42	6.16
51				-218.02[b]	222.23		195.76	302.97	14.40	821.59	565.48	8.45
54							-50.15[b]	245.91		354.74	466.85	13.90
57										-32.30[b]	387.04	

[a]ANPV = Accumulated Net Present Value.

[b]Once ANPV becomes negative the interest elasticity become meaningless in this study. Therefore, no values are calculated when negative ANPV's occur.

Table 34. Sensitivity of four orchard systems operating in the Pick-Your-Own market to a change in the discount rate measured by marginal ANPV[a] and an interest elasticity coefficient.

	Orchard Systems in Pick-Your-Own Market											
	Standard			Semi-dwarf I			Semi-dwarf II			Dwarf		
Discount Rate	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity	ANPV[a]	Marginal ANPV	Interest Elasticity
(Percent)	(dollars)											
3	28276.23			80179.36			82828.80			132754.75		
		10483.52	.69		25080.41	.56		24771.67	.53		38662.56	.52
6	17792.71			55098.95			58057.13			94092.19		
		6554.59	1.13		16496.61	.88		16496.84	.83		25908.34	.80
9	11238.12			38602.34			41560.29			68183.85		
		4170.32	1.59		11108.00	1.18		11264.57	1.10		17818.57	1.05
12	7067.80			27494.34			30295.72			50365.28		
		2694.83	2.12		7643.44	1.45		7871.99	1.34		12553.48	1.28
15	4372.97			19850.90			22423.73			37811.80		
		1764.94	2.78		5365.09	1.72		5619.29	1.58		9041.9	1.49
18	2608.03			14485.81			16804.44			28769.90		
		1168.92	3.76		3834.74	1.98		4089.59	1.80		6645.12	1.70
21	1439.11			10651.07			12714.85			22124.78		
		780.95	5.59		2786.27	2.26		3028.81	2.03		4973.43	1.90
24	658.16			7864.80			9686.04			17151.35		
		524.78	11.28		2054.58	2.56		2278.73	2.27		3783.73	2.11
27	133.38			5810.22			7407.31			13367.62		
		353.46			1535.18	2.89		1738.69	2.53		2921.07	2.33
30	-220.08[b]			4275.04			5668.62			10446.55		
					1160.64	3.30		1343.33	2.82		2284.71	2.58
33				3114.40			4325.29			8161.84		
					886.60	3.82		1049.46	3.17		1807.79	2.86
36				2227.80			3275.83			6354.05		
					683.44	4.53		827.94	3.62		1445.19	3.21
39				1544.36			2447.89			4908.86		
					530.98	5.60		658.83	4.20		1165.83	3.64
42				1013.38			1789.06			3743.03		
					415.30	7.47		528.22	5.02		948.02	4.20
45				598.08			1260.84			2795.01		
					326.63	11.65		426.27	6.31		776.33	5.00
48				271.45			834.57			2018.68		
					258.03	29.89		345.93	8.63		639.67	6.21
51				13.42			488.64			1379.01		
					204.53			282.06	14.21		529.87	8.33
54				-191.11b			206.58			849.14		
								230.88			440.95	12.96
57							-24.30[b]			408.19		
											368.40	32.06
60										39.79		
											308.79	
63										-269.00[b]		

[a]ANPV = Accumulated Net Present Value.

[b]Once ANPV becomes negative the interest elasticity becomes meaningless in this study. Therefore, no values are calculated when negative ANPV's occur.

from the Standard to the Dwarf, and an orchard was shifted from the Wholesale to the Farmers and Pick-Your-Own markets. This indicates that the higher density orchards and the direct forms of marketing were less vulnerable to a change in the interest rates.

Even though the net present value approach to this type of analysis is generally considered superior, it is not without criticism. Two alternative enterprises, for example, can have the same net returns and thus yield the same ANPV but yet have drastically different levels of investment and gross returns. The inability for NPV to distinguish between enterprises as described is a weakness worth noting; however, it was not a problem in this study.

As the discount rate increases, the ANPV decreases, goes to zero, and then becomes negative. The point that ANPV crosses the horizontal axis and goes to zero defines the internal rate of return, sometimes referred to as the return on investment.

6. INTERNAL RATE OF RETURN

The Standard orchard for each marketing alternative and the Wholesale market for each orchard alternative once more ranked at the bottom among the 12 orchard-market combinations because of low internal rates of return (IRR). The Standard orchard had substantially lower IRR's in all markets when compared to other orchards. The IRR's improved as the technical complexity of the orchards changed from the Standard to the Dwarf and when a producer shifted an orchard from the Wholesale to the direct forms of marketing (Table 35).

Table 35. Internal rates of return for 12 orchard-market combinations over a 20-year orchard life.

	Internal Rates of Return			
	Orchard Systems			
Markets	Standard	Semi-dwarf I	Semi-dwarf II	Dwarf
Wholesale	9.8	31.3	32.1	36.5
Farmers	24.9	48.1	53.4	56.8
Pick-Your-Own	28.0	51.2	56.7	60.4

The IRR approach to analysis is not without doubts. Over the years as the IRR method increased in popularity, problems began to surface. Users began to notice if net returns of an enterprise alternated between positive and negative more than once, a unique IRR for the enterprise could not be determined. For an orchard-market combination that experienced more than one negative to positive fluctuation in annual net returns, the IRR method would be useless. The NPV approach is not affected by these fluctuations.

Another problem with the IRR method is that net returns are assumed to be reinvested at the internal rate of return for the enterprise under consideration. This can result in an overstatement of the potential return on an investment. The returns on investment in this study seem to be overstated, because the IRR's of each orchard-marketing system (Table 35) appear to be unrealistically high.

The net present value and internal rate of return methods are generally recognized as giving the same accept/reject decision for a particular enterprise. However, as a result of the assumption concerning the investment rate, the IRR criterion, for two or more orchards, can render a ranking different from the NPV approach (42).

Figure 8 illustrates a hypothetical example of the possible conflict between the IRR and the ANPV ranking of two orchards. At the discount rate d the ANPV of orchard A is ranked higher than the ANPV of orchard B, but the IRR of orchard B at r_b is ranked higher than the IRR of orchard A at r_a. As long as the discount rate used

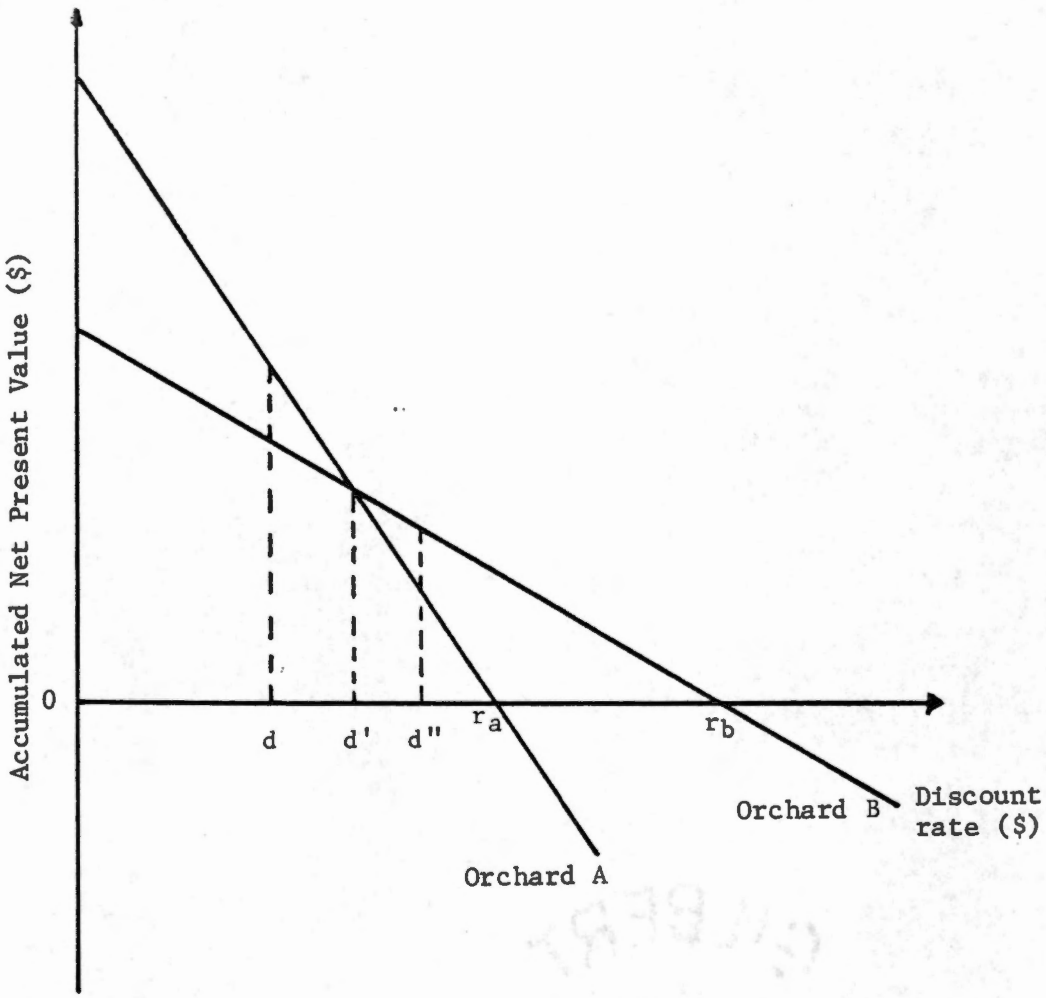

Figure 8. Hypothetical example of the possible conflict between the IRR and the ANPV ranking of two orchards.

Source: Warren F. Lee, Michael E. Boehlje, Aaron G. Nelson, and William G. Murray. Agricultural Finance; The Iowa State University Press, Ames, 1980. Also E. J. Mishan, Cost Benefit Analysis, Praeger Publishers, New York, 1976.

is greater than d' the ANPV and IRR methods give the same ranking. If, however, the rate used is less than d' the ANPV and IRR methods give conflicting ranking. When a conflict arises economists prefer to make a decision based on the discount rate using the ANPV criterion and not the IRR (66).

The scenario of Figure 8 occurred for the Semi-dwarf orchards in the Wholesale market. The astutute reader will have noticed that the ANPV of the Semi-dwarf I orchard was ranked above the ANPV of the Semi-dwarf II orchard (Tables 29 and 30-32, pages 100, 101, 103, and 106). However, Table 34 in the Wholesale market ranks the IRR of the Semi-dwarf II orchard above the IRR of the Semi-dwarf I orchard. The switch in the ANPV ranking occurs between 12% and 15% as shown in Table 32.

7. ANNUITY

The performance of the Standard orchard in each respective market and the Wholesale market for each respective orchard continued to be substantially less than the other orchard-marketing combinations (Table 36). Once again the Semi-dwarf I orchard was ranked above the Semi-dwarf II orchard in the Wholesale market, but not in the remaining markets.

The Pick-Your-Own markets for each alternative apple orchard had the greatest annuity values per acre and per hour of labor than the other apple orchard-marketing systems (Tables 36 and 37). The Standard and Semi-dwarf II orchards in the Wholesale market had lower

Table 36. Annuity value per acre for 12 orchard-market combinations over a 20-year orchard life.

	Annuity Values			
	Orchard Systems			
Markets	Standard	Semi-dwarf I	Semi-dwarf II	Dwarf
	------------------(dollars per acre)---------------			
Wholesale	-298.19	922.39	852.08	2025.63
Farmers	431.67	2802.34	3048.04	5279.28
Pick-Your-Own	741.12	3428.99	3744.69	6418.24

Table 37. Net returns per acre and per hour of labor for various agricultural enterprise-market combinations.

Enterprise	Market	Net Returns[a] Per Acre	Per Hour Labor
		---------(dollars)---------	
Apples:[b]			
Standard	Wholesale	-298.19	-6.12
	Farmers	431.67	2.56
	Pick-Your-Own	741.12	8.94
Semi-dwarf I	Wholesale	922.39	14.17
	Farmers	2802.34	11.49
	Pick-Your-Own	3428.99	35.46
Semi-dwarf II	Wholesale	852.08	9.37
	Farmers	3048.04	10.98
	Pick-Your-Own	3744.69	43.34
Dwarf	Wholesale	2025.63	17.63
	Farmers	5279.28	14.65
	Pick-Your-Own	6418.24	44.66
Fruits:[c]			
Peaches	Wholesale	503.67	6.18
Grapes	Fresh	215.04	1.58
Blue Berries	Pick-Your-Own	2742.95	15.15
Blackberries, thornless	Pick-Your-Own	2742.95	15.15
Strawberries	Pick-Your-Own	952.73	5.16
Vegetables:[d,e]			
Sweet Corn	Fresh	222.72	5.62
Snapbeans	Fresh	240.89	20.87
	Processing	15.31	1.85
Broccoli	Fresh	1325.23	36.36
Okra	Fresh	1382.13	6.34
	Processing	-326.90	-1.48
Tomatoes, East Tenn.	Fresh	1061.01	6.99
Sweet Potatoes	Fresh	274.05	2.75

Table 37. (Continued)

Enterprise	Market	Net Returns[a] Per Acre	Per Hour Labor
		--------(dollars)----------	
Row Crops:[c]			
Burley Tobacco	Wholesale	959.76	3.01
Cotton	Wholesale	51.04	9.54
Corn, min. till.	Wholesale	64.46	36.83
Soybeans, no till.	Wholesale	35.70	29.02
Wheat	Wholesale	2.41	1.22
Livestock:[e]			
Dairy, 15000 lb.	Wholesale	228.55	5.71
Hog, farrow to finish	Wholesale	2.69	2.30
Feeder Steer	Wholesale	5.85	1.19
Beef, cow-calf	Wholesale	-.57	-3.35

[a]Net returns for polyperiodic enterprises in terms of annuity values.

[b]Net returns to management and overhead in terms of annuity values.

[c]Net returns to land and management in terms of annuity value.

[d]The fresh and processing markets are subsets of the wholesale market.

[e]Net returns to land and management.

annuity values per hour of labor than the Semi-dwarf and Dwarf orchards in the Wholesale market. The Semi-dwarf I and Dwarf orchards in the Farmers market had lower annuity values per hour of labor than the same orchards operating in the Wholesale market (Table 37).

The annuity values of the apple orchard-marketing combinations were compared to the annuity values or net returns of selected alternative agricultural enterprises on a per acre and per hour of labor basis (Table 37). Generally the net returns from the apple orchard-marketing combinations were competitive when compared to the net returns from the alternative enterprises.

The Semi-dwarf and Dwarf orchards operating in the Farmers and Pick-Your-Own markets had the greatest net returns per acre of the enterprises considered in Table 37. The net returns per hour of labor were the greatest for the Semi-dwarf II and Dwarf orchards operating in the direct forms of marketing. However, broccoli and minimum tillage corn had greater net returns per hour of labor in their respective markets than the remaining apple orchard-marketing combinations (Table 37) even though their net returns per acre were often substantially less. No-tillage soybeans in the wholesale market and snapbeans in the fresh market were also very competitive enterprises when compared to the apple orchard-marketing combinations on a per hour of labor basis. The livestock enterprises were more competitive in net returns per hour of labor with the Standard orchard in each respective market than any other apple orchard-market combination.

There are potential criticisms of having all the orchards with a productive life limited to 20 years. For example, one could argue that the life of the Standard orchard is longer than 20 years and that the value of the Standard orchard is being undervalued with a 20-year life span. Also, there is some indication that the productive life of the Dwarf orchard in Tennessee may be less than 20 years, sometimes averaging 10 years (48). Hence, one could argue that the value of the Dwarf orchard is being overstated with a 20-year life span.

However, when the productive life of the Standard orchard was extended to 30 years the annuity values in relation to the annuity values of the other orchards at 20 years were not changed (Table 38). The 30-year annuity value of the Standard orchard remained negative for the Wholesale market and the direct marketing alternatives remained below the 20-year annuity values of the other orchards in the corresponding market. Also, when the productive life of the Dwarf orchard was assumed to be only 10 years, the annuity value indicated that the Dwarf orchard would still be favored above the other orchards in each alternative market with a 20-year life span. That is, the 10-year annuity value of the Dwarf orchard in each respective market was greater than the 20-year annuity of the other orchards in each respective market (Table 38).

Table 38. Annuity value per acre for 12 orchard-market combinations for selected orchard ages.

Orchard-Market Systems	Annuity Value				
	Age of Orchard				
	5 Years	10 Years	15 Years	20 Years	30 Years
	(dollars)				
Wholesale:					
Standard	-674.96	-692.88	-416.72	-298.19	-209.05
Semi-dwarf I	-1026.96	218.50	710.99	922.39	-
Semi-dwarf II	-1033.00	316.88	691.35	852.08	-
Dwarf	-943.30	1134.00	1757.86	2025.63	-
Farmers:					
Standard	-702.40	-545.23	138.29	431.67	652.30
Semi-dwarf I	-957.01	1449.04	2395.92	2802.34	-
Semi-dwarf II	-660.59	1965.18	2722.94	3048.04	-
Dwarf	106.79	3725.87	4812.76	5279.28	-
Pick-Your-Own:					
Standard	-656.88	-383.63	403.34	741.12	995.14
Semi-dwarf I	-845.55	1892.08	2967.42	3428.99	-
Semi-dwarf II	-500.31	2500.75	3371.11	3744.69	-
Dwarf	535.14	4651.42	5887.62	6418.24	-

CHAPTER IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

1. SUMMARY

Problem and Objectives

The Tennessee apple industry has remained an infant industry for various reasons. A farmer wishing to improve his income by producing apples often abandons the idea because of the initial investment requirements and the several years required before realization of a positive cashflow. Also, many farmers lack the management skills necessary to move to an intensive, highly specialized crop like apples. Even the move from a low-density to a high-density orchard requires greater management skills.

The Wholesale market for apples in Tennessee presents several obstacles to producers. A wholesaler wants apples of consistent quality supplied over an extended period of time at specified volumes in prepacked containers. He/She also wants a producer that will sell to him/her even though a better price can on occasion be obtained elsewhere. Many growers cannot meet all these demands. Therefore, direct forms of marketing become attractive to the grower even though these markets may be small and localized.

Agricultural research in Tennessee has generally been geared toward traditional agriculture. Also, the apple industry is changing so rapidly that relevant results from replicated trial plantings are often difficult to obtain or are outdated before being completed. An innovative farmer trying to evaluate apples as an alternative enterprise is then faced with the problem of acquiring timely data that are relevant to his/her situation and assimulating the informa tion into a format flexible enough to accept and evaluate various technologies and markets.

Therefore the objectives of this study were:

1. To determine the resource requirements for four apple orchard technologies operating under three marketing alternatives.

2. To compare and analyze the net returns over time from each orchard-marketing system.

3. To compare selected economic characteristics of each orchard-market combination with alternative agricultural enterprises.

Procedures

To meet the objectives of the study, enterprise budgets were developed that were flexible enough to evaluate various production-marketing systems. This was accomplished by utilizing V*Plan, a computerized spreadsheet. The enterprise budgets were patterned after the budgets developed by North Carolina State University. Their basic format was expanded to include various marketing alternatives.

All inputs and prices were obtained by personal interviews with farmers, farm chemical and implement dealers, and university and extension personnel from Tennessee and North Carolina. All applicable orchard and marketing operations were performed in accordance with recommended practices from the North Carolina Agricultural Extension Service and the Tennessee Agricultural Extension Service (21,108,54, 70,69,111,55,53).

Orchard Systems

Budgets for one standard, two semi-dwarf, and one dwarf orchard, each having a life of 20 years, were developed for comparative analysis. The Standard orchard had seedling rootstocks with 58 trees per acre on a 30' x 25' grid. The two semi-dwarf systems had semi-dwarfing rootstocks. The Semi-dwarf I orchard had 218 trees per acre spaced at 20' x 10'. The Semi-dwarf II orchard had 363 trees per acre spaced at 20' x 6'. The Dwarf orchard had M9 full dwarfing rootstock with 908 trees per acre spaced at 12' x 4'.

Yields were assumed to be the average of red and golden apples for all systems. The life time yield of the Standard orchard was 8,200 bushels per acre, which was based on estimates from Northeastern states (35). The life time yields were 15,450 and 16,500 bushels per acre for the Semi-dwarf I and Semi-dwarf II orchards, respectively. Each was based on estimates used by the North Carolina State University Agricultural Extension Service (54,55). The life time yield was 23,000 bushels per acre for the Dwarf orchard and was based on work done by Westwood (115).

Markets

Each of the above production systems were evaluated in conjunction with each of three marketing alternatives--the Wholesale, Farmers, and Pick-Your-Own markets. Under the Wholesale market, the apples were custom harvested and packed. The culls were sold to a processor by the packer. The graded apples were sold through a broker at harvest and were based on the wholesale prices received by North Carolina growers.

With the Farmers market alternative, the apples were also custom harvested but were graded, packed, and placed in cold storage on the farm. The off-grade apples (culls) were turned into juice. The apples and juice were sold at a local farmers market from harvest through December. The price per bushel was assumed to be $2.00 above the wholesale price. Juice was sold for $3.50 a gallon and each bushel of culls produced 3.5 gallons of juice.

With the Pick-Your-Own alternative the customer picked the apples and paid the farmer at the time of harvest. The price per bushel was based on the 125 count size from the Farmers Market alternative and was constant regardless of size or grade.

Results

Thd 12 orchard-marketing combinations were economically evaluated utilizing six approaches. The approaches consisted of undiscounted returns, breakeven analysis, benefit-cost ratios, accumulated net present value, internal rates of return, and annuity values.

Undiscounted Returns

Generally, the undiscounted costs, returns, and net returns per acre increased as tree density per acre increased and as a producer moved an orchard from the wholesale to direct marketing. However, the undiscounted costs and net returns per bushel decreased as tree density per acre increased and a producer shifted an orchard from the wholesale to direct marketing.

Breakeven

Two breakeven points were observed. One involved time and the other involved size in acreage per marginal unit. The first was the year that accumulated returns exceeded accumulated costs. The breakeven year occurred earlier in the life of an orchard as the orchard complexity increased from the Standard, the least complex or intensive, to the Dwarf orchard, the most complex or intensive, and as the markets went from the Wholesale to the retail alternative, Pick-Your-Own. The respective breakeven years for the Standard and Dwarf orchards in the Wholesale market were the eighteenth and sixth. For the same orchards under the Pick-Your-Own alternative, the breakeven years were the eleventh and fifth, respectively.

The second breakeven point was the orchard acreage per farm required just to cover the total fixed cost. The breakeven size in acres of apples per farm decreased as orchard complexity increased from the Standard to the Dwarf orchard and as the marketing alternative varied from Wholesale to Pick-Your-Own. The breakeven respective acreages for the Standard and Dwarf orchards in the Wholesale market were 147.9 acres and 5.6 acres. For the same orchards in the Pick-Your-Own market the breakeven acreages were 12.2 acres and 1.7 acres, respectively.

The Standard-Wholesale combination was the most sensitive to a price-cost squeeze. A 10-cent increase in discounted cost per bushel increased the breakeven acreage an additional 1478.9 acres from 148 acres. The Dwarf Pick-Your-Own combination was the least sensitive orchard-market system to a price-cost squeeze. A 25-cent increase in discounted cost per bushel increased the breakeven acreage .1 acre.

Benefit-Cost Ratio

The benefit-cost (B/C) ratios generally became greater as the intensiveness of the orchard systems increased from the Standard to the Dwarf orchard. However, the B/C criterion did rate the Semi-dwarf I orchard above the Semi-dwarf II orchard across all marketing alternatives even though I was less complex than II. The B/C ratios increased for each orchard alternative from the Wholesale to the retail Farmers and Pick-Your-Own marketing alternatives. The B/C ratios for the Standard-Wholesale and Dwarf-Wholesale combinations were .85 and 1.34, respectively. The same orchards under the Pick-Your-Own alternative had B/C ratios of 1.40 and 2.82, respectively.

Accumulated Net Present Value

Generally, the accumulated net present value (ANPV) increased as the intensiveness of the orchard alternatives increased from Standard to Dwarf. Only in the Wholesale market was the ANPV of the Semi-dwarf I orchard, $6,889.73, greater than the ANPV of the Semi-dwarf II orchard, $6,364.57. Also, the ANPV increased substantially for each orchard for the direct forms of marketing over the Wholesale alternative. For example, the ANPV's for the Standard and Dwarf orchards in the Wholesale market were $-2,227.32 and $15,130.36, respectively. When the same orchards were operated in the Pick-Your-Own market their ANPV's were $5,535.77 and $47,940.66, respectively.

Higher ANPV's were associated in the early years with the Semi-dwarf and Dwarf orchards for each market and for the Farmers and Pick-Your-Own markets for each orchard. In the tenth year under the Farmers market alternative, the Standard orchard had an ANPV of $-3,080.66 while the Semi-dwarf I, II, and Dwarf orchards had ANPV's of $8.187.42, $11,103.72, and $21,052.02, respectively. Also, the Dwarf orchard in the fifth year had ANPV's in the Farmers and Pick-Your-Own market alternatives of $384.97 and $1,929.05, respectively, while in the Wholesale market the ANPV was $-3,400.37.

The interest elasticity coefficients developed from the ANPV's at discount rates ranging from 3% to 63% indicated the higher density, more intensive orchards and the direct forms of marketing were less vulnerable to changes in the interest rate. For example, between the discount rates of 12% and 15% the respective interest elasticities of the Standard and Dwarf orchards under the Farmers market alternative were 1.72 and 1.06. The interest elasticities for the Dwarf orchard between the discount rates of 12% and 15% were 1.53 for the Wholesale, 1.30 for the Farmers, and 1.28 for the Pick-Your-Own markets.

Internal Rate of Return

The Standard orchard had substantially lower internal rates of return (IRR's) in all markets when compared to the other orchard systems. The IRR's increased as the complexity and intensiveness of the orchards increased from the Standard to the Dwarf. The IRR's of the Standard and Dwarf orchards in the Wholesale market were 9.8 and 36.5, respectively.

For the marketing alternatives, the IRR for Pick-Your-Own was greater than Farmers which was in turn greater than Wholesale for each orchard. The IRR's for the Standard orchard in the Pick-Your-Own, Farmers, Wholesale markets were 28.0, 24.9, and 9.8, respectively.

Annuity

Generally the annuity values increased as the complexity and intensiveness of the orchards increased from the Standard to the Dwarf. For example, the respective annuity values for the Standard and Dwarf orchards in the Wholesale market were \$-298.19 and \$2,025.63. For the marketing alternatives, the annuity values for Pick-Your-Own was greater than the Farmers which was in turn greater than the Wholesale across all orchards. The Dwarf orchard had annuity values of

$6,418.24, $5,279.28, and $2,025.63 for the Pick-Your-Own, Farmers, and Wholesale markets, respectively. Once again the Semi-dwarf I was ranked above the Semi-dwarf II orchard in the Wholesale market with annuity values of $922.39 and $852.08, respectively.

The annuity values from each apple orchard-market combination were compared against selected alternative agricultural enterprises on a per-acre and per-hour-of-labor basis. Generally the annuity values from the apple orchard-marketing combinations were competitive when compared to the net returns from the alternative enterprises. For example, the Semi-dwarf I orchard under the Pick-Your-Own market had net returns per hour of labor in annuity terms of $35.46, slightly less than for broccoli in the fresh market at $36.36 or grain corn in the wholesale market at $36.83. However, the differences became more apparent when the net returns per acre were observed. The annuity value per acre for the Semi-dwarf I orchard in the Pick-Your-Own market was $3,428.99 while the net returns per acre for broccoli and grain corn were $1,325.23 and $64.46, respectively.

Using annuity values as a criterion of evaluation and comparison helped to address some of the potential criticism regarding the longer life span of a standard orchard over other orchard systems and the possible shorter life span of a dwarf orchard in relation to other orchard systems. The use of annuity values still continued to rank the Standard orchard across all markets on the bottom after the life of the orchard had been extended to 30 years. The annuity value of the Standard orchard in the Wholesale market remained negative at $-209.05 with slight improvements in the annuity values in the direct markets. The annuity values of the Dwarf orchard across all markets at 10 years was greater than the annuity values of the other orchard-marketing combinations at their assumed life span. For example, under the Farmers market alternative the Dwarf orchard at 10 years had an annuity value of $3,725.87 while the Semi-dwarf I and II orchards at 20 years had annuity values of $2,802.34 and $3,048.04, respectively, and the Standard orchard at 30 years had an annuity value of $652.30.

Rank Order Based on the Economic Criteria

Tables 39-40 provide a summary of the comparisons of the 12 different orchard-marketing systems using the six comparison criteria. The Standard orchard was consistently ranked as having the least earning potential by each of the economic criteria for comparison as shown in Table 39. Likewise, the Dwarf orchard was consistently ranked as having the greatest earning potential of the orchard systems studied. The poor performance of the Standard orchard was attributable to lower yields and delayed production. The reverse was true for the Dwarf orchard. Its good performance was due to higher yields and earlier production.

The two semi-dwarf orchards gave mixed results as to which of the two had the greatest earning potential. However, most of the criteria used for comparison indicated the Semi-dwarf II orchard had more earning potential than the Semi-dwarf I orchard. Importantly,

Table 39. Ranking[a] of four orchard technologies in each of three marketing alternatives using six economic criteria.

Analytical Criteria	Markets: Wholesale				Farmers				Pick-Your-Own			
	Std.[b]	SDI[c]	SDII[d]	D[e]	Std.[b]	SDI[c]	SDII[d]	D[e]	Std.[b]	SDI[c]	SDII[d]	D[e]
Undiscounted Returns:												
Acre	D	B	C	A[e]	D	C	B	A	D	C	B	A
Bushel	D	B	C	A	D	B	C	A	D	B	C	A
Breakeven:												
Year	D	C	B	A	D	C	B	A	D	C	B	A
Acre	D	C	B	A	D	B	C	A	D	B	C	A
B/C[f]	D	B	C	A	D	B	C	A	D	B	C	A
ANPV[g]:												
20th Year	D	B	C	A	D	C	B	A	D	C	B	A
10th Year	D	C	B	A	D	C	B	A	D	C	B	A
Interest Elasticity	D	C	B	A	D	C	B	A	D	C	B	A
IRR[h]:	D	C	B	A	D	C	B	A	D	C	B	A
Annuity:	D	B	C	A	D	C	B	A	D	C	B	A

[a]Ranking with "A" being the highest and "D" being the lowest.

[b]Standard orchard.

Table 39. (Continued)

[c]Semi-dwarf I orchard.

[d]Semi-dwarf II orchard.

[e]Dwarf orchard.

[f]Benefit-Cost.

[g]Accumulated Net Present Value.

[h]Internal Rate of Return.

Table 40. Ranking[a] of three marketing alternatives in each of four orchard technologies using six economic criteria.

Analytical Criteria	Standard			Semi-dwarf I			Semi-dwarf II			Dwarf		
	W[b]	FM[c]	PYO[d]	W[b]	FM[c]	PYO[d]	W[b]	FM[c]	PYO[d]	W[b]	FM[c]	PYO[d]
Undiscounted Returns:												
Acre	C	B	A[d]	C	B	A	C	B	A	C	B	A
Bushel	C	B	A	C	B	A	C	B	A	C	B	A
Breakeven:												
Year	C	B	A	C	B	A	C	B	A	C	B	A
Acre	C	B	A	C	B	A	C	B	A	C	B	A
B/C[e] Ratio:	C	B	A	C	B	A	C	B	A	C	B	A
ANPV[f]:												
20th Year	C	B	A	C	B	A	C	B	A	C	B	A
10th Year	C	B	A	C	B	A	C	B	A	C	B	A
Interest Elasticity	C	B	A	C	B	A	C	B	A	C	B	A
IRR[g]:	C	B	A	C	B	A	C	B	A	C	B	A
Annuity:	C	B	A	C	B	A	C	B	A	C	B	A

Orchard Systems: Standard, Semi-dwarf I, Semi-dwarf II, Dwarf.

[a]Ranking with "A" being the highest and "C" being the lowest.

[b]Wholesale market.

Table 40. (Continued)

[c]Farmers market.

[d]Pick-Your-Own market.

[e]Benefit-Cost.

[f]Accumulated Net Present Value.

[g]Internal Rate of Return.

the differences revealed by the criteria used for comparison between the two Semi-dwarf orchards were relatively small in most cases as Shown in the tables of Chapter III. Even the differences between the Semi-dwarf and Dwarf orchards were relatively small when compared to the Standard orchard. However, both of the Semi-dwarf orchards indicated greater earning potential than the Standard orchard and less earning potential than the Dwarf orchard across all markets.

The Wholesale market was consistently ranked as having the least earning potential of the three markets studied as shown in Table 40. The Pick-Your-Own market was consistently ranked as having the greatest earning potential and was followed closely by the Farmers market.

Across all orchard systems the discounted total cost for the Wholesale and Farmers market were very close to each other. However, because of the assumed higher price per bushel and the juice operation in the Farmers market, the discounted returns were much higher. This resulted in the Farmers market having substantially greater net returns than the Wholesale market.

The Pick-Your-Own market ranked first even though its discounted returns were less than the Farmers market. The difference resulted from the discounted cost being substantially less which led to its net returns per acre being greater than the other markets.

The Standard orchard and the Wholesale market were the most sensitive to economic changes. The Dwarf orchard and the Pick-Your-Own market were the least sensitive to a change in the economy. The

Standard orchard indicated positive earning potential only with the direct forms of marketing. The interest rate would have had to have fallen to about 10% before it would have been profitable for the Standard orchard in the Wholesale market.

2. CONCLUSIONS AND IMPLICATIONS

The Standard orchard should only be considered by Tennessee growers wishing to direct market a variety of apples not available on dwarfing rootstock. If potential producers experience conditions similar to the ones of this study and their objective function is to maximize profits, they should consider a Semi-dwarf or Dwarf orchard.

A potential grower should be aware that even though the economic risks seem to decrease as the complexity and intensiveness of the orchard changes from the Standard to the Dwarf orchard, indications are that the technological risks seem to increase. Therefore, better management is likely needed for higher density orchards. The Semi-dwarf orchards would be more adaptable to a wider spectrum of environmental conditions and existing management skill levels than the Dwarf orchard. Such an orchard would be good for a grower not faced with a land or capital constraint.

The Dwarf orchard should be considered as an alternative by most growers, especially those with limited orchard sites. Starting small would permit a grower to gain the necessary management experience to expand and still provide an excellent income on a per-acre basis. The early returns would relieve the strain of the capital investment.

The smaller dwarf trees are much easier to harvest. Women, children, and the elderly could harvest the apples without ladders, thereby providing employment to a segment of the population often underutilized. The control of Pick-Your-Own pickers is much easier with a trellised Dwarf orchard. The trellis can act as a barrier thereby isolating those sections to be harvested.

Under the assumed conditions of this study and with the subsequent analysis of the orchard-marketing systems, one conclusion is that the earning potential of an apple orchard is dependent on the manner in which apples are marketed, all other things being the same. The key to the relative stability of the higher density orchards and the direct forms of marketing lies in their earlier and heavier yields and their greater returns above variable cost. Therefore, the higher earning potential and lower sensitivity of higher density orchards and direct marketing become more apparent during periods of economic hardship.

Even though the direct forms of marketing indicated greater earning potential for each orchard, the grower needs to be aware of certain limitations. For example, the Farmers and especially the Pick-Your-Own markets are limited by local demand.

The Wholesale market, though indicating less earning potential, would not be limited by this particular variable. This situation suggests the possibility of utilizing more than one marketing alternative. For example, during the early productive life of an orchard, the Pick-Your-Own market could be utilized until production became greater than the local population could absorb. Hence, utilizing multiple marketing alternatives over the life of the orchard would permit an orchard to be more profitable in the early years and as production increased, some or all of the production could be moved into the Farmers and/or Wholesale market.

A producer operating under the conditions of the Farmers market as outlined in this study would be able to divert production into the Wholesale market. This is consistent with the concept of profit maximization. From a theoretical perspective, a producer will shift quantities of production between marketing alternatives until the marginal revenue from the last bushel sold in each market is equal. The result of multiple markets will be an increase in total revenue because of the movement of apples from a market with lower marginal revenue to one with higher marginal revenue. Therefore, a grower will gear production to a level that equates the marginal costs and marginal revenues in each alternative market (33).

The implications for further research are numerous. The high estimated net returns from the Dwarf orchard systems indicate the potential advantages of further experimentation by pomologists and fruit growers. This type of study could be conducted on other specialty crops. These detailed budgets could be expanded to encompass true capital budgeting for a specific sized orchard.

One of the next logical steps would be to utilize these enterprise budgets in total farm planning. Also, the budgets could be incorporated into a dynamic programming model used to determine the type and timing of an orchard systems replacement schedule.

The spreadsheets could aid extension personnel in helping potential and existing growers evaluate an orchard-market system or some combination of systems for their particular individual situations. Hopefully, such information would help growers make better economic decisions in the production and marketing of apples.

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APPENDIXES

APPENDIX A

DATA FOR THE STANDARD ORCHARD UNDER THREE MARKETING ALTERNATIVES

PREHARVEST
POWER AND LABOR REQUIREMENTS PER ACRE

YEAR	ROOTSTOCK		SPACING	TREES/AC.	
ELEVEN+	STANDARD		30' X 25'	58	
MONTH	TYPE OF OPERATION	TIMES	EQUIPMENT USED	MACH./HRS.	LABOR HRS.
JAN.-FEB.	HERBICIDE		SPRAYER W/BOOM	.23	.29
	PRUNE & MOVE BRUSH		PNEUMATIC PRUNERS	10.00	12.50
	CHOP BRUSH		MOWER/CHOPPER	.49	.61
	FERTILIZE TREES		SPREADER	.22	.28
			TRACTOR*		
MARCH	HERBICIDE		SPRAYER W/BOOM	.23	.29
	FERTILIZE SOD		SPREADER	.11	.14
	LIME		SPREADER	.02	.03
	INSECTICIDE & FUNGICIDE		AIR BLAST SPRAYER	.15	.19
	IRRIGATION	4	FROST	20.00	4.00
APRIL	INSECTICIDE & FUNGICIDE	5	AIR BLAST SPRAYER	.75	.94
	MOW		MOWER/CHOPPER	.49	.61
	GROWTH REGULATOR		AIR BLAST SPRAYER	.08	.09
MAY	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	.45	.56
	PRUNE & TRAIN		HAND		4.00
	CHOP BRUSH		MOWER/CHOPPER	.49	.61
	CHEMICAL THIN		AIR BLAST SPRAYER	.05	.06
	GROWTH REGULATOR		AIR BLAST SPRAYER	.15	.19
JUNE	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	.45	.56
	MOW		MOWER/CHOPPER	.49	.61
	PRUNE & TRAIN		HAND		4.00
	CHOP BRUSH		MOWER/CHOPPER	.49	.61
	SUCKER CONTROL		HAND		1.00
JULY	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.30	.38
	IRRIGATION	2	DRIP	10.00	2.00
	GROWTH REGULATOR		AIR BLAST SPRAYER	.08	.09
AUGUST	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.30	.38
	MOW		MOWER/CHOPPER	.49	.61
	IRRIGATION	2	DRIP	10.00	2.00
	STOP DROP		AIR BLAST SPRAYER	.15	.19
SEPT.	HARVEST**				
	MONITOR VOLE BAIT STATION		HAND		.25
OCT.	HERBICIDE		SPRAYER W/BOOM	.23	.29
	MONITOR VOLE BAIT STATION		HAND		.25
NOV.	BAIT VOLE STATIONS		HAND		1.00
DEC.	MONITOR VOLE BAIT STATION		HAND		.25
	PRUNE & MOVE BRUSH		PNEUMATIC PRUNERS	10.00	12.50
	CHOP BRUSH		MOWER/CHOPPER	.49	.61

*TRACTOR HOURS ARE THE SUM OF THE TRACTOR IMPLEMENT HOURS.
**ALL HARVEST EQUIPMENT AND LABOR ARE A FUNCTION OF SALES OR PRODUCTION AND ARE NOT INCLUDED HERE.

YEAR	TREE	SPACING	DENSITY													
ELEVEN*	STANDARD	30' X 25'	50/AC.													
CATEGORY:	UNIT	PRICE	RECOM. QUAN.	1 JAN	2 FEB	3 MARCH	4 APRIL	5 MAY	6 JUNE	7 JULY	8 AUG	9 SEPT	10 OCT	11 NOV	12 DEC	TOTAL
PRODUCTION:	BU.		700.00													
FRESH:																
72'S (QUAN.)	BU.		105.00									105.00				105.00
WHOLESALE	$/BU.	11.50										1207.50				1207.50
(QUAN.)	BU.		105.00									42.00	21.00	21.00	21.00	105.00
FARMER'S MKT.	$/BU.	13.50										567.00	283.50	283.50	283.50	1417.50
80'S (QUAN.)	BU.		105.00									105.00				105.00
WHOLESALE	$/BU.	11.00										1155.00				1155.00
(QUAN.)	BU.		105.00									42.00	21.00	21.00	21.00	105.00
FARMER'S MKT.	$/BU.	13.00										546.00	273.00	273.00	273.00	1365.00
88'S (QUAN.)	BU.		105.00									105.00				105.00
WHOLESALE	$/BU.	10.50										1102.50				1102.50
(QUAN.)	BU.		105.00									42.00	21.00	21.00	21.00	105.00
FARMER'S MKT.	$/BU.	12.50										525.00	262.50	262.50	262.50	1312.50
100'S (QUAN.)	BU.		105.00									105.00				105.00
WHOLESALE	$/BU.	10.00										1050.00				1050.00
(QUAN.)	BU.		105.00									42.00	21.00	21.00	21.00	105.00
FARMER'S MKT.	$/BU.	12.00										504.00	252.00	252.00	252.00	1260.00
113'S (QUAN.)	BU.		52.50									52.50				52.50
WHOLESALE	$/BU.	9.50										498.75				498.75
(QUAN.)	BU.		52.50									21.00	10.50	10.50	10.50	52.50
FARMER'S MKT.	$/BU.	11.50										241.50	120.75	120.75	120.75	603.75
125'S (QUAN.)	BU.		52.50									52.50				52.50
WHOLESALE	$/BU.	9.00										472.50				472.50
(QUAN.)	BU.		52.50									21.00	10.50	10.50	10.50	52.50
FARMER'S MKT.	$/BU.	11.00										231.00	115.50	115.50	115.50	577.50
12/3 LB. BAGS	BU.		35.00									35.00				35.00
WHOLESALE	$/BU.	7.75										271.25				271.25
QUANITY	BU.		700.00									700.00				700.00
PICK YOUR OWN	$/BU.	11.00										7700.00				7700.00
OTHER: (QUAN.)	BU.															.00
TOTAL FRESH QUANITY:																
WHOLESALE	BU.		560.00									560.00	.00	.00	.00	560.00
FARMER'S MKT.	BU.		525.00									210.00	105.00	105.00	105.00	525.00
PICK YOUR OWN	BU.		700.00									700.00	.00	.00	.00	700.00
TOTAL FRESH RECEIPTS:																
WHOLESALE												5757.50				5757.50
FARMER'S MKT.												2614.50	1307.25	1307.25	1307.25	6536.25
PICK YOUR OWN												7700.00				7700.00
PROCESSED:																

CULLS (QUAN.)	BU.		140.00									140.00				140.00
WHOLESALE	$/BU.	2.75										385.00				385.00
CULLS (QUAN.)	BU.		175.00									175.00				175.00
GAL./BU.			3.50													
JUICE (QUAN.)	GAL.		612.50									245.00	122.50	122.50	122.50	612.50
FARMER'S MKT.	$/GAL.	3.50										857.50	428.75	428.75	428.75	2143.75
TOTAL PROC. QUANITY:																
WHOLESALE	BU.											140.00				140.00
FARMER'S MKT.	BU.											175.00				175.00
TOTAL PROC. RECEIPTS:																
WHOLESALE												385.00				385.00
FARMER'S MKT.												857.50	428.75	428.75	428.75	2143.75
TOTAL QUANITY	BU.		700.00									700.00				700.00
TOTAL RECEIPTS:																
WHOLESALE												6142.50				6142.50
FARMER'S MKT.												3472.00	1736.00	1736.00	1736.00	8680.00
PICK YOUR OWN												7700.00				7700.00
OPERATING INPUTS:																
PREHARVEST COSTS:																
TREES	EACH	4.75														.00
SUBSOIL, CUSTOM	HR.	41.44														.00
BIG HOLES, CUSTOM	EACH	.30														.00
TREE GUARDS	EACH	.27														.00
ROOF SHINGLES	EACH	1.20														.00
SPREADERS	EACH															.00
NAILS	LBS.															.00
FERTILIZER:																
LIME	TON	9.00	.40			3.60										3.60
AMMONIUM NITRATE	CWT.	10.00														.00
CALCIUM NITRATE	CWT.	10.50			31.50											31.50
SODIUM NITRATE	CWT.	12.80														.00
10-10-10	CWT.	7.40	1.50			11.10										11.10
UREA, 46%	CWT.	11.40														.00
OTHER:																.00
TOTAL FERTILIZER				.00	31.50	14.70	.00	.00	.00	.00	.00	.00	.00	.00	.00	46.20
INSECTICIDE:																
AMBUSH	OZ.	1.09														.00
CYGON (DEFEND), 2.7 EC	OZ.	1.56														.00
DEMETON (SYSTOX)	OZ.	.47														.00
ETHION																.00
GUTHION, 50WP	LBS.	6.10							51.24	34.16	34.16					119.56
IMIDAN (PROLATE), 50WP	LBS.	2.80						39.23								39.23
KELTHANE, 35WP	LBS.	3.98														.00
LORSBAN, 4EC	PTS.	5.58														.00
MALATHION, 25WP	LBS.	1.49														.00
METHOXYCHLOR, 24 EC	PTS.	2.13														.00
SUBTOTAL				.00	.00	.00	.00	39.23	51.24	34.16	34.16	.00	.00	.00	00	
OIL, SUPERIOR	GAL.	5.40				75.60										75.60

OMITE, 30WP	LBS.	3.75												.00
PARATHION, 15WP	LBS.	.90				18.29								18.29
PHOSALONE	PTS.	3.58												.00
PLICTRAN, 50WP	LBS.	20.63												.00
POUNCE, 3.3 EC	OZ.	1.32												.00
PYDRIN, 2.4 EC	OZ.	.99												.00
SEVIN, 50WP	LBS.	2.33												.00
THIODAN, 50WP	LBS.	5.10												.00
OTHER:														.00
TOTAL INSECTICIDE			.00	.00	75.60	18.29	39.23	51.24	34.16	34.16	.00	.00	.00	.00	252.67
FUNGICIDE:														
BAYLETON, 50WP	OZ.	3.38												.00
BENLATE (BENOMYL), 50WP	OZ.	.74												.00
CAPTAN, 50WP	LBS.	1.55						43.38	28.92	28.92					101.23
CYPREX (DODINE), 65WP	LBS.	5.88												.00
DIFOLATAN	PTS.	3.34			233.77										233.77
DIKAR, 76.6WP	LBS.	2.00				37.32	55.98								93.30
FERBAM, 76WP	LBS.	2.47												.00
FUNGINEX	PTS.	9.28												.00
GLYODIN	PTS.	2.20												.00
KARATHANE, MILDEX, 25WP	LBS.	4.05												.00
SUBTOTAL			.00	.00	233.77	37.32	55.98	43.38	28.92	28.92	.00	.00	.00	.00	
MANCOZEB														.00
MANEB, 80WP	LBS.	2.10												.00
PHALTAN (FOLPET), 50WP	LBS.	2.16												.00
POLYRAM, 80WP	LBS.	1.83												.00
RIDOMIL	OZ.	.91												.00
STREPTOMYCIN, 21.2WP	LBS.	7.02				49.07									49.07
ZINEB, 75WP	LBS.	1.02												.00
OTHER:														.00
TOTAL FUNGICIDE			.00	.00	233.77	86.39	55.98	43.38	28.92	28.92	.00	.00	.00	.00	477.37
HERBICIDE:														
DALAPON (DOWPON M) 85SP	LBS.	2.11												.00
DICHLOBENIL (CASORON) 50WP	LBS.	1.23												.00
FUSILADE 4E	PTS.	35.46												.00
KARMEX 80WP	LBS.	4.25												.00
PARAQUAT CL	QTS.	10.70			1.39							1.39			2.78
PRINCEP 80WP	LBS.	3.18			1.05							1.05			2.10
ROUNDUP	OZS.	.65												.00
SIMAZINE	QTS.	3.46												.00
SOILCAM 80WP	LBS.	11.83												.00
SURFLAN 75WP	LBS.	9.78	3.42												3.42
TERBACIL (SINBAR) 80WP	LBS.	19.80												.00
OTHER:														.00
TOTAL HERBICIDE			3.42	.00	2.44	.00	.00	.00	.00	.00	.00	2.44	.00	.00	8.30
GROWTH REGULATORS:														
ALAR 85WP	LBS.	21.00					98.07		73.50						171.57
ETHERAL	PTS.	7.01												.00
NAA (KLING-TITE)	PTS.	4.75								.95					.95
NAD	OZ.													.00
PROMALIN	PTS.	43.45				101.24									101.24
SEVIN, 50WP	LBS.	2.33					5.44								5.44
NAA (TREE HOLD)	GAL.	42.90						2.54							2.54

TOTAL GROWTH REGULATORS				.00	.00	.00	101.24	103.51	2.54	73.50	.95	.00	.00	.00	.00	281.73
SURFACTANT:																
ORTHO X 77	PTS.	1.75				.12							.12			.25
OTHER:																.00
				------	------	------	------	------	------	------	------	------	------	------	------	------
TOTAL SURFACTANT				.00	.00	.12	.00	.00	.00	.00	.00	.00	.12	.00	.00	.25
RODENTICIDE:																
ENDRIN	PTS.															.00
RAMIK	LBS.															.00
ROZOL (GR. SPRAY)	PTS.															.00
ROZOL (BAIT)	LBS.															.00
ZP RODENT BAIT AG	LBS.	1.91												11.46		11.46
OTHER:																.00
				------	------	------	------	------	------	------	------	------	------	------	------	------
TOTAL RODENTICIDE				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	11.46	.00	11.46
BEEHIVE, RENTED	ACRE	10.00	1.00				10.00									10.00
IRRIGATION:																
VARIABLE EQUIPMENT COST:																
IRRIGATION, FROST	HRS.					20.00										20.00
	$/HR.	2.68		.00	.00	53.54	.00	.00	.00	.00	.00	.00	.00	.00	.00	53.54
IRRIGATION, DRIP	HRS.									10.00	10.00					20.00
	$/HR.	2.66		.00	.00	.00	.00	.00	.00	26.64	26.64	.00	.00	.00	.00	53.29
OTHER:																.00
				------	------	------	------	------	------	------	------	------	------	------	------	------
TOTAL VAR. EQUIP. COST				.00	.00	53.54	.00	.00	.00	26.64	26.64	.00	.00	.00	.00	106.83
LABOR:																
MACHINE	HRS.			.00	.00	4.00	.00	.00	.00	2.00	2.00	.00	.00	.00	.00	8.00
WAGE	$/HR.	4.43		.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
HAND	HRS.															.00
WAGE	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SUPERVISION	HRS.															.00
WAGE	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
				------	------	------	------	------	------	------	------	------	------	------	------	------
TOTAL LABOR				.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
TOTAL IRRIGATION				.00	.00	71.25	.00	.00	.00	35.50	35.50	.00	.00	.00	.00	142.24
MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
MOWER	T.O.		.49				.49		.49		.49					1.47
BRUSH CHOPPER	T.O.		.98		.49			.49	.49						.49	1.96
AIR BLAST SPRAYER	T.O.		.15			.15	.92	.66	.46	.46	.36					3.00
SPRAYER W/BOOM	T.O.		.23	.23		.23							.23			.69
SPREADER	T.O.		.11		.22	.13										.35
PNEUMATIC PRUNERS	T.O.				10.00										10.00	20.00
OTHER:																.00
TRUCK, PU	HRS.															.00
TRACTOR, 60HP	HRS.			.23	10.71	.51	1.41	1.15	1.44	.46	.85	.00	.23	.00	10.49	27.47
OTHER:																.00
VARIABLE MACHINE COST:		($/HR.)														DOL.
MOWER	ACRE	9.39		.00	.00	.00	4.59	.00	4.59	.00	4.59	.00	.00	.00	.00	13.77
BRUSH CHOPPER	ACRE	9.39		.00	4.59	.00	.00	4.59	4.59	.00	.00	.00	.00	.00	4.59	18.36
AIR BLAST SPRAYER	ACRE	7.77		.00	.00	1.19	7.12	5.14	3.56	3.56	2.77	.00	.00	.00	.00	23.33
SPRAYER W/BOOM	ACRE	1.21		.28	.00	.28	.00	.00	.00	.00	.00	.00	.28	.00	.00	.83

SPREADER	ACRE	.65		.00	.14	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.23
PNEUMATIC PRUNERS	ACRE	.85		.00	8.45	.00	.00	.00	.00	.00	.00	.00	.00	.00	8.45	16.91
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCK, PU	ACRE	5.01		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRACTOR, 60HP	ACRE	5.10		1.17	54.62	2.62	7.17	5.87	7.32	2.34	4.31	.00	1.17	.00	53.49	140.08
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL VARIABLE MACHINE COST:				1.45	67.80	4.17	18.88	15.60	20.06	5.90	11.67	.00	1.45	.00	66.54	213.51
FIELD LABOR:																
MACHINERY	HRS.			.29	13.39	.64	1.76	1.44	1.80	.57	1.06	.00	.29	.00	13.11	34.33
WAGES	$/HR.	4.43		1.27	59.25	2.84	7.78	6.37	7.95	2.54	4.68	.00	1.27	.00	58.03	151.96
HAND	HRS.							4.00	5.00			.25	.25	1.00	.25	10.75
WAGES	$/HR.	4.43		.00	.00	.00	.00	17.70	22.13	.00	.00	1.11	1.11	4.43	1.11	47.58
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL FIELD LABOR				1.27	59.25	2.84	7.78	24.07	30.08	2.54	4.68	1.11	2.37	4.43	59.14	199.54
TOTAL LABOR COST				1.27	59.25	20.55	7.78	24.07	30.08	11.39	13.53	1.11	2.37	4.43	59.14	234.95
OTHER:																.00
OTHER:																.00
SUBTOTAL				6.14	158.55	404.89	242.57	238.39	147.30	180.51	115.88	1.11	6.38	15.89	125.67	1643.27
INTEREST, OPERATING CAPITAL	ACRE	.12		.06	1.65	5.71	8.20	10.66	12.24	14.17	15.47	.00	.06	.22	1.48	69.93
TOTAL PREHARVEST				6.20	160.20	410.60	250.76	249.05	159.54	194.68	131.35	1.11	6.45	16.11	127.16	1713.20
HARVEST & MARKETING COST FOR WHOLESALE, FARMER'S MARKET, AND PICK YOUR OWN OPERATIONS:																
WHOLESALE:																
CUSTOM HARVEST	$/BU.	.60	700.00									420.00				420.00
CUSTOM PACK	$/BU.	3.50	560.00									1960.00				1960.00
BROKERS FEE	$/BU.	.25	560.00									140.00				140.00
VARIABLE EQUIPMENT COST:																
BINS	EACH	.17										.78				.78
LADDERS	HR.	.02										.14				.14
PICKING SACKS	HR.	.01										.10				.10
TOTAL VAR. EQUIP. COST												1.03				1.03
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.		7.00									7.00				7.00
OTHER:																.00
TRUCK, 2 TON	HRS.											3.68				3.68
TRACTOR, 60HP	HRS.											7.00				7.00
OTHER:																.00
VARIABLE FIELD MACHINE COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										7.80				7.80
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										38.23				38.23
TRACTOR, 60HP	HR.	5.10										35.70				35.70

OTHER:											.00				.00
TOTAL VAR. FIELD MACH. COST											81.72				81.72
LABOR:															
MACHINERY	HRS.										13.34				13.34
WAGES	$/HR.	4.43									59.06				59.06
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
TOTAL LABOR COST											59.06				59.06
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	2661.81	.00	.00	.00	2661.81
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	2661.81	.00	.00	.00	2661.81
TOTAL INTEREST, OPERATING CAPITAL			.06	1.65	5.71	8.20	10.66	12.24	14.17	15.47	.00	.06	.22	1.48	69.93
TOTAL OPERATING INPUTS			6.20	160.20	410.60	250.76	249.05	159.54	194.68	131.35	2662.92	6.45	16.11	127.16	4375.01
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															1767.49
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															1719.39
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													172.97
TRUCK, PU	DOL./HR.	4.16													.00
TRUCK, 2 TON	DOL./HR.	11.37													41.80
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./AC.	13.44													268.82
DRIP	DOL./AC.	2.96													59.13
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													62.06
AIR BLAST SPRAYER	DOL./HR.	13.03													39.14
SPRAYER W/BOOM	DOL./HR.	3.27													2.25
SPREADER	DOL./HR.	4.68													1.65
PNEUMATIC PRUNERS	DOL./HR.	2.08													41.63
FRONT END FORK LIFT	DOL./HR.	4.69													32.85
BINS	DOL/150 BU	11.94													55.74
LADDERS	DOL./HR.	.11													.75
PICKING SACKS	DOL./HR.	.08													.54
TOTAL FIXED COST															779.33

RETURN TO OVERHEAD AND MANAGEMENT								940.06
FARMER'S MARKET:								
CUSTOM HARVEST	$/BU.	.60	700.00	420.00				420.00
PACKING CHARGE:								
LABOR:								
MACHINERY	HRS.			85.31				85.31
WAGES	$/HR.	4.43		377.59				377.59
HAND	HRS.			12.25				12.25
WAGES	$/HR.	4.43		54.22				54.22
SUPERVISION	HRS							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				431.81				431.81
VARIABLE EQUIPMENT COST:								
BINS	EACH	.17		.78				.78
LADDERS	HR.	.02		.14				.14
PICKING SACKS	HR.	.01		.10				.10
GRADER	HR.	2.83		19.80				19.80
BOX W/TRAYS	BU.	.71		372.75				372.75
FORKLIFT	HR.	3.40		17.85				17.85
COLD STORAGE	BU./MO.	.02		4.79	2.39	2.39	2.39	11.97
TOTAL VAR. EQUIP. COST				416.21	2.39	2.39	2.39	423.39
TOTAL PACKING CHARGE.	ACRE			848.02	2.39	2.39	2.39	855.20
TOTAL PACKING CHARGE	BU.							1.63
CIDER JUICING CHARGE:								
LABOR:								
MACHINERY	HRS.			7.66				7.66
WAGES	$/HR.	4.43		33.89				33.89
HAND	HRS.			1.28				1.28
WAGES	$/HR.	4.43		5.65				5.65
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				39.53				39.53
VARIABLE EQUIPMENT COST:								
PRESS	HR.	1.85		7.56				7.56
JUG FILLER	HR.	.07		.07				.07
JUGS & LABELS	GAL.	.16		98.00				98.00
FORKLIFT	HR.	3.40		5.95				5.95
REFRIGERATED BULK TANK	GAL.	.02		11.24				11.24
COLD STORAGE	GAL./MO.	.01		1.60	.80	.80	.80	3.99
TOTAL VAR. EQUIP. COST				124.42	.80	.80	.80	126.81
TOTAL CIDER JUICING CHARGE	ACRE			163.96	.80	.80	.80	166.35
TOTAL CIDER JUICING CHARGE	BU.							.27
MARKETING CHARGE:								
LABOR:								
MACHINERY	HRS.			2.00	2.00	2.00	2.00	8.00

WAGES	$/HR.	4.43									8.85	8.85	8.85	8.85	35.41
HAND	HRS.										16.00	16.00	16.00	16.00	64.00
WAGES	$/HR.	4.43									70.82	70.82	70.82	70.82	283.26
SUPERVISION	HRS.														.00
WAGES	$/HR.	4.43									.00	.00	.00	.00	.00
TOTAL LABOR COST											79.67	79.67	79.67	79.67	318.67
VARIABLE EQUIPMENT COST:															
MARKET COOLER	HR.	.03									1.34	.67	.67	.67	3.35
TRUCK, 2 TON	HR.	10.40									20.80	20.80	20.80	20.80	83.20
TOTAL VAR. EQUIP. COST											22.14	21.47	21.47	21.47	86.55
TOTAL MARKETING CHARGE											101.81	101.14	101.14	101.14	405.22
FIELD MACHINERY:															
TIMES OVER/HRS. PER ACRE		(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.	7.00									7.00				49.00
OTHER:															.00
TRUCK, 2 TON	HRS.										3.68				3.68
TRACTOR, 60HP	HRS.										7.00				7.00
OTHER:															.00
VARIABLE FIELD MACH. COST:															DOL.
FRONT END FORK LIFT	HR.	1.11									7.80				7.80
OTHER:											.00				.00
TRUCK, 2 TON	HR.	10.40									38.23				38.23
TRACTOR, 60HP	HR.	5.10									35.70				35.70
OTHER:	HR.										.00				.00
TOTAL VAR. FIELD MACH. COST											81.72				81.72
FIELD LABOR:															
MACHINERY	HRS.										13.34				13.34
WAGES	$/HR.	4.43									59.06				59.06
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
TOTAL FIELD LABOR COST											59.06				59.06
TOTAL LABOR COST											610.07				610.07
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	1674.57	104.33	104.33	104.33	1987.56
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.04	2.10	3.16	6.30
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	1674.57	105.37	106.43	107.49	1993.86
TOTAL INTEREST, OPERATING CAPITAL			.06	1.65	5.71	8.20	10.66	12.24	14.17	15.47	.00	1.11	2.32	4.64	76.23
TOTAL OPERATING INPUTS			6.20	160.20	410.60	250.76	249.05	159.54	194.68	131.35	1675.67	111.82	122.54	234.65	3707.06
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT,															

OVERHEAD, AND MANAGEMENT				4972.94
LAND CHARGE	ACRE	48.10		48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD & MANAGEMENT				4924.84
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)				
TRACTOR, 60HP	DOL./HR.	5.02		172.97
TRUCK, PU	DOL./HR.	4.16		.00
TRUCK, 2 TON	DOL./HR.	11.37		132.79
TRELLIS	DOL./AC.			.00
IRRIGATION:				
FROST	DOL./AC.	13.44		268.82
DRIP	DOL./AC.	2.96		59.13
MOWER/BRUSH CHOPPER	DOL./HR.	18.14		62.06
AIR BLAST SPRAYER	DOL./HR.	13.03		39.14
SPRAYER W/BOOM	DOL./HR.	3.27		2.25
SPREADER	DOL./HR.	4.68		1.65
PNEUMATIC PRUNERS	DOL./HR.	2.08		41.63
FRONT END FORK LIFT	DOL./HR.	4.69		229.95
BINS	DOL/150 BU	11.94		55.74
LADDERS	DOL./HR.	.11		.75
PICKING SACKS	DOL./HR.	.08		.54
JUG FILLER	DOL./HR.	.45		.46
PALLETS	DOL/150 BU	.01		.04
GRADER	DOL./BU.	.02		12.72
HAND STAPLER	DOL./HR.	.03		.18
FORKLIFT	DOL./HR.	3.40		23.83
COLD STORAGE	DOL./BU.	.21		74.03
CIDER PRESS	DOL./GAL.	.03		16.12
REFRIGERATED BULK TANK	DOL./GAL.	.05		27.69
MARKET COOLER	DOL./GAL.	.04		24.14
MARKET SPACE	DOL./AC.	2% OF TOTAL SALES		173.60
TOTAL FIXED COST				1420.22
RETURN TO OVERHEAD AND MANAGEMENT				3504.62
PICK YOUR OWN MARKET:				
VARIABLE EQUIPMENT COST:				
1/2 BU. PICKING BAG	EACH	.28	392.00	392.00
OTHER:				.00
TOTAL VAR. EQUIP. COST			392.00	392.00
FIELD MACHINERY:				HRS
WAGON	HRS.		3.50	3.50
TRACTOR, 60HP	HRS.		3.50	3.50
OTHER:				.00
VARIABLE FIELD MACHINE COST:				DOL.
WAGON	HR.	.18	.61	.61
TRACTOR, 60HP	HR.	5.10	17.85	17.85
OTHER:			.00	.00

TOTAL VAR. FIELD MACH. COST											18.46				18.46
LABOR:															
MACHINERY	HRS.										3.50				3.50
WAGES	$/HR.	4.43									15.49				15.49
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.										50.00				50.00
WAGES	$/HR.	4.43									221.30				221.30
TOTAL LABOR COST											236.79				236.79
ADVERTISING	ACRE										154.00				154.00
LIABILITY INSURANCE	ACRE										192.50				192.50
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	993.75	.00	.00	.00	993.75
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	993.75	.00	.00	.00	993.75
TOTAL INTEREST, OPERATING CAPITAL			.06	1.65	5.71	8.20	10.66	12.24	14.17	15.47	.00	.06	.22	1.48	69.93
TOTAL OPERATING INPUTS			6.20	160.20	410.60	250.76	249.05	159.54	194.68	131.35	994.86	6.45	16.11	127.16	2706.95
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															4993.05
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															4944.95
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													155.41
TRUCK, PU	DOL./HR.	4.16													.00
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./AC.	13.44													268.82
DRIP	DOL./AC.	2.96													59.13
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													62.06
AIR BLAST SPRAYER	DOL./HR.	13.03													39.14
SPRAYER W/BOOM	DOL./HR.	3.27													2.25
SPREADER	DOL./HR.	4.68													1.65
PNEUMATIC PRUNERS	DOL./HR.	2.08													41.63
WAGON	DOL./HR.	6.05													21.17
FRUIT PICKER	DOL./AC.	45.32													45.32
CHECK FACILITIES	DOL./AC.	1.55													1.55
TOTAL FIXED COST															698.12
RETURN TO OVERHEAD AND MANAGEMENT															4246.82

TREE: STANDARD

SPACING: 30' X 25'

DENSITY: 58/AC.

CATEGORY:		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8
WHOLESALE:									
RETURN TO OVERHEAD AND MANAGEMENT		-877.24	-519.63	-554.02	-813.77	-571.15	-807.85	-817.47	-721.22
ACCUMULATED NET RETURNS		-877.24	-1396.87	-1950.89	-2764.66	-3335.81	-4143.66	-4961.13	-5682.35
DISCOUNT RATE	.12								
NET PRESENT VALUE		-783.25	-414.25	-394.34	-517.17	-324.09	-409.28	-369.78	-291.29
ACCUMULATED NET PRESENT VALUE		-783.25	-1197.50	-1591.84	-2109.00	-2433.09	-2842.37	-3212.15	-3503.44
INTERNAL RATE OF RETURN, %						<0			
VALUE OF ANNUITY		-877.24	-708.56	-662.76	-694.36	-674.96	-691.34	-703.84	-705.25
FARMER'S MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-877.24	-519.63	-554.02	-813.77	-745.43	-728.73	-578.57	-211.09
ACCUMULATED NET RETURNS		-877.24	-1396.87	-1950.89	-2764.66	-3510.09	-4238.82	-4817.39	-5028.48
DISCOUNT RATE	.12								
NET PRESENT VALUE		-783.25	-414.25	-394.34	-517.17	-422.98	-369.20	-261.72	-85.26
ACCUMULATED NET PRESENT VALUE		-783.25	-1197.50	-1591.84	-2109.00	-2531.98	-2901.18	-3162.89	-3248.15
INTERNAL RATE OF RETURN, %						<0			
VALUE OF ANNUITY		-877.24	-708.56	-662.76	-694.36	-702.40	-705.64	-693.05	-653.86
PICK YOUR OWN MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-877.24	-519.63	-554.02	-813.77	-456.29	-412.10	-242.98	159.70
ACCUMULATED NET RETURNS		-877.24	-1396.87	-1950.89	-2764.66	-3220.95	-3633.05	-3876.03	-3716.33
DISCOUNT RATE	.12								
NET PRESENT VALUE		-783.25	-414.25	-394.34	-517.17	-258.91	-208.78	-109.91	64.50
ACCUMULATED NET PRESENT VALUE		-783.25	-1197.50	-1591.84	-2109.00	-2367.91	-2576.70	-2686.61	-2622.11
INTERNAL RATE OF RETURN, %						<0			
VALUE OF ANNUITY		-877.24	-708.56	-662.76	-694.36	-656.88	-626.72	-588.68	-527.84

YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
-656.13	-543.18	927.66	927.66	927.66	927.66	927.66	927.66	927.66	927.66	927.66	927.66
-6338.48	-6881.66	-5954.00	-5026.34	-4098.68	-3171.02	-2243.36	-1315.70	-388.04	539.62	1467.28	2394.94
-236.61	-174.89	266.68	238.11	212.60	189.82	169.48	151.32	135.11	120.63	107.71	96.17
-3740.05	-3914.94	-3648.26	-3410.15	-3197.55	-3007.74	-2838.26	-2686.93	-2551.83	-2431.19	-2323.49	-2227.32
	<0					3.60					9.80
-701.93	-692.88	-614.42	-550.52	-497.79	-453.78	-416.72	-385.28	-358.42	-335.35	-315.44	-298.19
77.44	433.47	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76
-4951.04	-4517.57	-1051.81	2413.95	5879.71	9345.47	12811.23	16276.99	19742.75	23208.51	26674.27	30140.03
27.93	139.57	996.32	889.57	794.26	709.16	633.18	565.34	504.77	450.69	402.40	359.28
-3220.22	-3080.66	-2084.33	-1194.76	-400.50	308.67	941.85	1507.19	2011.96	2462.64	2865.04	3224.33
	>0 BUT <.1					21.60					24.90
-604.37	-545.23	-351.03	-192.88	-62.35	46.57	138.29	216.12	282.59	339.69	388.97	431.67
480.13	873.97	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42
-3236.20	-2362.23	1872.19	6106.61	10341.03	14575.45	18809.87	23044.29	27278.71	31513.13	35747.55	39981.97
173.14	281.39	1217.29	1086.87	970.42	866.45	773.61	690.73	616.72	550.64	491.64	438.97
-2448.97	-2167.57	-950.28	136.59	1107.01	1973.46	2747.07	3437.80	4054.52	4605.16	5096.80	5535.77
	>0 BUT <.1					25.30					28.00
-459.62	-383.63	-160.04	22.05	172.34	297.74	403.34	492.95	569.48	635.22	691.96	741.12

YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	YEAR 26	YEAR 27	YEAR 28	YEAR 29	YEAR 30
927.66	927.66	927.66	927.66	927.66	927.66	927.66	927.66	927.66	927.66
3322.60	4250.26	5177.92	6105.58	7033.24	7960.90	8888.56	9816.22	10743.88	11671.54
85.86	76.66	68.45	61.12	54.57	48.72	43.50	38.84	34.68	30.96
-2141.45	-2064.79	-1996.34	-1935.22	-1880.66	-1831.93	-1788.43	-1749.59	-1714.91	-1683.95
				11.80					12.60
-283.19	-270.10	-258.65	-248.61	-239.78	-232.02	-225.17	-219.13	-213.78	-209.05
3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76	3465.76
33605.79	37071.55	40537.31	44003.07	47468.83	50934.59	54400.35	57866.11	61331.87	64797.63
320.79	286.42	255.73	228.33	203.87	182.02	162.52	145.11	129.56	115.68
3545.12	3831.53	4087.27	4315.60	4519.46	4701.49	4864.01	5009.12	5138.68	5254.36
				25.70					25.90
468.81	501.20	529.55	554.40	576.23	595.45	612.40	627.36	640.59	652.30
4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42	4234.42
44216.39	48450.81	52685.23	56919.65	61154.07	65388.49	69622.91	73857.33	78091.75	82326.17
391.94	349.94	312.45	278.97	249.08	222.40	198.57	177.29	158.30	141.34
5927.71	6277.65	6590.10	6869.07	7118.15	7340.55	7539.12	7716.41	7874.71	8016.04
				28.70					28.80
783.88	821.18	853.81	882.42	907.56	929.69	949.21	966.43	981.66	995.14

APPENDIX B

DATA FOR THE SEMI-DWARF I ORCHARD UNDER

THREE MARKETING ALTERNATIVES

PREHARVEST
POWER AND LABOR REQUIREMENTS PER ACRE
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YEAR	ROOTSTOCK	SPACING	TREES/AC.
SEVEN+	SEMI-DWARF	20' X 10'	218

MONTH	TYPE OF OPERATION	TIMES	EQUIPMENT USED	MACH./HRS.	LABOR HRS.
JAN.-FEB.	HERBICIDE		SPRAYER W/BOOM	.34	.43
	PRUNE & TRAIN		PNEUMATIC PRUNERS	10.00	12.50
	CHOP BRUSH		MOWER/CHOPPER	.57	.71
			TRACTOR*		
MARCH	IRRIGATION	4	FROST	20.00	4.00
	FERTILIZE SOD		SPREADER	.17	.21
	LIME		SPREADER	.03	.04
	FERTILIZE TREES		SPREADER	.17	.21
	INSECTICIDE & FUNGICIDE		AIR BLAST SPRAYER	.23	.29
APRIL	INSECTICIDE & FUNGICIDE	5	AIR BLAST SPRAYER	1.15	1.44
	HERBICIDE		SPRAYER W/BOOM	.34	.43
	MOW		MOWER/CHOPPER	.56	.70
	GROWTH REGULATOR		AIR BLAST SPRAYER	.23	.29
MAY	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	.69	.86
	PRUNE & TRAIN		HAND		3.00
	CHOP BRUSH		MOWER/CHOPPER	.57	.71
	CHEMICAL THIN		AIR BLAST SPRAYER	.08	.10
	GROWTH REGULATOR		AIR BLAST SPRAYER	.23	.29
JUNE	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	.69	.86
	MOW		MOWER/CHOPPER	.56	.70
	PRUNE & TRAIN		HAND		1.00
	CHOP BRUSH		MOWER/CHOPPER	.57	.71
	SUCKER CONTROL		HAND		1.50
JULY	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.46	.58
	IRRIGATION	2	IRRIGATION	10.00	2.00
AUGUST	MOW		MOWER/CHOPPER	.56	.70
	IRRIGATION	2	IRRIGATION	10.00	2.00
	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.46	.58
	STOP DROP		AIR BLAST SPRAYER	.23	.29
SEPT.	HARVEST**				
	MONITOR VOLE BAIT STATION		HAND		.50
OCT.	HERBICIDE		SPRAYER W/BOOM	.34	.43
	MONITOR VOLE BAIT STATION		HAND		.50
NOV.	BAIT VOLE STATIONS		HAND		1.00
DEC.	MONITOR VOLE BAIT STATION		HAND		.50
	PRUNE & TRAIN		PNEUMATIC PRUNERS	10.00	12.50
	CHOP BRUSH		MOWER/CHOPPER	.57	.71

*TRACTOR HOURS ARE THE SUM OF THE TRACTOR IMPLEMENT HOURS.
**ALL HARVEST EQUIPMENT AND LABOR ARE A FUNCTION OF SALES OR PRODUCTION AND ARE NOT INCLUDED HERE.

YEAR	TREE	SPACING	DENSITY
SEVEN+	SEMI-DWARF	20' X 10'	218/AC.

CATEGORY:	UNIT	PRICE	RECOM. QUAN.	1 JAN	2 FEB	3 MARCH	4 APRIL	5 MAY	6 JUNE	7 JULY	8 AUG	9 SEPT	10 OCT	11 NOV	12 DEC	TOTAL
PRODUCTION:	BU.		1050.00													
FRESH:																
72'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	11.50										1811.25				1811.25
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	13.50										850.50	425.25	425.25	425.25	2126.25
80'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	11.00										1732.50				1732.50
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	13.00										819.00	409.50	409.50	409.50	2047.50
88'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	10.50										1653.75				1653.75
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	12.50										787.50	393.75	393.75	393.75	1968.75
100'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	10.00										1575.00				1575.00
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	12.00										756.00	378.00	378.00	378.00	1890.00
113'S (QUAN.)	BU.		78.75									78.75				78.75
WHOLESALE	$/BU.	9.50										748.13				748.12
(QUAN.)	BU.		78.75									31.50	15.75	15.75	15.75	78.75
FARMER'S MKT.	$/BU.	11.50										362.25	181.13	181.13	181.13	905.62
125'S (QUAN.)	BU.		78.75									78.75				78.75
WHOLESALE	$/BU.	9.00										708.75				708.75
(QUAN.)	BU.		78.75									31.50	15.75	15.75	15.75	78.75
FARMER'S MKT.	$/BU.	11.00										346.50	173.25	173.25	173.25	866.25
12/3 LB. BAGS	BU.		52.50									52.50				52.50
WHOLESALE	$/BU.	7.75										406.88				406.88
QUANITY	BU.		1050.00									1050.00				1050.00
PICK YOUR OWN	$/BU.	11.00										11550.00				11550.00
OTHER: (QUAN.)	BU.															.00
TOTAL FRESH QUANITY:																
WHOLESALE	BU.		840.00									840.00	.00	.00	.00	840.00
FARMER'S MKT.	BU.		787.50									315.00	157.50	157.50	157.50	787.50
PICK YOUR OWN	BU.		1050.00									1050.00	.00	.00	.00	1050.00
TOTAL FRESH RECEIPTS:																
WHOLESALE												8636.25				8636.25
FARMER'S MKT.												3921.75	1960.88	1960.88	1960.88	9804.38
PICK YOUR OWN												11550.00				11550.00
PROCESSED:																

CULLS (QUAN.)	BU.		210.00									210.00				210.00
WHOLESALE	$/BU.	2.75										577.50				577.50
CULLS (QUAN.)	BU.		262.50									262.50				262.50
GAL./BU.			3.50													
JUICE (QUAN.)	GAL.		918.75									367.50	183.75	183.75	183.75	918.75
FARMER'S MKT.	$/GAL.	3.50										1286.25	643.13	643.13	643.13	3215.63
TOTAL PROC. QUANITY:																
WHOLESALE	BU.											210.00				210.00
FARMER'S MKT.	BU.											262.50				262.50
TOTAL PROC. RECEIPTS:																
WHOLESALE												577.50				577.50
FARMER'S MKT.												1286.25	643.13	643.13	643.13	3215.63
TOTAL QUANITY	BU.		1050.00									1050.00				1050.00
TOTAL RECEIPTS:																
WHOLESALE												9213.75				9213.75
FARMER'S MKT.												5208.00	2604.00	2604.00	2604.00	13020.00
PICK YOUR OWN												11550.00				11550.00
OPERATING INPUTS:																
PREHARVEST COSTS:																
TREES	EACH	3.35														.00
SUBSOIL, CUSTOM	HR.	41.44														.00
DIG HOLES, CUSTOM	EACH	.30														.00
TREE GUARDS	EACH	.27														.00
ROOF SHINGLES	EACH	1.20														.00
SPREADERS	EACH	.10														.00
NAILS	LBS.	.70														.00
FERTILIZER:																
LIME	TON	9.00	.40			3.60										3.60
AMMONIUM NITRATE	CWT.	10.00														.00
CALCIUM NITRATE	CWT.	10.50	9.80			102.90										102.90
SODIUM NITRATE	CWT.	12.80														.00
10-10-10	CWT.	7.40	1.50			11.10										11.10
UREA, 46%	CWT.	11.40														.00
OTHER:																.00
TOTAL FERTILIZER				.00	.00	117.60	.00	.00	.00	.00	.00	.00	.00	.00	.00	117.60
INSECTICIDE:																
AMBUSH	OZ.	1.09														.00
CYGON (DEFEND), 2.7 EC	OZ.	1.56														.00
DEMETON (SYSTOX)	OZ.	.47														.00
ETHION																.00
GUTHION, 50WP	LBS.	6.10							20.13	13.42	13.42					46.97
IMIDAN (PROLATE), 50WP	LBS.	2.80						15.37								15.37
KELTHANE, 35WP	LBS.	3.98														.00
LORSBAN, 4EC	PTS.	5.58														.00
MALATHION, 25WP	LBS.	1.49														.00
METHOXYCHLOR, 24 EC	PTS.	2.13														.00
SUBTOTAL				.00	.00	.00	.00	15.37	20.13	13.42	13.42	.00	.00	.00	.00	
OIL, SUPERIOR	GAL.	5.40				29.70										29.70

OMITE, 30WP	LBS.	3.75													.00
PARATHION, 15WP	LBS.	.90				7.19									7.19
PHOSALONE	PTS.	3.50													.00
PLICTRAN, 50WP	LBS.	20.63													.00
POUNCE, 3.3 EC	OZ.	1.32													.00
PYDRIN, 2.4 EC	OZ.	.99													.00
SEVIN, 50WP	LBS.	2.33													.00
THIODAN, 50WP	LBS.	5.10													.00
OTHER:															.00
TOTAL INSECTICIDE			.00	.00	29.70	7.19	15.37	20.13	13.42	13.42	.00	.00	.00	.00	99.24
FUNGICIDE:															
BAYLETON, 50WP	OZ.	3.38													.00
BENLATE (BENOMYL), 50WP	OZ.	.74													.00
CAPTAN, 50WP	LBS.	1.55						8.15	5.43	5.43					19.01
CYPREX (DODINE), 65WP	LBS.	5.88													.00
DIFOLATAN	PTS.	3.34			91.82										91.82
DIKAR, 76.6WP	LBS.	2.00				14.68	22.02								36.70
FERBAM, 76WP	LBS.	2.47													.00
FUNGINEX	PTS.	9.28													.00
GLYODIN	PTS.	2.20													.00
KARATHANE, MILDEX, 25WP	LBS.	4.05													.00
SUBTOTAL			.00	.00	91.82	14.68	22.02	8.15	5.43	5.43	.00	.00	.00	.00	
MANCOZEB															.00
MANEB, 80WP	LBS.	2.10													.00
PHALTAN (FOLPET), 50WP	LBS.	2.16													.00
POLYRAM, 80WP	LBS.	1.83													.00
RIDOMIL	OZ.	.91													.00
STREPTOMYCIN, 21.2WP	LBS.	7.02				19.38									19.38
ZINEB, 75WP	LBS.	1.02													.00
OTHER:															.00
TOTAL FUNGICIDE			.00	.00	91.82	34.06	22.02	8.15	5.43	5.43	.00	.00	.00	.00	166.90
HERBICIDE:															
DALAPON (DOWPON M) 85SP	LBS.	2.11													.00
DICHLOBENIL (CASORON) 50WP	LBS.	1.23													.00
FUSILADE 4E	PTS.	35.46													.00
KARMEX 80WP	LBS.	4.25													.00
PARAQUAT CL	QTS.	10.70			2.14							2.14			4.28
PRINCEP 80WP	LBS.	3.18			1.59							1.59			3.18
ROUNDUP	OZS.	.65													.00
SIMAZINE	QTS.	3.46													.00
SOILCAM 80WP	LBS.	11.83													.00
SURFLAN 75WP	LBS.	9.78		5.18											5.18
TERBACIL (SINBAR) 80WP	LBS.	19.80													.00
OTHER:															.00
TOTAL HERBICIDE			.00	5.18	3.73	.00	.00	.00	.00	.00	.00	3.73	.00	.00	12.64
GROWTH REGULATORS:															
ALAR 85WP	LBS.	21.00					38.43								38.43
ETHERAL	PTS.	7.01													.00
NAA (KLING-TITE)	PTS	4.75								1.09					1.09
NAD	OZ.														.00
PROMALIN	PTS.	43.45				39.76									39.76
SEVIN, 50WP	LBS.	2.33					2.14								2.14
NAA (TREE HOLD)	GAL.	42.90						9.53							9.53

TOTAL GROWTH REGULATORS				.00	.00	.00	39.76	40.57	9.53	.00	1.09	.00	.00	.00	.00	90.94
SURFACTANT:																
ORTHO X 77	PTS.	1.75				.18							.18			.35
OTHER:																.00
TOTAL SURFACTANT				.00	.00	.18	.00	.00	.00	.00	.00	.00	.18	.00	.00	.35
RODENTICIDE:																
ENDRIN	PTS.															.00
RAMIK	LBS.															.00
ROZOL (GR. SPRAY)	PTS.															.00
ROZOL (BAIT)	LBS.															.00
ZP RODENT BAIT AG	LBS.	1.91												15.28		15.28
OTHER:																.00
TOTAL RODENTICIDE				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	15.28	.00	15.28
BEEHIVE, RENTED	ACRE	10.00	1.00				10.00									10.00
IRRIGATION:																
VARIABLE EQUIPMENT COST:																
IRRIGATION, FROST	HRS.					20.00										20.00
	$/HR.	2.68		.00	.00	53.54	.00	.00	.00	.00	.00	.00	.00	.00	.00	53.54
IRRIGATION, DRIP	HRS.									10.00	10.00					20.00
	$/HR.	2.73		.00	.00	.00	.00	.00	.00	27.35	27.35	.00	.00	.00	.00	54.70
OTHER:																.00
TOTAL VAR. EQUIP. COST				.00	.00	53.54	.00	.00	.00	27.35	27.35	.00	.00	.00	.00	108.24
LABOR:																
MACHINE	HRS.			.00	.00	4.00	.00	.00	.00	2.00	2.00	.00	.00	.00	.00	8.00
WAGE	$/HR.	4.43		.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
HAND	HRS.															.00
WAGE	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SUPERVISION	HRS.															.00
WAGE	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL LABOR				.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
TOTAL IRRIGATION				.00	.00	71.25	.00	.00	.00	36.20	36.20	.00	.00	.00	.00	143.65
MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
MOWER	T.O.		.56				.56		.56		.56					1.69
BRUSH CHOPPER	T.O.		1.13		.56			.56	.56						.56	2.26
AIR BLAST SPRAYER	T.O.		.23			.23	1.38	.76	.69	.46	.69					4.20
SPRAYER W/BOOM	T.O.		.34		.34		.34						.34			1.03
SPREADER	T.O.		.17			.36										.36
PNEUMATIC PRUNERS	T.O.				10.00										10.00	20.00
OTHER:																.00
TRUCK, PU	HRS.															.00
TRACTOR, 60HP	HRS.			.00	10.91	.59	2.28	1.33	1.82	.46	1.25	.00	.34	.00	10.56	29.54
OTHER:																.00
VARIABLE MACHINE COST:		($/HR.)														DOL.
MOWER	ACRE	9.39		.00	.00	.00	5.30	.00	5.30	.00	5.30	.00	.00	.00	.00	15.89
BRUSH CHOPPER	ACRE	9.39		.00	5.30	.00	.00	5.30	5.30	.00	.00	.00	.00	.00	5.30	21.19
AIR BLAST SPRAYER	ACRE	7.77		.00	.00	1.78	10.68	5.93	5.34	3.56	5.34	.00	.00	.00	.00	32.63
SPRAYER W/BOOM	ACRE	1.21		.00	.42	.00	.42	.00	.00	.00	.00	.00	.42	.00	.00	1.25

SPREADER	ACRE	.65		.00	.00	.24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.24
PNEUMATIC PRUNERS	ACRE	.85		.00	8.45	.00	.00	.00	.00	.00	.00	.00	.00	.00	8.45	16.91
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCK, PU	ACRE	5.01		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRACTOR, 60HP	ACRE	5.10		.00	55.63	3.02	11.64	6.77	9.26	2.34	6.38	.00	1.75	.00	53.88	150.68
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL VARIABLE MACHINE COST:				.00	69.79	5.04	28.03	18.00	25.19	5.90	17.02	.00	2.17	.00	67.63	238.77
FIELD LABOR:																
MACHINERY	HRS.			.00	13.63	.74	2.85	1.66	2.27	.57	1.56	.00	.43	.00	13.21	36.93
WAGES	$/HR.	4.43		.00	60.35	3.28	12.63	7.35	10.05	2.54	6.92	.00	1.90	.00	58.45	163.45
HAND	HRS.							3.00	3.00			.50	.50	1.00	.50	8.50
WAGES	$/HR.	4.43		.00	.00	.00	.00	13.28	13.28	.00	.00	2.21	2.21	4.43	2.21	37.62
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL FIELD LABOR				.00	60.35	3.28	12.63	20.63	23.32	2.54	6.92	2.21	4.11	4.43	60.66	201.08
TOTAL LABOR COST				.00	60.35	20.98	12.63	20.63	23.32	11.39	15.78	2.21	4.11	4.43	60.66	236.48
OTHER:																.00
OTHER:																.00
SUBTOTAL				.00	135.33	322.58	131.67	116.58	86.32	63.49	80.09	2.21	10.19	19.71	128.29	1096.45
INTEREST, OPERATING CAPITAL	ACRE	.12		.00	1.35	4.59	5.96	7.18	8.12	8.83	9.72	.00	.10	.30	1.59	47.74
TOTAL PREHARVEST				.00	136.68	327.18	137.62	123.77	94.44	72.32	89.81	2.21	10.29	20.01	129.87	1144.19
HARVEST & MARKETING COST FOR WHOLESALE, FARMER'S MARKET, AND PICK YOUR OWN OPERATIONS:																
WHOLESALE:																
CUSTOM HARVEST	$/BU.	.60	1050.00									630.00				630.00
CUSTOM PACK	$/BU.	3.50	840.00									2940.00				2940.00
BROKERS FEE	$/BU.	.25	840.00									210.00				210.00
VARIABLE EQUIPMENT COST:																
BINS	EACH	.17										1.18				1.18
LADDERS	HR.	.01										.15				.15
PICKING SACKS	HR.	.01										.15				.15
TOTAL VAR. EQUIP. COST												1.48				1.48
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.		10.50									10.50				10.50
OTHER:																.00
TRUCK, 2 TON	HRS.											5.51				5.51
TRACTOR, 60HP	HRS.											10.50				10.50
OTHER:																.00
VARIABLE FIELD MACHINE COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										11.69				11.69
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										57.34				57.34
TRACTOR, 60HP	HR.	5.10										53.55				53.55

OTHER:											.00				.00
TOTAL VAR. FIELD MACH. COST											122.59				122.59
LABOR:															
MACHINERY	HRS.										20.02				20.02
WAGES	$/HR.	4.43									88.59				88.59
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
TOTAL LABOR COST											88.59				88.59
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	3992.65	.00	.00	.00	3992.65
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	3992.65	.00	.00	.00	3992.65
TOTAL INTEREST, OPERATING CAPITAL			.00	1.35	4.59	5.96	7.18	8.12	8.83	9.72	.00	.10	.30	1.59	47.74
TOTAL OPERATING INPUTS			.00	136.68	327.18	137.62	123.77	94.44	72.32	89.81	3994.86	10.29	20.01	129.87	5136.84
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															4076.91
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															4028.81
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													200.97
TRUCK, PU	DOL./HR.	4.16													.00
TRUCK, 2 TON	DOL./HR.	11.37													62.70
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./AC.	13.44													268.82
DRIP	DOL./AC.	3.35													66.95
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													71.61
AIR BLAST SPRAYER	DOL./HR.	13.03													54.73
SPRAYER W/BOOM	DOL./HR.	3.27													3.37
SPREADER	DOL./HR.	4.68													1.70
PNEUMATIC PRUNERS	DOL./HR.	2.08													41.63
FRONT END FORK LIFT	DOL./HR.	4.69													49.27
BINS	DOL/150 BU	11.94													83.61
LADDERS	DOL./HR.	.08													.79
PICKING SACKS	DOL./HR.	.08													.82
TOTAL FIXED COST															906.97

RETURN TO OVERHEAD AND MANAGEMENT								3121.85
FARMER'S MARKET:								
CUSTOM HARVEST	$/BU.	.60	1050.00	630.00				630.00
PACKING CHARGE:								
LABOR:								
MACHINERY	HRS.			127.97				127.97
WAGES	$/HR.	4.43		566.39				566.39
HAND	HRS.			18.38				18.37
WAGES	$/HR.	4.43		81.33				81.33
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				647.72				647.72
VARIABLE EQUIPMENT COST:								
BINS	EACH	.17		1.18				1.18
LADDERS	HR.	.01		.15				.15
PICKING SACKS	HR.	.01		.15				.15
GRADER	HR.	2.83		29.69				29.69
BOX W/TRAYS	BU.	.71		559.13				559.12
FORKLIFT	HR.	3.40		26.78				26.78
COLD STORAGE	BU./MO.	.02		7.18	3.59	3.59	3.59	17.95
TOTAL VAR. EQUIP. COST				624.25	3.59	3.59	3.59	635.02
TOTAL PACKING CHARGE	ACRE			1271.97	3.59	3.59	3.59	1282.74
TOTAL PACKING CHARGE	BU.							1.63
CIDER JUICING CHARGE:								
LABOR:								
MACHINERY	HRS.			11.48				11.48
WAGES	$/HR.	4.43		50.83				50.83
HAND	HRS.			1.91				1.91
WAGES	$/HR.	4.43		8.47				8.47
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				59.30				59.30
VARIABLE EQUIPMENT COST:								
PRESS	HR.	1.85		11.34				11.34
JUG FILLER	HR.	.07		.11				.11
JUGS & LABELS	GAL.	.16		147.00				147.00
FORKLIFT	HR.	3.40		8.93				8.92
REFRIGERATED BULK TANK	GAL.	.02		16.86				16.86
COLD STORAGE	GAL./MO.	.01		2.39	1.20	1.20	1.20	5.98
TOTAL VAR. EQUIP. COST				186.63	1.20	1.20	1.20	190.22
TOTAL CIDER JUICING CHARGE	ACRE			245.93	1.20	1.20	1.20	249.52
TOTAL CIDER JUICING CHARGE	BU.							.27
MARKETING CHARGE:								
LABOR:								
MACHINERY	HRS.			2.00	2.00	2.00	2.00	8.00

WAGES	$/HR.	4.43										8.85	8.85	8.85	8.85	35.41
HAND	HRS.											16.00	16.00	16.00	16.00	64.00
WAGES	$/HR.	4.43										70.82	70.82	70.82	70.82	283.26
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43										.00	.00	.00	.00	.00
TOTAL LABOR COST												79.67	79.67	79.67	79.67	318.67
VARIABLE EQUIPMENT COST:																
MARKET COOLER	HR.	.03										2.01	1.01	1.01	1.01	5.03
TRUCK, 2 TON	HR.	10.40										20.80	20.80	20.80	20.80	83.20
TOTAL VAR. EQUIP. COST												22.81	21.81	21.81	21.81	88.23
TOTAL MARKETING CHARGE												102.48	101.47	101.47	101.47	406.90
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE			(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.		10.50									10.50				110.25
OTHER:																.00
TRUCK, 2 TON	HRS.											5.51				5.51
TRACTOR, 60HP	HRS.											10.50				10.50
OTHER:																.00
VARIABLE FIELD MACH. COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										11.69				11.69
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										57.34				57.34
TRACTOR, 60HP	HR.	5.10										53.55				53.55
OTHER:	HR.											.00				.00
TOTAL VAR. FIELD MACH. COST												122.59				122.59
FIELD LABOR:																
MACHINERY	HRS.											20.02				20.02
WAGES	$/HR.	4.43										88.59				88.59
HAND	HRS.															.00
WAGES	$/HR.	4.43										.00				.00
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43										.00				.00
TOTAL FIELD LABOR COST												88.59				88.59
TOTAL LABOR COST												875.28				875.28
OTHER:																.00
OTHER:																.00
SUBTOTAL				.00	.00	.00	.00	.00	.00	.00	.00	2461.56	106.26	106.26	106.26	2780.34
INTEREST, OPERATING CAPITAL	ACRE	.12		.00	.00	.00	.00	.00	.00	.00	.00	.00	1.06	2.14	3.22	6.42
TOTAL HARVEST & MARKET				.00	.00	.00	.00	.00	.00	.00	.00	2461.56	107.32	108.40	109.48	2786.76
TOTAL INTEREST, OPERATING CAPITAL				.00	1.35	4.59	5.96	7.18	8.12	8.83	9.72	.00	1.16	2.44	4.81	54.16
TOTAL OPERATING INPUTS				.00	136.60	327.18	137.62	123.77	94.44	72.32	89.81	2463.77	117.61	128.40	239.35	3930.94
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT,																

OVERHEAD, AND MANAGEMENT				9089.06
LAND CHARGE	ACRE	48.10		48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD & MANAGEMENT				9040.96
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)				
TRACTOR, 60HP	DOL./HR.	5.02		200.97
TRUCK, PU	DOL./HR.	4.16		.00
TRUCK, 2 TON	DOL./HR.	11.37		151.69
TRELLIS	DOL./AC.			.00
IRRIGATION:				
FROST	DOL./AC.	13.44		268.82
DRIP	DOL./AC.	3.35		66.95
MOWER/BRUSH CHOPPER	DOL./HR.	18.14		71.61
AIR BLAST SPRAYER	DOL./HR.	13.83		54.73
SPRAYER W/BOOM	DOL./HR.	3.27		3.37
SPREADER	DOL./HR.	4.68		1.70
PNEUMATIC PRUNERS	DOL./HR.	2.08		41.63
FRONT END FORK LIFT	DOL./HR.	4.69		517.39
BINS	DOL/150 BU	11.94		83.61
LADDERS	DOL./HR.	.08		.79
PICKING SACKS	DOL./HR.	.08		.82
JUG FILLER	DOL./HR.	.45		.69
PALLETS	DOL/150 BU	.01		.07
GRADER	DOL./BU.	.02		19.08
HAND STAPLER	DOL./HR.	.03		.27
FORKLIFT	DOL./HR.	3.40		35.75
COLD STORAGE	DOL./BU.	.21		111.04
CIDER PRESS	DOL./GAL.	.03		24.18
REFRIGERATED BULK TANK	DOL./GAL.	.05		41.54
MARKET COOLER	DOL./GAL.	.04		36.20
MARKET SPACE	DOL./AC.	2% OF TOTAL SALES		260.40
TOTAL FIXED COST				1995.27
RETURN TO OVERHEAD AND MANAGEMENT				7045.69
PICK YOUR OWN MARKET:				
VARIABLE EQUIPMENT COST:				
1/2 BU. PICKING BAG	EACH	.28	588.00	588.00
OTHER:				.00
TOTAL VAR. EQUIP. COST			588.00	588.00
FIELD MACHINERY:				HRS.
WAGON	HRS.		5.25	5.25
TRACTOR, 60HP	HRS.		5.25	5.25
OTHER:				.00
VARIABLE FIELD MACHINE COST:				DOL.
WAGON	HR.	.18	.92	.92
TRACTOR, 60HP	HR.	5.10	26.78	26.78
OTHER:			00	.00

TOTAL VAR. FIELD MACH. COST											27.69				27.69
LABOR:															
MACHINERY	HRS.										5.25				5.25
WAGES	$/HR.	4.43									23.24				23.24
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.										50.00				50.00
WAGES	$/HR.	4.43									221.30				221.30
TOTAL LABOR COST											244.54				244.54
ADVERTISING	ACRE										231.00				231.00
LIABILITY INSURANCE	ACRE										288.75				288.75
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	1379.98	.00	.00	.00	1379.98
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	1379.98	.00	.00	.00	1379.98
TOTAL INTEREST, OPERATING CAPITAL			.00	1.35	4.59	5.96	7.18	8.12	8.83	9.72	.00	.10	.30	1.59	47.74
TOTAL OPERATING INPUTS			.00	136.68	327.18	137.62	123.77	94.44	72.32	89.81	1382.19	10.29	20.01	129.87	2524.17
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															9025.83
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															8977.73
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													174.62
TRUCK, PU	DOL./HR.	4.16													.00
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./AC.	13.44													268.82
DRIP	DOL./AC.	3.35													66.95
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													71.61
AIR BLAST SPRAYER	DOL./HR.	13.03													54.73
SPRAYER W/BOOM	DOL./HR.	3.27													3.37
SPREADER	DOL./HR.	4.68													1.70
PNEUMATIC PRUNERS	DOL./HR.	2.08													41.63
WAGON	DOL./HR.	6.05													31.75
FRUIT PICKER	DOL./AC.	45.32													45.32
CHECK FACILITIES	DOL./AC.	1.55													1.55
TOTAL FIXED COST															762.06
RETURN TO OVERHEAD AND MANAGEMENT															8215.68

TREE — SPACING — DENSITY

SEMI-DWARF — 20' X 10' — 218/AC.

CATEGORY:	PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8
WHOLESALE:									
RETURN TO OVERHEAD AND MANAGEMENT		-1682.56	-753.16	-823.19	-1105.07	-548.13	301.96	3108.57	3108.57
ACCUMULATED NET RETURNS		-1682.56	-2435.72	-3258.91	-4363.98	-4912.11	-4610.15	-1501.58	1606.99
DISCOUNT RATE	.12								
NET PRESENT VALUE		-1502.29	-600.41	-585.93	-702.29	-311.02	152.98	1406.16	1255.50
ACCUMULATED NET PRESENT VALUE		-1502.29	-2102.70	-2688.63	-3390.92	-3701.95	-3548.96	-2142.80	-887.31
INTERNAL RATE OF RETURN, %						<0			
VALUE OF ANNUITY		-1682.56	-1244.16	-1119.41	-1116.41	-1026.96	-863.20	-469.53	-178.62
FARMER'S MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-1682.56	-753.16	-823.19	-1163.81	-38.00	1691.78	7005.47	7005.47
ACCUMULATED NET RETURNS		-1682.56	-2435.72	-3258.91	-4422.72	-4460.72	-2768.94	4236.53	11242.00
DISCOUNT RATE	.12								
NET PRESENT VALUE		-1502.29	-600.41	-585.93	-739.62	-21.56	857.11	3168.92	2829.39
ACCUMULATED NET PRESENT VALUE		-1502.29	-2102.70	-2688.63	-3428.25	-3449.82	-2592.71	576.21	3405.60
INTERNAL RATE OF RETURN, %						>0 BUT <.1			
VALUE OF ANNUITY		-1682.56	-1244.16	-1119.41	-1128.70	-957.01	-630.61	126.26	685.56
PICK YOUR OWN MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-1682.56	-753.16	-823.19	-862.57	332.70	2204.12	8202.41	8202.41
ACCUMULATED NET RETURNS		-1682.56	-2435.72	-3258.91	-4121.48	-3788.78	-1584.66	6617.75	14820.16
DISCOUNT RATE	.12								
NET PRESENT VALUE		-1502.29	-600.41	-585.93	-548.18	188.78	1116.68	3710.35	3312.82
ACCUMULATED NET PRESENT VALUE		-1502.29	-2102.70	-2688.63	-3236.81	-3048.03	-1931.35	1779.00	5091.82
INTERNAL RATE OF RETURN, %						>0 BUT <.1			
VALUE OF ANNUITY		-1682.56	-1244.16	-1119.41	-1065.67	-845.55	-469.75	389.81	1025.00

YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
3108.57	3108.57	3108.57	3108.57	3108.57	3108.57	3108.57	3108.57	3108.57	3108.57	3108.57	3108.57
4715.56	7824.13	10932.70	14041.27	17149.84	20258.41	23366.98	26475.55	29584.12	32692.69	35801.26	38909.83
1120.98	1000.88	893.64	797.89	712.40	636.08	567.92	507.08	452.75	404.24	360.93	322.26
233.68	1234.55	2128.19	2926.08	3638.49	4274.56	4842.49	5349.56	5802.31	6206.55	6567.47	6889.73
	23.80					30.20					31.30
43.86	218.50	358.42	472.38	566.43	644.91	710.99	767.07	814.97	856.11	891.62	922.39
7005.47	7005.47	7005.47	7005.47	7005.47	7005.47	7005.47	7005.47	7005.47	7005.47	7005.47	7005.47
18247.47	25252.94	32258.41	39263.88	46269.35	53274.82	60280.29	67285.76	74291.23	81296.70	88302.17	95307.64
2526.24	2255.57	2013.91	1798.13	1605.47	1433.46	1279.87	1142.74	1020.31	910.99	813.38	726.23
5931.85	8187.42	10201.33	11999.46	13604.93	15038.39	16318.26	17461.00	18481.31	19392.30	20205.68	20931.92
	43.40					47.60					48.10
1113.28	1449.04	1718.06	1937.15	2117.98	2268.86	2395.92	2503.73	2595.82	2674.92	2743.18	2802.34
8202.41	8202.41	8202.41	8202.41	8202.41	8202.41	8202.41	8202.41	8202.41	8202.41	8202.41	8202.41
23022.57	31224.98	39427.39	47629.80	55832.21	64034.62	72237.03	80439.44	88641.85	96844.26	105046.67	113249.08
2957.87	2640.96	2358.00	2105.35	1879.78	1678.38	1498.55	1337.99	1194.63	1066.64	952.36	850.32
8049.69	10690.65	13048.64	15154.00	17033.78	18712.15	20210.70	21548.69	22743.33	23809.97	24762.32	25612.64
	47.00					50.80					51.20
1510.76	1892.08	2197.59	2446.41	2651.77	2823.13	2967.42	3089.87	3194.45	3284.28	3361.81	3428.99

APPENDIX C

DATA FOR THE SEMI-DWARF II ORCHARD UNDER THREE MARKETING ALTERNATIVES

PREHARVEST
POWER AND LABOR REQUIREMENTS PER ACRE
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YEAR	ROOTSTOCK	SPACING	TREES/AC.
EIGHT	SEMI-DWARF	20' X 6'	363

MONTH	TYPE OF OPERATION	TIMES	EQUIPMENT USED	MACH./HRS.	LABOR HRS.
JAN.-FEB.	HERBICIDE		SPRAYER W/BOOM	.34	.43
	PRUNE & TRAIN		PNEUMATIC PRUNERS	19.00	23.75
	CHOP BRUSH		MOWER/CHOPPER	.57	.71
			TRACTOR*		
MARCH	IRRIGATION	4	FROST	20.00	4.00
	FERTILIZE SOD		SPREADER	.17	.21
	LIME		SPREADER	.03	.04
	FERTILIZE TREES		SPREADER	.17	.21
	INSECTICIDE & FUNGICIDE		AIR BLAST SPRAYER	.23	.29
APRIL	INSECTICIDE & FUNGICIDE	5	AIR BLAST SPRAYER	1.15	1.44
	HERBICIDE		SPRAYER W/BOOM	.34	.43
	MOW		MOWER/CHOPPER	.56	.70
	GROWTH REGULATOR		AIR BLAST SPRAYER	.23	.29
MAY	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	.69	.86
	PRUNE & TRAIN		HAND		5.50
	CHOP BRUSH		MOWER/CHOPPER	.57	.71
	CHEMICAL THIN		AIR BLAST SPRAYER	.08	.10
	GROWTH REGULATOR		AIR BLAST SPRAYER	.23	.29
JUNE	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	.69	.86
	MOW		MOWER/CHOPPER	.56	.70
	PRUNE & TRAIN		HAND		5.50
	CHOP BRUSH		MOWER/CHOPPER	.57	.71
	SUCKER CONTROL		HAND		2.50
JULY	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.46	.58
	IRRIGATION	2	IRRIGATION	10.00	2.00
AUGUST	MOW		MOWER/CHOPPER	.56	.70
	IRRIGATION	2	IRRIGATION	10.00	2.00
	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.46	.58
	STOP DROP		AIR BLAST SPRAYER	.23	.29
SEPT.	HARVEST**				
	MONITOR VOLE BAIT STATION		HAND		.50
OCT.	HERBICIDE		SPRAYER W/BOOM	.34	.43
	MONITOR VOLE BAIT STATION		HAND		.50
NOV.	BAIT VOLE STATIONS		HAND		1.00
DEC.	MONITOR VOLE BAIT STATION		HAND		.50
	PRUNE & TRAIN		PNEUMATIC PRUNERS	19.00	23.75
	CHOP BRUSH		MOWER/CHOPPER	.57	.71

*TRACTOR HOURS ARE THE SUM OF THE TRACTOR IMPLEMENT HOURS.
**ALL HARVEST EQUIPMENT AND LABOR ARE A FUNCTION OF SALES OR PRODUCTION AND ARE NOT INCLUDED HERE.

YEAR	TREE	SPACING	DENSITY
EIGHT	SEMI-DWARF	20' X 8'	363/AC.

CATEGORY:	UNIT	PRICE	RECOM. QUAN.	1 JAN	2 FEB	3 MARCH	4 APRIL	5 MAY	6 JUNE	7 JULY	8 AUG	9 SEPT	10 OCT	11 NOV	12 DEC	TOTAL
PRODUCTION:	BU.		1050.00													
FRESH:																
72'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	11.50										1811.25				1811.25
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	13.50										850.50	425.25	425.25	425.25	2126.25
80'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	11.00										1732.50				1732.50
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	13.00										819.00	409.50	409.50	409.50	2047.50
88'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	10.50										1653.75				1653.75
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	12.50										787.50	393.75	393.75	393.75	1968.75
100'S (QUAN.)	BU.		157.50									157.50				157.50
WHOLESALE	$/BU.	10.00										1575.00				1575.00
(QUAN.)	BU.		157.50									63.00	31.50	31.50	31.50	157.50
FARMER'S MKT.	$/BU.	12.00										756.00	378.00	378.00	378.00	1890.00
113'S (QUAN.)	BU.		78.75									78.75				78.75
WHOLESALE	$/BU.	9.50										748.13				748.12
(QUAN.)	BU.		78.75									31.50	15.75	15.75	15.75	78.75
FARMER'S MKT.	$/BU.	11.50										362.25	181.13	181.13	181.13	905.62
125'S (QUAN.)	BU.		78.75									78.75				78.75
WHOLESALE	$/BU.	9.00										708.75				708.75
(QUAN.)	BU.		78.75									31.50	15.75	15.75	15.75	78.75
FARMER'S MKT.	$/BU.	11.00										346.50	173.25	173.25	173.25	866.25
12/3 LB. BAGS	BU.		52.50									52.50				52.50
WHOLESALE	$/BU.	7.75										406.88				406.88
QUANITY	BU.		1050.00									1050.00				1050.00
PICK YOUR OWN	$/BU.	11.00										11550.00				11550.00
OTHER: (QUAN.)	BU.															.00
TOTAL FRESH QUANITY:																
WHOLESALE	BU.		840.00									840.00	.00	.00	.00	840.00
FARMER'S MKT.	BU.		787.50									315.00	157.50	157.50	157.50	787.50
PICK YOUR OWN	BU.		1050.00									1050.00	.00	.00	.00	1050.00
TOTAL FRESH RECEIPTS:																
WHOLESALE												8636.25				8636.25
FARMER'S MKT.												3921.75	1960.88	1960.88	1960.88	9804.38
PICK YOUR OWN												11550.00				11550.00
PROCESSED:																

CULLS (QUAN.)	BU.		210.00									210.00				210.00
WHOLESALE	$/BU.	2.75										577.50				577.50
CULLS (QUAN.)	BU.		262.50									262.50				262.50
GAL./BU.			3.50													
JUICE (QUAN.)	GAL.		918.75									367.50	183.75	183.75	183.75	918.75
FARMER'S MKT.	$/GAL.	3.50										1286.25	643.13	643.13	643.13	3215.63
TOTAL PROC. QUANITY:																
WHOLESALE	BU.											210.00				210.00
FARMER'S MKT.	BU.											262.50				262.50
TOTAL PROC. RECEIPTS:																
WHOLESALE												577.50				577.50
FARMER'S MKT.												1286.25	643.13	643.13	643.13	3215.63
TOTAL QUANITY	BU.		1050.00									1050.00				1050.00
TOTAL RECEIPTS:																
WHOLESALE												9213.75				9213.75
FARMER'S MKT.												5208.00	2604.00	2604.00	2604.00	13020.00
PICK YOUR OWN												11550.00				11550.00
OPERATING INPUTS:																
PREHARVEST COSTS:																
TREES	EACH	3.35														.00
SUBSOIL, CUSTOM	HR.	41.44														.00
DIG HOLES, CUSTOM	EACH	.30														.00
TREE GUARDS	EACH	.27														.00
ROOF SHINGLES	EACH	1.20														.00
SPREADERS	EACH	.10														.00
NAILS	LBS.	.70														.00
FERTILIZER:																
LIME	TON	9.00	.40			3.60										3.60
AMMONIUM NITRATE	CWT.	10.00														.00
CALCIUM NITRATE	CWT.	10.50	16.73			175.67										175.67
SODIUM NITRATE	CWT.	12.80														.00
10-10-10	CWT.	7.40	1.50			11.10										11.10
UREA, 46%	CWT.	11.40														.00
OTHER:																.00
TOTAL FERTILIZER				.00	.00	190.37	.00	.00	.00	.00	.00	.00	.00	.00	.00	190.37
INSECTICIDE:																
AMBUSH	OZ.	1.09														.00
CYGON (DEFEND), 2.7 EC	OZ.	1.56														.00
DEMETON (SYSTOX)	OZ.	.47														.00
ETHION																.00
GUTHION, 50WP	LBS.	6.10	1.54						28.18	28.18						56.36
IMIDAN (PROLATE), 50WP	LBS.	2.80	2.57					21.59								21.59
KELTHANE, 35WP	LBS.	3.98														.00
LORSBAN, 4EC	PTS.	5.58														.00
MALATHION, 25WP	LBS.	1.49														.00
METHOXYCHLOR, 24 EC	PTS.	2.13														.00
SUBTOTAL				.00	.00	.00	.00	21.59	28.18	28.18	.00	.00	.00	.00	.00	
OIL, SUPERIOR	GAL.	5.40	7.70			41.58										41.58

OMITE, 30WP	LBS.	3.75														.00
PARATHION, 15WP	LBS.	.90	5.13				10.05									10.05
PHOSALONE	PTS.	3.58														.00
PLICTRAN, 50WP	LBS.	20.63														.00
POUNCE, 3.3 EC	OZ.	1.32														.00
PYDRIN, 2.4 EC	OZ.	.99														.00
SEVIN, 50WP	LBS.	2.33														.00
THIODAN, 50WP	LBS.	5.10														.00
OTHER:																.00
TOTAL INSECTICIDE				.00	.00	41.58	10.05	21.59	28.18	28.18	.00	.00	.00	.00	.00	129.59
FUNGICIDE:																
BAYLETON, 50WP	OZ.	3.38														.00
BENLATE (BENOMYL), 50WP	OZ.	.74														.00
CAPTAN, 50WP	LBS.	1.55	5.13						23.85	15.90						39.76
CYPREX (DODINE), 65WP	LBS.	5.88														.00
DIFOLATAN	PTS.	3.34	38.49			128.56										128.56
DIKAR, 76.6WP	LBS.	2.00	5.13				20.52	30.78								51.30
FERBAM, 76WP	LBS.	2.47														.00
FUNGINEX	PTS.	9.28														.00
GLYODIN	PTS.	2.20														.00
KARATHANE, MILDEX, 25WP	LBS.	4.05														.00
SUBTOTAL				.00	.00	128.56	20.52	30.78	23.85	15.90	.00	.00	.00	.00	.00	
MANCOZEB																.00
MANEB, 80WP	LBS.	2.10														.00
PHALTAN (FOLPET), 50WP	LBS.	2.16														.00
POLYRAM, 80WP	LBS.	1.83														.00
RIDOMIL	OZ.	.91														.00
STREPTOMYCIN, 21.2WP	LBS.	7.02	1.28				26.96									26.96
ZINEB, 75WP	LBS.	1.02														.00
OTHER:																.00
TOTAL FUNGICIDE				.00	.00	128.56	47.48	30.78	23.85	15.90	.00	.00	.00	.00	.00	246.57
HERBICIDE:																
DALAPON (DOWPON M) 85SP	LBS.	2.11														00
DICHLOBENIL (CASORON) 50WP	LBS.	1.23														00
FUSILADE 4E	PTS.	35.46														.00
KARMEX 80WP	LBS.	4.25														.00
PARAQUAT CL	QTS.	10.70	.20			2.14							2.14			4.28
PRINCEP 80WP	LBS.	3.18	.50			1.59							1.59			3.18
ROUNDUP	OZS.	.65														.00
SIMAZINE	QTS.	3.46														.00
SOILCAN 80WP	LBS.	11.83														.00
SURFLAN 75WP	LBS.	9.78	.53		5.18											5.18
TERBACIL (SINBAR) 80WP	LBS.	19.80														.00
OTHER:																.00
TOTAL HERBICIDE				.00	5.18	3.73	.00	.00	.00	.00	.00	.00	3.73	.00	.00	12.64
GROWTH REGULATORS:																
ALAR 85WP	LBS.	21.00	1.83					38.43								38.43
ETHERAL	PTS.	7.01														.00
NAA (KLING-TITE)	PTS.	4.75	.23								1.09					1.09
NAD	OZ.															.00
PROMALIN	PTS.	43.45	.92				39.76									39.76
SEVIN, 50WP	LBS.	2.33	.92					2.14								2.14
NAA (TREE HOLD)	GAL.	42.90							15.87							15.87

TOTAL GROWTH REGULATORS				.00	.00	.00	39.76	40.57	15.87	.00	1.09	.00	.00	.00	.00	97.28
SURFACTANT:																
ORTHO X 77	PTS.	1.75	.10				.18						.18			.35
OTHER:																.00
TOTAL SURFACTANT				.00	.00	.00	.18	.00	.00	.00	.00	.00	.18	.00	.00	.35
RODENTICIDE:																
ENDRIN	PTS.															.00
RAMIK	LBS.															.00
ROZOL (GR. SPRAY)	PTS.															.00
ROZOL (BAIT)	LBS.															.00
ZP RODENT BAIT AG	LBS.	1.91	8.00											15.28		15.28
OTHER:																.00
TOTAL RODENTICIDE				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	15.28	.00	15.28
BEEHIVE, RENTED	ACRE	10.00	1.00				10.00									10.00
IRRIGATION:																
VARIABLE EQUIPMENT COST:																
IRRIGATION, FROST	HRS.					20.00										20.00
	S/HR.	2.68		.00	.00	53.54	.00	.00	.00	.00	.00	.00	.00	.00	.00	53.54
IRRIGATION, DRIP	HRS.									10.00	10.00					20.00
	S/HR.	2.74		.00	.00	.00	.00	.00	.00	27.39	27.39	.00	.00	.00	.00	54.78
OTHER:																.00
TOTAL VAR. EQUIP. COST				.00	.00	53.54	.00	.00	.00	27.39	27.39	.00	.00	.00	.00	108.33
LABOR:																
MACHINE	HRS.			.00	.00	4.00	.00	.00	.00	2.00	2.00	.00	.00	.00	.00	8.00
WAGE	S/HR.	4.43		.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
HAND	HRS.															.00
WAGE	S/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SUPERVISION	HRS.															.00
WAGE	S/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL LABOR				.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
TOTAL IRRIGATION				.00	.00	71.25	.00	.00	.00	36.24	36.24	.00	.00	.00	.00	143.74
MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
MOWER	T.O.		.56				.56		.56		.56					1.69
BRUSH CHOPPER	T.O.		1.13		.56			.56	.56						.56	2.26
AIR BLAST SPRAYER	T.O.		.23			.23	1.38	.99	.69	.46	.69					4.43
SPRAYER W/BOOM	T.O.		.34		.34		.34						.34			1.03
SPREADER	T.O.		.17			.36										.36
PNEUMATIC PRUNERS	HRS.				19.00										19.00	38.00
OTHER:																.00
TRUCK, PU	HRS.															.00
TRACTOR, 60HP	HRS.			.00	19.91	.59	2.28	1.56	1.82	.46	1.25	.00	.34	.00	19.56	47.77
OTHER:																.00
VARIABLE MACHINE COST:		($/HR.)														DOL.
MOWER	ACRE	9.39		.00	.00	.00	5.30	.00	5.30	.00	5.30	.00	.00	.00	.00	15.89
BRUSH CHOPPER	ACRE	9.39		.00	5.30	.00	.00	5.30	5.30	.00	.00	.00	.00	.00	5.30	21.19
AIR BLAST SPRAYER	ACRE	7.77		.00	.00	1.78	10.68	7.71	5.34	3.56	5.34	.00	.00	.00	.00	34.41
SPRAYER W/BOOM	ACRE	1.21		.00	.42	.00	.42	.00	.00	.00	.00	.00	.42	.00	.00	1.25

SPREADER	ACRE	.65		.00	.00	.24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.24
PNEUMATIC PRUNERS	ACRE	.85		.00	16.06	.00	.00	.00	.00	.00	.00	.00	.00	.00	16.06	32.12
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCK, PU	ACRE	5.01		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRACTOR, 60HP	ACRE	5.10		.00	101.53	3.02	11.64	7.94	9.26	2.34	6.38	.00	1.75	.00	99.78	243.65
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL VARIABLE MACHINE COST:				.00	123.30	5.04	28.03	20.95	25.19	5.90	17.02	.00	2.17	.00	121.13	348.73
FIELD LABOR:																
MACHINERY	HRS.			.00	24.88	.74	2.85	1.95	2.27	.57	1.56	.00	.43	.00	24.46	59.72
WAGES	$/HR.	4.43		.00	110.14	3.28	12.63	8.62	10.05	2.54	6.92	.00	1.90	.00	108.24	264.31
HAND	HRS.							5.50	8.00			.50	.50	1.00	.50	16.00
WAGES	$/HR.	4.43		.00	.00	.00	.00	24.34	35.41	.00	.00	2.21	2.21	4.43	2.21	70.82
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL FIELD LABOR				.00	110.14	3.28	12.63	32.96	45.45	2.54	6.92	2.21	4.11	4.43	110.45	335.12
TOTAL LABOR COST				.00	110.14	20.98	12.63	32.96	45.45	11.39	15.78	2.21	4.11	4.43	110.45	370.53
OTHER:																.00
OTHER:																.00
SUBTOTAL				.00	238.63	443.79	148.13	146.85	138.55	88.76	61.28	2.21	10.19	19.71	231.58	1529.68
INTEREST, OPERATING CAPITAL	ACRE	.12		.00	2.39	6.85	8.40	9.95	11.44	12.44	13.17	.00	.10	.30	2.62	67.65
TOTAL PREHARVEST				.00	241.01	450.64	156.52	156.80	149.99	101.20	74.45	2.21	10.29	20.01	234.20	1597.33
HARVEST & MARKETING COST FOR WHOLESALE, FARMER'S MARKET, AND PICK YOUR OWN OPERATIONS:																
WHOLESALE:																
CUSTOM HARVEST	$/BU.	.60	1050.00									630.00				630.00
CUSTOM PACK	$/BU.	3.50	840.00									2940.00				2940.00
BROKERS FEE	$/BU.	.25	840.00									210.00				210.00
VARIABLE EQUIPMENT COST:																
BINS	EACH	.17										1.18				1.18
LADDERS	HR.	.01										.15				.15
PICKING SACKS	HR.	.01										.15				.15
TOTAL VAR. EQUIP. COST												1.48				1.48
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
FRONT END FORK LIFT	1.0.	•	10.50									10.50				10.50
OTHER:																.00
TRUCK, 2 TON	HRS.											5.51				5.51
TRACTOR, 60HP	HRS.											10.50				10.50
OTHER:																.00
VARIABLE FIELD MACHINE COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										11.69				11.69
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										57.34				57.34
TRACTOR, 60HP	HR.	5.10										53.55				53.55

WAGES	$/HR.	4.43										8.85	8.85	8.85	8.85	35.41
HAND	HRS.											16.00	16.00	16.00	16.00	64.00
WAGES	$/HR.	4.43										70.82	70.82	70.82	70.82	283.26
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43										.00	.00	.00	.00	.00
TOTAL LABOR COST												79.67	79.67	79.67	79.67	318.67
VARIABLE EQUIPMENT COST:																
MARKET COOLER	HR.	.03										2.01	1.01	1.01	1.01	5.03
TRUCK, 2 TON	HR.	10.40										20.80	20.80	20.80	20.80	83.20
TOTAL VAR. EQUIP. COST												22.81	21.81	21.81	21.81	88.23
TOTAL MARKETING CHARGE												102.48	101.47	101.47	101.47	406.90
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE			(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.		10.50									10.50				110.25
OTHER:																.00
TRUCK, 2 TON	HRS.											5.51				5.51
TRACTOR, 60HP	HRS.											10.50				10.50
OTHER:																.00
VARIABLE FIELD MACH. COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										11.69				11.69
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										57.34				57.34
TRACTOR, 60HP	HR.	5.10										53.55				53.55
OTHER:	HR.											.00				.00
TOTAL VAR. FIELD MACH. COST												122.59				122.59
FIELD LABOR:																
MACHINERY	HRS.											20.02				20.02
WAGES	$/HR.	4.43										88.59				88.59
HAND	HRS.															.00
WAGES	$/HR.	4.43										.00				.00
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43										.00				.00
TOTAL FIELD LABOR COST												88.59				88.59
TOTAL LABOR COST												875.28				875.28
OTHER:																.00
OTHER:																.00
SUBTOTAL				.00	.00	.00	.00	.00	.00	.00	.00	2461.56	106.26	106.26	106.26	2780.34
INTEREST, OPERATING CAPITAL	ACRE	.12		.00	.00	.00	.00	.00	.00	.00	.00	.00	1.06	2.14	3.22	6.42
TOTAL HARVEST & MARKET				.00	.00	.00	.00	.00	.00	.00	.00	2461.56	107.32	108.40	109.48	2786.76
TOTAL INTEREST, OPERATING CAPITAL				.00	2.39	6.85	8.40	9.95	11.44	12.44	13.17	.00	1.16	2.44	5.84	74.07
TOTAL OPERATING INPUTS				.00	241.01	450.64	156.52	156.80	149.99	101.20	74.45	2463.77	117.61	128.40	343.68	4384.08
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT.																

OTHER:											.00				.00
TOTAL VAR. FIELD MACH. COST											122.59				122.59
LABOR:															
MACHINERY	HRS.										20.02				20.02
WAGES	$/HR.	4.43									88.59				88.59
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
TOTAL LABOR COST											88.59				88.59
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	3992.65	.00	.00	.00	3992.65
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	3992.65	.00	.00	.00	3992.65
TOTAL INTEREST, OPERATING CAPITAL			.00	2.39	6.85	8.40	9.95	11.44	12.44	13.17	.00	.10	.30	2.62	67.65
TOTAL OPERATING INPUTS			.00	241.01	450.64	156.52	156.80	149.99	101.20	74.45	3994.86	10.29	20.01	234.20	5589.98
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															3623.77
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															3575.67
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													292.45
TRUCK, PU	DOL./HR.	4.16													.00
TRUCK, 2 TON	DOL./HR.	11.37													62.70
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./HR.	13.44													268.82
DRIP	DOL./HR.	3.37													67.45
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													71.61
AIR BLAST SPRAYER	DOL./HR.	13.03													57.72
SPRAYER W/BOOM	DOL./HR.	3.27													3.37
SPREADER	DOL./HR.	4.68													1.70
PNEUMATIC PRUNERS	DOL./HR.	2.08													79.10
FRONT END FORK LIFT	DOL./HR.	4.69													49.27
BINS	DOL/150 BU	11.94													83.61
LADDERS	DOL./HR.	.08													.79
PICKING SACKS	DOL./HR.	.08													.82
TOTAL FIXED COST															1039.41

RETURN TO OVERHEAD AND MANAGEMENT								2536.26
FARMER'S MARKET:								
CUSTOM HARVEST	$/BU.	.60	1050.00	630.00				630.00
PACKING CHARGE:								
LABOR:								
MACHINERY	HRS.			127.97				127.97
WAGES	$/HR.	4.43		566.39				566.39
HAND	HRS.			18.38				18.37
WAGES	$/HR.	4.43		81.33				81.33
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				647.72				647.72
VARIABLE EQUIPMENT COST:								
BINS	EACH	.17		1.18				1.18
LADDERS	HR.	.01		.15				.15
PICKING SACKS	HR.	.01		.15				.15
GRADER	HR.	2.83		29.69				29.69
BOX W/TRAYS	BU.	.71		559.13				559.12
FORKLIFT	HR.	3.40		26.78				26.78
COLD STORAGE	BU./MO.	.02		7.18	3.59	3.59	3.59	17.95
TOTAL VAR. EQUIP. COST				624.25	3.59	3.59	3.59	635.02
TOTAL PACKING CHARGE	ACRE			1271.97	3.59	3.59	3.59	1282.74
TOTAL PACKING CHARGE	BU.							1.63
CIDER JUICING CHARGE:								
LABOR:								
MACHINERY	HRS.			11.48				11.48
WAGES	$/HR.	4.43		50.83				50.83
HAND	HRS.			1.91				1.91
WAGES	$/HR.	4.43		8.47				8.47
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				59.30				59.30
VARIABLE EQUIPMENT COST:								
PRESS	HR.	1.85		11.34				11.34
JUG FILLER	HR.	.07		.11				.11
JUGS & LABELS	GAL.	.16		147.00				147.00
FORKLIFT	HR.	3.40		8.93				8.92
REFRIGERATED BULK TANK	GAL.	.02		16.86				16.86
COLD STORAGE	GAL./MO.	.01		2.39	1.20	1.20	1.20	5.98
TOTAL VAR. EQUIP. COST				186.63	1.20	1.20	1.20	190.22
TOTAL CIDER JUICING CHARGE	ACRE			245.93	1.20	1.20	1.20	249.52
TOTAL CIDER JUICING CHARGE	BU.							.27
MARKETING CHARGE:								
LABOR:								
MACHINERY	HRS.			2.00	2.00	2.00	2.00	8.00

OVERHEAD, AND MANAGEMENT															8635.92
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD & MANAGEMENT															8587.82
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													292.45
TRUCK, PU	DOL./HR.	4.16													.00
TRUCK, 2 TON	DOL./HR.	11.37													153.69
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./HR.	13.44													268.82
DRIP	DOL./HR.	3.37													67.45
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													71.61
AIR BLAST SPRAYER	DOL./HR.	13.03													57.72
SPRAYER W/BOOM	DOL./HR.	3.27													3.37
SPREADER	DOL./HR.	4.60													1.70
PNEUMATIC PRUNERS	DOL./HR.	2.08													79.10
FRONT END FORK LIFT	DOL./HR.	4.69													517.39
BINS	DOL/150 BU	11.94													83.61
LADDERS	DOL./HR.	.08													.79
PICKING SACKS	DOL./HR.	.08													.82
JUG FILLER	DOL./HR.	.45													.69
PALLETS	DOL/150 BU	.01													.07
GRADER	DOL./BU.	.02													19.08
HAND STAPLER	DOL./HR.	.03													.27
FORKLIFT	DOL./HR.	3.40													35.75
COLD STORAGE	DOL./BU.	.21													111.04
CIDER PRESS	DOL./GAL.	.03													24.18
REFRIGERATED BULK TANK	DOL./GAL.	.05													41.54
MARKET COOLER	DOL./GAL.	.04													36.20
MARKET SPACE	DOL./AC.	2% OF TOTAL SALES													260.40
TOTAL FIXED COST															2127.72
RETURN TO OVERHEAD AND MANAGEMENT															6460.10
PICK YOUR OWN MARKET:															
VARIABLE EQUIPMENT COST:															
1/2 BU. PICKING BAG	EACH	.28									588.00				588.00
OTHER:															.00
TOTAL VAR. EQUIP. COST											588.00				588.00
FIELD MACHINERY:															HRS.
WAGON	HRS.										5.25				5.25
TRACTOR, 60HP	HRS.										5.25				5.25
OTHER:															.00
VARIABLE FIELD MACHINE COST:															DOL.
WAGON	HR.	.18									.92				.92
TRACTOR, 60HP	HR.	5.10									26.78				26.78
OTHER:											.00				.00

TOTAL VAR. FIELD MACH. COST											27.69				27.69
LABOR:															
MACHINERY	HRS.										5.25				5.25
WAGES	$/HR.	4.43									23.24				23.24
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.										50.00				50.00
WAGES	$/HR.	4.43									221.30				221.30
TOTAL LABOR COST											244.54				244.54
ADVERTISING	ACRE										231.00				231.00
LIABILITY INSURANCE	ACRE										288.75				288.75
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	1379.98	.00	.00	.00	1379.98
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	1379.98	.00	.00	.00	1379.98
TOTAL INTEREST, OPERATING CAPITAL			.00	2.39	6.85	8.40	9.95	11.44	12.44	13.17	.00	.10	.30	2.62	67.65
TOTAL OPERATING INPUTS			.00	241.01	450.64	156.52	156.80	149.99	101.20	74.45	1382.19	10.29	20.01	234.20	2977.31
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															8572.69
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															8524.59
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 60HP	DOL./HR.	5.02													266.11
TRUCK, PU	DOL./HR.	4.16													.00
TRELLIS	DOL./AC.														.00
IRRIGATION:															
FROST	DOL./HR.	13.44													268.82
DRIP	DOL./HR.	3.37													67.45
MOWER/BRUSH CHOPPER	DOL./HR.	18.14													71.61
AIR BLAST SPRAYER	DOL./HR.	13.03													57.72
SPRAYER W/BOOM	DOL./HR.	3.27													3.37
SPREADER	DOL./HR.	4.68													1.70
PNEUMATIC PRUNERS	DOL./HR.	2.08													79.10
WAGON	DOL./HR.	6.05													31.75
FRUIT PICKER	DOL./AC.	45.32													45.32
CHECK FACILITIES	DOL./AC.	1.55													1.55
TOTAL FIXED COST															894.50
RETURN TO OVERHEAD AND MANAGEMENT															7630.09

TREE	SPACING	DENSITY
SEMI-DWARF	20' X 6'	363/AC.

CATEGORY:	PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8
WHOLESALE:									
RETURN TO OVERHEAD AND MANAGEMENT		-2357.47	-913.54	-986.75	-961.41	745.08	2969.39	2825.23	2514.35
ACCUMULATED NET RETURNS		-2357.47	-3271.01	-4257.76	-5219.17	-4474.09	-1504.70	1320.53	3834.88
DISCOUNT RATE	.12								
NET PRESENT VALUE		-2104.88	-728.27	-702.35	-610.99	422.78	1504.39	1277.99	1015.50
ACCUMULATED NET PRESENT VALUE		-2104.88	-2833.15	-3535.50	-4146.50	-3723.72	-2219.33	-941.34	74.16
INTERNAL RATE OF RETURN, %						>0 BUT <.1			
VALUE OF ANNUITY		-2357.47	-1676.37	-1472.00	-1365.17	-1033.00	-539.80	-206.26	14.93
FARMER'S MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-2357.47	-913.54	-986.75	-563.88	2665.65	6866.28	6722.13	6411.24
ACCUMULATED NET RETURNS		-2357.47	-3271.01	-4257.76	-4821.64	-2155.99	4710.29	11432.42	17843.66
DISCOUNT RATE	.12								
NET PRESENT VALUE		-2104.88	-728.27	-702.35	-358.36	1512.56	3478.67	3040.75	2589.39
ACCUMULATED NET PRESENT VALUE		-2104.88	-2833.15	-3535.50	-3893.86	-2381.30	1097.38	4138.13	6727.52
INTERNAL RATE OF RETURN, %						>0 BUT <.1			
VALUE OF ANNUITY		-2357.47	-1676.37	-1472.00	-1281.99	-660.59	266.91	906.74	1354.27
PICK YOUR OWN MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-2357.47	-913.54	-986.75	-208.24	3285.58	8063.22	7919.06	7608.18
ACCUMULATED NET RETURNS		-2357.47	-3271.01	-4257.76	-4466.00	-1180.42	6882.80	14801.86	22410.04
DISCOUNT RATE	.12								
NET PRESENT VALUE		-2104.88	-728.27	-702.35	-132.34	1864.33	4085.08	3582.18	3072.82
ACCUMULATED NET PRESENT VALUE		-2104.88	-2833.15	-3535.50	-3667.84	-1803.52	2281.56	5863.74	8936.56
INTERNAL RATE OF RETURN, %						>0 BUT <.1			
VALUE OF ANNUITY		-2357.47	-1676.37	-1472.00	-1207.58	-500.31	554.93	1284.85	1798.95

YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
2514.35	2514.35	2514.35	2514.35	2514.35	2514.35	2514.35	2514.35	2514.35	2514.35	2514.35	2514.35
6349.23	8863.58	11377.93	13892.28	16406.63	18920.98	21435.33	23949.68	26464.03	28978.38	31492.73	34007.08
906.70	809.55	722.82	645.37	576.22	514.49	459.36	410.14	366.20	326.97	291.93	260.65
980.86	1790.42	2513.23	3158.60	3734.83	4249.31	4708.68	5118.82	5485.02	5811.99	6103.92	6364.57
	26.70					31.20					32.10
184.09	316.88	423.27	509.91	581.43	641.10	691.35	733.99	770.41	801.69	828.69	852.08
6411.24	6411.24	6411.24	6411.24	6411.24	6411.24	6411.24	6411.24	6411.24	6411.24	6411.24	6411.24
24254.90	30666.14	37077.38	43488.62	49899.86	56311.10	62722.34	69133.58	75544.82	81956.06	88367.30	94778.54
2311.96	2064.25	1843.08	1645.61	1469.29	1311.87	1171.31	1045.81	933.76	833.72	744.39	664.63
9039.47	11103.72	12946.80	14592.41	16061.70	17373.56	18544.87	19590.69	20524.45	21358.16	22102.55	22767.18
	50.60					53.10					53.40
1696.52	1965.18	2180.44	2355.75	2500.44	2621.17	2722.84	2809.11	2882.80	2946.09	3000.71	3048.04
7608.18	7608.18	7608.18	7608.18	7608.18	7608.18	7608.18	7608.18	7608.18	7608.18	7608.18	7608.18
30018.22	37626.40	45234.58	52842.76	60450.94	68059.12	75667.30	83275.48	90883.66	98491.84	106100.02	113708.20
2743.59	2449.63	2187.17	1952.83	1743.60	1556.78	1389.99	1241.06	1108.09	989.36	883.36	788.72
11680.15	14129.78	16316.95	18269.78	20013.37	21570.16	22960.14	24201.20	25309.29	26298.66	27182.02	27970.73
	54.20					56.50					56.70
2192.12	2500.75	2748.03	2949.41	3115.63	3254.32	3371.11	3470.21	3554.86	3627.57	3690.31	3744.69

APPENDIX D

DATA FOR THE DWARF ORCHARD UNDER

THREE MARKETING ALTERNATIVES

PREHARVEST
POWER AND LABOR REQUIREMENTS PER ACRE

YEAR	ROOTSTOCK	SPACING	TREES/AC.
FIVE+	DWARF	12' X 4'	908

MONTH	TYPE OF OPERATION	TIMES	EQUIPMENT USED	MACH./HRS.	LABOR HRS.
JAN.-FEB.	PRUNE & TRAIN		HAND		20.25
	CHOP BRUSH		MOWER/CHOPPER	.90	1.13
	HERBICIDE		SPRAYER W/BOOM	.29	.36
			TRACTOR*		
MARCH	IRRIGATION	4	FROST	20.00	4.00
	FERTILIZE SOD		SPREADER	.28	.35
	LIME		SPREADER	.06	.07
	FERTILIZE TREES		SPREADER	.28	.35
	INSECTICIDE & FUNGICIDE		AIR BLAST SPRAYER	.38	.48
APRIL	INSECTICIDE & FUNGICIDE	5	AIR BLAST SPRAYER	1.90	2.38
	HERBICIDE		SPRAYER W/BOOM	.29	.36
	MOW		MOWER/CHOPPER	.90	1.13
	GROWTH REGULATOR		AIR BLAST SPRAYER	.38	.48
MAY	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	1.14	1.43
	PRUNE & TRAIN		HAND		7.50
	CHOP BRUSH		MOWER/CHOPPER	.90	1.13
	CHEMICAL THIN		AIR BLAST SPRAYER	.13	.16
	GROWTH REGULATOR		AIR BLAST SPRAYER	.38	.48
JUNE	INSECTICIDE & FUNGICIDE	3	AIR BLAST SPRAYER	1.14	1.43
	MOW		MOWER/CHOPPER	.90	1.13
	PRUNE & TRAIN		HAND		7.50
	CHOP BRUSH		MOWER/CHOPPER	.90	1.13
	SUCKER CONTROL		HAND		6.25
JULY	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.76	.95
	IRRIGATION	2	IRRIGATION	10.00	2.00
AUGUST	MOW		MOWER/CHOPPER	.90	1.13
	IRRIGATION	2	IRRIGATION	10.00	2.00
	INSECTICIDE & FUNGICIDE	2	AIR BLAST SPRAYER	.76	.95
	STOP DROP		AIR BLAST SPRAYER	.38	.48
SEPT.	HARVEST**				
	MONITOR VOLE BAIT STATION		HAND		1.00
OCT.	HERBICIDE		SPRAYER W/BOOM	.29	.36
	MONITOR VOLE BAIT STATION		HAND		1.00
NOV.	BAIT VOLE STATIONS		HAND		1.50
DEC.	MONITOR VOLE BAIT STATION		HAND		1.00
	PRUNE & TRAIN		HAND		20.25
	CHOP BRUSH		MOWER/CHOPPER	.90	1.13

*TRACTOR HOURS ARE THE SUM OF THE TRACTOR IMPLEMENT HOURS.
**ALL HARVEST EQUIPMENT AND LABOR ARE A FUNCTION OF SALES OR PRODUCTION AND ARE NOT INCLUDED HERE.

YEAR	TREE	SPACING	DENSITY
FIVE+	DWARF	12' X 4'	900/AC.

CATEGORY:	UNIT	PRICE	RECOM. QUAN.	1 JAN	2 FEB	3 MARCH	4 APRIL	5 MAY	6 JUNE	7 JULY	8 AUG	9 SEPT	10 OCT	11 NOV	12 DEC	TOTAL
PRODUCTION:	BU.		1450.00													
FRESH:																
72'S (QUAN.)	BU.		217.50									217.50				217.50
WHOLESALE	$/BU.	11.50										2501.25				2501.25
(QUAN.)	BU.		217.50									87.00	43.50	43.50	43.50	217.50
FARMER'S MKT.	$/BU.	13.50										1174.50	587.25	587.25	587.25	2936.25
80'S (QUAN.)	BU.		217.50									217.50				217.50
WHOLESALE	$/BU.	11.00										2392.50				2392.50
(QUAN.)	BU.		217.50									87.00	43.50	43.50	43.50	217.50
FARMER'S MKT.	$/BU.	13.00										1131.00	565.50	565.50	565.50	2827.50
88'S (QUAN.)	BU.		217.50									217.50				217.50
WHOLESALE	$/BU.	10.50										2283.75				2283.75
(QUAN.)	BU.		217.50									87.00	43.50	43.50	43.50	217.50
FARMER'S MKT.	$/BU.	12.50										1087.50	543.75	543.75	543.75	2718.75
100'S (QUAN.)	BU.		217.50									217.50				217.50
WHOLESALE	$/BU.	10.00										2175.00				2175.00
(QUAN.)	BU.		217.50									87.00	43.50	43.50	43.50	217.50
FARMER'S MKT.	$/BU.	12.00										1044.00	522.00	522.00	522.00	2610.00
113'S (QUAN.)	BU.		108.75									108.75				108.75
WHOLESALE	$/BU.	9.50										1033.13				1033.13
(QUAN.)	BU.		108.75									43.50	21.75	21.75	21.75	108.75
FARMER'S MKT.	$/BU.	11.50										500.25	250.13	250.13	250.13	1250.63
125'S (QUAN.)	BU.		108.75									108.75				108.75
WHOLESALE	$/BU.	9.00										978.75				978.75
(QUAN.)	BU.		108.75									43.50	21.75	21.75	21.75	108.75
FARMER'S MKT.	$/BU.	11.00										478.50	239.25	239.25	239.25	1196.25
12/3 LB. BAGS	BU.		72.50									72.50				72.50
WHOLESALE	$/BU.	7.75										561.88				561.87
QUANITY	BU.		1450.00									1450.00				1450.00
PICK YOUR OWN	$/BU.	11.00										15950.00				15950.00
OTHER: (QUAN.)	BU.															.00
TOTAL FRESH QUANITY:																
WHOLESALE	BU.		1160.00									1160.00	.00	.00	.00	1160.00
FARMER'S MKT.	BU.		1087.50									435.00	217.50	217.50	217.50	1087.50
PICK YOUR OWN	BU.		1450.00									1450.00	.00	.00	.00	1450.00
TOTAL FRESH RECEIPTS:																
WHOLESALE												11926.25				11926.25
FARMER'S MKT.												5415.75	2707.88	2707.88	2707.88	13539.38
PICK YOUR OWN												15950.00				15950.00
PROCESSED:																

CULLS (QUAN.)	BU.		290.00									290.00				290.00
WHOLESALE	$/BU.	2.75										797.50				797.50
CULLS (QUAN.)	BU.		362.50									362.50				362.50
GAL./BU.			3.50													
JUICE (QUAN.)	GAL.		1268.75									507.50	253.75	253.75	253.75	1268.75
FARMER'S MKT.	$/GAL.	3.50										1776.25	888.13	888.13	888.13	4440.63
TOTAL PROC. QUANITY:																
WHOLESALE	BU.											290.00				290.00
FARMER'S MKT.	BU.											362.50				362.50
TOTAL PROC. RECEIPTS:																
WHOLESALE												797.50				797.50
FARMER'S MKT.												1776.25	888.13	888.13	888.13	4440.63
TOTAL QUANITY	BU.		1450.00									1450.00				1450.00
TOTAL RECEIPTS:																
WHOLESALE												12723.75				12723.75
FARMER'S MKT.												7192.00	3596.00	3596.00	3596.00	17980.00
PICK YOUR OWN												15950.00				15950.00
OPERATING INPUTS:																
PREHARVEST COSTS:																
TREES	EACH	3.25														.00
SUBSOIL, CUSTOM	HR.	41.66														.00
DIG HOLES, CUSTOM	EACH	.30														.00
TREE GUARDS	EACH	.27														.00
ROOF SHINGLES	EACH	1.20														.00
SPREADERS	EACH															.00
NAILS	LBS.															.00
FERTILIZER:																
LIME	TON	9.00	.40			3.60										3.60
AMMONIUM NITRATE	CWT.	10.00														.00
CALCIUM NITRATE	CWT.	10.50	37.80			396.90										396.90
SODIUM NITRATE	CWT.	12.80														.00
10-10-10	CWT.	7.40	1.50			11.10										11.10
UREA, 46%	CWT.	11.40														.00
OTHER:																.00
TOTAL FERTILIZER				.00	.00	411.60	.00	.00	.00	.00	.00	.00	.00	.00	.00	411.60
INSECTICIDE:																
AMBUSH	OZ.	1.09														.00
CYGON (DEFEND), 2.7 EC	OZ.	1.56														.00
DEMETON (SYSTOX)	OZ.	.47														.00
ETHION																.00
GUTHION, 50WP	LBS.	6.10	.73						13.36	8.91						22.27
IMIDAN (PROLATE), 50WP	LBS.	2.80	1.22					10.25								10.25
KELTHANE, 35WP	LBS.	3.98														.00
LORSBAN, 4EC	PTS.	5.58														.00
MALATHION, 25WP	LBS.	1.49														.00
METHOXYCHLOR, 24 EC	PTS.	2.13														.00
SUBTOTAL				.00	.00	.00	.00	10.25	13.36	8.91	.00	.00	.00	.00	.00	
OIL, SUPERIOR	GAL.	5.40	3.67			19.82										19.82

OMITE, 30WP	LBS.	3.75														.00
PARATHION, 15WP	LBS.	.98	2.44				4.78									4.78
PHOSALONE	PTS.	3.58														.00
PLICTRAN, 50WP	LBS.	20.63														.00
POUNCE, 3.3 EC	OZ.	1.32														.00
PYDRIN, 2.4 EC	OZ.	.99														.00
SEVIN, 50WP	LBS.	2.33														.00
THIODAN, 50WP	LBS.	5.10														.00
OTHER:																.00
TOTAL INSECTICIDE				.00	.00	19.82	4.78	10.25	13.36	8.91	.00	.00	.00	.00	.00	57.11
FUNGICIDE:																
BAYLETON, 50WP	OZ.	3.38														.00
BENLATE (BENOMYL), 50WP	OZ.	.74														.00
CAPTAN, 50WP	LBS.	1.55	2.44						11.35	7.56						18.91
CYPREX (DODINE), 65WP	LBS.	5.88														.00
DITOLATAN	PTS.	3.34	10.33			61.22										61.22
DIKAR, 76.6WP	LBS.	2.00	2.44				9.76	14.64								24.40
FERBAM, 76WP	LBS.	2.47														.00
FUNGINEX	PTS.	9.28														.00
GLYODIN	PTS.	2.20														.00
KARATHANE, MILDEX, 25WP	LBS.	4.05														.00
SUBTOTAL				.00	.00	61.22	9.76	14.64	11.35	7.56	.00	.00	.00	.00	.00	
MANCOZEB																.00
MANEB, 80WP	LBS.	2.10														.00
PHALTAN (FOLPET), 50WP	LBS.	2.16														.00
POLYRAM, 80WP	LBS.	1.83														.00
RIDOMIL	OZ.	.91														.00
STREPTOMYCIN, 21.2WP	LBS.	7.02	.61				12.85									12.85
ZINEB, 75WP	LBS.	1.02														.00
OTHER:																.00
TOTAL FUNGICIDE				.00	.00	61.22	22.61	14.64	11.35	7.56	.00	.00	.00	.00	.00	117.38
HERBICIDE:																
DALAPON (DOWPON M) 85SP	LBS.	2.11														.00
DICHLOBENIL (CASORON) 50WP	LBS.	1.23														.00
FUSILADE 4E	PTS.	35.46														.00
KARMEX 80WP	LBS.	4.25														.00
PARAQUAT CL	QTS.	10.70	.33			3.53							3.53			7.06
PRINCEP 80WP	LBS.	3.18	.83			2.64							2.64			5.28
ROUNDUP	OZS.	.65														.00
SIMAZINE	QTS.	3.46														.00
SOILCAM 80WP	LBS.	11.83														.00
SURFLAN 75WP	LBS.	9.78	.88		8.61											8.61
TERBACIL (SINBAR) 80WP	LBS.	19.80														.00
OTHER:																.00
TOTAL HERBICIDE				.00	8.61	6.17	.00	.00	.00	.00	.00	.00	6.17	.00	.00	20.95
GROWTH REGULATORS:																
ALAR 85WP	LBS.	21.00	1.22					25.62								25.62
ETHERAL	PTS.	7.01														.00
NAA (KLING-TITE)	PTS.	4.75	.16								.76					.76
NAD	OZ.															.00
PROMALIN	PTS.	43.45	.61				26.50									26.50
SEVIN, 50WP	LBS.	2.33	.15					.36								.36
NAA (TREE HOLD)	GAL.	42.90	.93						39.90							39.90

TOTAL GROWTH REGULATORS				.00	.00	.00	26.50	25.98	39.90	.00	.76	.00	.00	.00	.00	93.14
SURFACTANT:																
ORTHO X 77	PTS.	1.75	.17			.29							.29			.58
OTHER:																.00
TOTAL SURFACTANT				.00	.00	.29	.00	.00	.00	.00	.00	.00	.29	.00	.00	.58
RODENTICIDE:																
ENDRIN	PTS.															.00
RAMIK	LBS.															.00
ROZOL (GR. SPRAY)	PTS.															.00
ROZOL (BAIT)	LBS.															.00
ZP RODENT BAIT AG	LBS.	1.91	10.00											19.10		19.10
OTHER:																.00
TOTAL RODENTICIDE				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	19.10	.00	19.10
BEEHIVE, RENTED	ACRE	10.00	1.00				10.00									10.00
IRRIGATION:																
VARIABLE EQUIPMENT COST:																
IRRIGATION, FROST	HRS.					20.00										20.00
	$/HR.	2.68		.00	.00	53.54	.00	.00	.00	.00	.00	.00	.00	.00	.00	53.54
IRRIGATION, DRIP	HRS.									10.00	10.00					20.00
	$/HR.	2.89		.00	.00	.00	.00	.00	.00	28.88	28.88	.00	.00	.00	.00	57.75
OTHER:																.00
TOTAL VAR. EQUIP. COST				.00	.00	53.54	.00	.00	.00	28.88	28.88	.00	.00	.00	.00	111.30
LABOR:																
MACHINE	HRS.			.00	.00	4.00	.00	.00	.00	2.00	2.00	.00	.00	.00	.00	8.00
WAGE	$/HR.	4.43		.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
HAND	HRS.															.00
WAGE	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SUPERVISION	HRS.															.00
WAGE	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL LABOR				.00	.00	17.70	.00	.00	.00	8.85	8.85	.00	.00	.00	.00	35.41
TOTAL IRRIGATION				.00	.00	71.25	.00	.00	.00	37.73	37.73	.00	.00	.00	.00	146.71
MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
MOWER	T.O.		.90				.90		.90		.90					2.70
BRUSH CHOPPER	T.O.		1.80		.90			.90	.90						.90	3.59
AIR BLAST SPRAYER	T.O.		.38			.38	2.29	1.91	1.15	.76	1.15					7.64
SPRAYER W/BOOM	T.O.		.29		.29		.29						.29			.86
SPREADER	T.O.		.28			.61										.61
PNEUMATIC PRUNERS	HRS.															.00
OTHER:																.00
TRUCK, PU	HRS.															.00
TRACTOR, 40HP	HRS.			.00	1.19	.99	3.48	2.81	2.94	.76	2 04	.00	.29	.00	.90	15.39
OTHER:																.00
VARIABLE MACHINE COST:		($/HR.)														DOL.
MOWER	ACRE	8.30		.00	.00	.00	7.46	.00	7.46	.00	7.46	.00	.00	.00	.00	22.38
BRUSH CHOPPER	ACRE	8.30		.00	7.46	.00	.00	7.46	7.46	.00	.00	.00	.00	.00	7.46	29.84
AIR BLAST SPRAYER	ACRE	4.05		.00	.00	1.55	9.28	7.73	4.64	3.09	4 64	.00	.00	.00	.00	30.92
SPRAYER W/BOOM	ACRE	1.21		.00	.35	.00	.35	.00	.00	.00	.00	.00	.35	.00	.00	1.04

SPREADER	ACRE	.65		.00	.00	.39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.39
PNEUMATIC PRUNERS	ACRE	.85		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCK, PU	ACRE	5.01		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRACTOR, 40HP	ACRE	3.40		.00	4.03	3.36	11.82	9.55	10.01	2.60	6.95	.00	.97	.00	3.06	52.34
OTHER:				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL VARIABLE MACHINE COST:				.00	11.83	5.30	28.90	24.74	29.56	5.69	19.05	.00	1.32	.00	10.51	136.91
FIELD LABOR:																
MACHINERY	HRS.			.00	1.48	1.23	4.35	3.51	3.68	.95	2.56	.00	.36	.00	1.12	19.24
WAGES	$/HR.	4.43		.00	6.56	5.46	19.24	15.54	16.28	4.23	11.31	.00	1.58	.00	4.97	85.17
HAND	HRS.				20.25			7.50	13.75			1.00	1.00	1.50	21.25	66.25
WAGES	$/HR.	4.43		.00	89.63	.00	.00	33.20	60.86	.00	.00	4.43	4.43	6.64	94.05	293.22
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL FIELD LABOR				.00	96.18	5.46	19.24	48.73	77.14	4.23	11.31	4.43	6.01	6.64	99.02	378.39
TOTAL LABOR COST				.00	96.18	23.16	19.24	48.73	77.14	13.08	20.16	4.43	6.01	6.64	99.02	413.80
OTHER:																.00
OTHER:																.00
SUBTOTAL				.00	116.62	581.10	112.03	124.34	171.31	64.11	68.85	4.43	13.79	25.74	109.54	1391.86
INTEREST, OPERATING CAPITAL	ACRE	.12		.00	1.17	6.99	8.18	9.50	11.31	12.07	12.88	.00	.14	.40	1.50	64.12
TOTAL PREHARVEST				.00	117.79	588.09	120.21	133.84	182.62	76.18	81.73	4.43	13.93	26.14	111.04	1455.99
HARVEST & MARKETING COST FOR WHOLESALE, FARMER'S MARKET, AND PICK YOUR OWN OPERATIONS:																
WHOLESALE:																
CUSTOM HARVEST	$/BU.	.60	1450.00									870.00				870.00
CUSTOM PACK	$/BU.	3.50	1160.00									4060.00				4060.00
BROKERS FEE	$/BU.	.25	1160.00									290.00				290.00
VARIABLE EQUIPMENT COST:																
BINS	EACH	.17										1.62				1.62
LADDERS	HR.											.00				.00
PICKING SACKS	HR.	.01										.21				.21
TOTAL VAR. EQUIP. COST												1.84				1.84
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE:			(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.		14.50									14.50				14.50
OTHER:																.00
TRUCK, 2 TON	HRS.											7.61				7.61
TRACTOR, 40HP	HRS.											14.50				14.50
OTHER:																.00
VARIABLE FIELD MACHINE COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										16.15				16.15
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										79.19				79.19
TRACTOR, 40HP	HR.	3.40										49.30				49.30

OTHER:											.00				.00
TOTAL VAR. FIELD MACH. COST			------	------	------	------	------	------	------	------	144.64	------	------	------	144.64
LABOR:															
MACHINERY	HRS.										27.64				27.64
WAGES	$/HR.	4.43									122.34				122.34
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
TOTAL LABOR COST			------	------	------	------	------	------	------	------	122.34	------	------	------	122.34
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	5488.81	.00	.00	.00	5488.81
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	5488.81	.00	.00	.00	5488.81
TOTAL INTEREST, OPERATING CAPITAL			.00	1.17	6.99	8.18	9.50	11.31	12.07	12.88	.00	.14	.40	1.50	64.12
TOTAL OPERATING INPUTS			.00	117.79	588.09	120.21	133.84	182.62	76.18	81.73	5493.23	13.93	26.14	111.04	6944.79
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															5778.96
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															5730.86
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 40HP	DOL./HR.	3.35													100.21
TRUCK, PU	DOL./HR.	4.16													.00
TRUCK, 2 TON	DOL./HR.	11.37													86.58
TRELLIS	DOL./AC.	41.02													41.02
IRRIGATION:															
FROST	DOL./HR.	13.44													268.82
DRIP	DOL./HR.	4.19													83.89
MOWER/BRUSH CHOPPER	DOL./HR.	15.98													100.53
AIR BLAST SPRAYER	DOL./HR.	6.82													52.10
SPRAYER W/BOOM	DOL./HR.	3.27													2.41
SPREADER	DOL./HR.	4.68													2.83
PNEUMATIC PRUNERS	DOL./HR.	2.08													.00
FRONT END FORK LIFT	DOL./HR.	4.69													68.05
BINS	DOL/150 BU	11.94													115.46
LADDERS	DOL./HR.														.00
PICKING SACKS	DOL./HR.	.08													1.13
TOTAL FIXED COST															923.43

RETURN TO OVERHEAD AND MANAGEMENT								4807.43
FARMER'S MARKET:								
CUSTOM HARVEST	$/BU.	.60	1450.00	870.00				870.00
PACKING CHARGE:								
LABOR:								
MACHINERY	HRS.			176.72				176.72
WAGES	$/HR.	4.43		782.16				782.16
HAND	HRS.			25.38				25.38
WAGES	$/HR.	4.43		112.31				112.31
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				894.47				894.47
VARIABLE EQUIPMENT COST:								
BINS	EACH	.17		1.62				1.62
LADDERS	HR.	.00		.00				.00
PICKING SACKS	HR.	.01		.21				.21
GRADER	HR.	2.83		41.00				41.00
BOX W/TRAYS	BU.	.71		772.13				772.12
FORKLIFT	HR.	3.40		36.98				36.98
COLD STORAGE	BU./MO.	.02		9.92	4.96	4.96	4.96	24.79
TOTAL VAR. EQUIP. COST				861.86	4.96	4.96	4.96	876.73
TOTAL PACKING CHARGE	ACRE			1756.32	4.96	4.96	4.96	1771.20
TOTAL PACKING CHARGE	BU.							1.63
CIDER JUICING CHARGE:								
LABOR:								
MACHINERY	HRS.			15.86				15.86
WAGES	$/HR.	4.43		70.19				70.19
HAND	HRS.			2.64				2.64
WAGES	$/HR.	4.43		11.70				11.70
SUPERVISION	HRS.							.00
WAGES	$/HR.	4.43		.00				.00
TOTAL LABOR COST				81.89				81.89
VARIABLE EQUIPMENT COST:								
PRESS	HR.	1.85		15.66				15.66
JUG FILLER	HR.	.07		.15				.15
JUGS & LABELS	GAL.	.16		203.00				203.00
FORKLIFT	HR.	3.40		12.33				12.33
REFRIGERATED BULK TANK	GAL.	.02		23.28				23.28
COLD STORAGE	GAL./MO.	.01		3.31	1.65	1.65	1.65	8.26
TOTAL VAR. EQUIP. COST				257.73	1.65	1.65	1.65	262.69
TOTAL CIDER JUICING CHARGE	ACRE			339.62	1.65	1.65	1.65	344.58
TOTAL CIDER JUICING CHARGE	BU.							.27
MARKETING CHARGE:								
LABOR:								
MACHINERY	HRS.			2.00	2.00	2.00	2.00	8.00

WAGES	$/HR.	4.43										8.85	8.85	8.85	8.85	35.41
HAND	HRS.											16.00	16.00	16.00	16.00	64.00
WAGES	$/HR.	4.43										70.82	70.82	70.82	70.82	283.26
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43										.00	.00	.00	.00	.00
TOTAL LABOR COST												79.67	79.67	79.67	79.67	318.67
VARIABLE EQUIPMENT COST:																
MARKET COOLER	HR.	.03										2.78	1.39	1.39	1.39	6.94
TRUCK, 2 TON	HR.	10.40										20.80	20.80	20.80	20.80	83.20
TOTAL VAR. EQUIP. COST												23.58	22.19	22.19	22.19	90.14
TOTAL MARKETING CHARGE												103.24	101.86	101.86	101.86	408.81
FIELD MACHINERY:																
TIMES OVER/HRS. PER ACRE.			(HRS/T.O)													HRS.
FRONT END FORK LIFT	T.O.		14.50									14.50				210.25
OTHER:																.00
TRUCK, 2 TON	HRS.											7.61				7.61
TRACTOR, 40HP	HRS.											14.50				14.50
OTHER:																.00
VARIABLE FIELD MACH. COST:																DOL.
FRONT END FORK LIFT	HR.	1.11										16.15				16.15
OTHER:												.00				.00
TRUCK, 2 TON	HR.	10.40										79.19				79.19
TRACTOR, 40HP	HR.	3.40										49.30				49.30
OTHER:	HR.											.00				.00
TOTAL VAR. FIELD MACH. COST												144.64				144.64
FIELD LABOR:																
MACHINERY	HRS.											27.64				27.64
WAGES	$/HR.	4.43										122.34				122.34
HAND	HRS.															.00
WAGES	$/HR.	4.43										.00				.00
SUPERVISION	HRS.															.00
WAGES	$/HR.	4.43										.00				.00
TOTAL FIELD LABOR COST												122.34				122.34
TOTAL LABOR COST												1178.36				1178.36
OTHER:																.00
OTHER:																.00
SUBTOTAL				.00	.00	.00	.00	.00	: .00	.00	.00	3336.16	108.47	108.47	108.47	3661.57
INTEREST, OPERATING CAPITAL	ACRE	.12		.00	.00	.00	.00	.00	.00	.00	.00	.00	1.08	2.18	3.29	6.55
TOTAL HARVEST & MARKET				.00	.00	.00	.00	.00	.00	.00	.00	3336.16	109.55	110.65	111.75	3668.12
TOTAL INTEREST, OPERATING CAPITAL				.00	1.17	6.99	8.18	9.50	11.31	12.07	12.88	.00	1.22	2.58	4.78	70.68
TOTAL OPERATING INPUTS				.00	117.79	588.09	120.21	133.84	182.62	76.18	81.73	3340.59	123.48	136.78	222.79	5124.10

RETURN TO LAND, CAPITAL,
MACHINERY & EQUIPMENT,

OVERHEAD, AND MANAGEMENT				12855.90
LAND CHARGE	ACRE	48.10		48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD & MANAGEMENT				12807.80
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)				
TRACTOR, 40HP	DOL./HR.	3.35		100.21
TRUCK, PU	DOL./HR.	4.16		.00
TRUCK, 2 TON	DOL./HR.	11.37		177.57
TRELLIS	DOL./AC.	41.02		41.02
IRRIGATION:				
FROST	DOL./HR.	13.44		268.82
DRIP	DOL./HR.	4.19		83.89
MOWER/BRUSH CHOPPER	DOL./HR.	15.98		100.53
AIR BLAST SPRAYER	DOL./HR.	6.82		52.10
SPRAYER W/BOOM	DOL./HR.	3.27		2.81
SPREADER	DOL./HR.	4.68		2.83
PNEUMATIC PRUNERS	DOL./HR.	2.08		.00
FRONT END FORK LIFT	DOL./HR.	4.69		986.67
BINS	DOL/150 BU	11.94		115.46
LADDERS	DOL./HR.	.00		.00
PICKING SACKS	DOL./HR	.08		1.13
JUG FILLER	DOL./HR	.45		.95
PALLETS	DOL/150 BU	.01		.09
GRADER	DOL./BU.	.02		26.35
HAND STAPLER	DOL./HR.	.03		.37
FORKLIFT	DOL./HR.	3.40		49.37
COLD STORAGE	DOL./BU.	.21		153.34
CIDER PRESS	DOL./GAL.	.03		33.39
REFRIGERATED BULK TANK	DOL./GAL.	.05		57.36
MARKET COOLER	DOL./GAL.	.04		50.00
MARKET SPACE	DOL./AC.	2% OF TOTAL SALES		359.60
TOTAL FIXED COST				2663.85
RETURN TO OVERHEAD AND MANAGEMENT				10143.95
PICK YOUR OWN MARKET:				
VARIABLE EQUIPMENT COST:				
1/2 BU. PICKING BAG	EACH	.28	812.00	812.00
OTHER:				.00
TOTAL VAR. EQUIP. COST			812.00	812.00
FIELD MACHINERY:				HRS.
WAGON	HRS.		7.25	7.25
TRACTOR, 40HP	HRS.		7.25	7.25
OTHER:				.00
VARIABLE FIELD MACHINE COST:				DOL.
WAGON	HR.	.18	1.27	1.27
TRACTOR, 40HP	HR.	3.40	24.65	24.65
OTHER:			.00	.00

TOTAL VAR. FIELD MACH. COST											25.92				25.92
LABOR:															
MACHINERY	HRS.										7.25				7.25
WAGES	$/HR.	4.43									32.09				32.09
HAND	HRS.														.00
WAGES	$/HR.	4.43									.00				.00
SUPERVISION	HRS.										50.00				50.00
WAGES	$/HR.	4.43									221.30				221.30
TOTAL LABOR COST											253.39				253.39
ADVERTISING	ACRE										319.00				319.00
LIABILITY INSURANCE	ACRE										398.75				398.75
OTHER:															.00
OTHER:															.00
SUBTOTAL			.00	.00	.00	.00	.00	.00	.00	.00	1809.06	.00	.00	.00	1809.06
INTEREST, OPERATING CAPITAL	ACRE	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL HARVEST & MARKET			.00	.00	.00	.00	.00	.00	.00	.00	1809.06	.00	.00	.00	1809.06
TOTAL INTEREST, OPERATING CAPITAL			.00	1.17	6.99	8.18	9.50	11.31	12.07	12.88	.00	.14	.40	1.50	64.12
TOTAL OPERATING INPUTS			.00	117.79	588.09	120.21	133.84	182.62	26.18	81.73	1813.48	11.93	26.14	111.04	3265.04
RETURN TO LAND, CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															12684.96
LAND CHARGE	ACRE	48.10													48.10
RETURN TO CAPITAL, MACHINERY & EQUIPMENT, OVERHEAD, AND MANAGEMENT															12636.86
FIXED COST: (INSURANCE, DEPRECIATION, SHELTER, AND INTEREST)															
TRACTOR, 40HP	DOL./HR.	3.35													75.91
TRUCK, PU	DOL./HR.	4.16													.00
TRELLIS	DOL./AC.	41.02													41.02
IRRIGATION:															
FROST	DOL./HR.	13.44													268.82
DRIP	DOL./HR.	4.19													83.89
MOWER/BRUSH CHOPPER	DOL./HR.	15.98													100.53
AIR BLAST SPRAYER	DOL./HR.	6.82													52.10
SPRAYER W/BOOM	DOL./HR.	3.27													2.81
SPREADER	DOL./HR.	4.68													2.83
PNEUMATIC PRUNERS	DOL./HR.	2.08													.00
WAGON	DOL./HR.	6.05													43.85
FRUIT PICKER	DOL./AC.														45.32
CHECK FACILITIES	DOL./AC.	1.55													1.55
TOTAL FIXED COST															718.63
RETURN TO OVERHEAD AND MANAGEMENT															11918.23

TREE	SPACING	DENSITY
DWARF	12' X 4'	908/AC.

CATEGORY:	PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8
WHOLESALE:									
RETURN TO OVERHEAD AND MANAGEMENT		-4948.80	-1083.81	-1252.66	83.50	4794.91	4794.91	4794.91	4794.91
ACCUMULATED NET RETURNS		-4948.80	-6032.61	-7285.27	-7201.77	-2406.86	2388.05	7182.96	11977.87
DISCOUNT RATE	.12								
NET PRESENT VALUE		-4418.57	-864.01	-891.62	53.07	2720.76	2429.25	2168.97	1936.58
ACCUMULATED NET PRESENT VALUE		-4418.57	-5282.58	-6174.20	-6121.13	-3400.37	-971.12	1197.85	3134.44
INTERNAL RATE OF RETURN, %						>0 BUT <.1			
VALUE OF ANNUITY		-4948.80	-3125.69	-2570.62	-2015.29	-943.30	-236.20	262.47	630.97
FARMER'S MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-4948.80	-1083.81	-1311.41	1365.41	10103.93	10103.93	10103.93	10103.93
ACCUMULATED NET RETURNS		-4948.80	-6032.61	-7344.02	-5978.61	4125.32	14229.25	24333.18	34437.11
DISCOUNT RATE	.12								
NET PRESENT VALUE		-4418.57	-864.01	-933.44	867.74	5733.24	5118.97	4570.50	4080.81
ACCUMULATED NET PRESENT VALUE		-4418.57	-5282.58	-6216.01	-5348.27	384.97	5503.94	10074.44	14155.25
INTERNAL RATE OF RETURN, %						22.40			
VALUE OF ANNUITY		-4948.80	-3125.69	-2588.03	-1760.84	106.79	1338.70	2207.49	2849.49
PICK YOUR OWN MARKET:									
RETURN TO OVERHEAD AND MANAGEMENT		-4948.80	-1083.81	-1011.94	1850.91	11905.71	11905.71	11905.71	11905.71
ACCUMULATED NET RETURNS		-4948.80	-6032.61	-7044.55	-5193.64	6712.07	18617.78	30523.49	42429.20
DISCOUNT RATE	.12								
NET PRESENT VALUE		-4418.57	-864.01	-720.28	1176.29	6755.62	6031.80	5385.54	4808.52
ACCUMULATED NET PRESENT VALUE		-4418.57	-5282.58	-6002.86	-4826.57	1929.05	7960.85	13346.39	18154.91
INTERNAL RATE OF RETURN, %						27.10			
VALUE OF ANNUITY		-4948.80	-3125.69	-2499.28	-1589.07	535.14	1936.28	2924.43	3654.63

YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20
4794.91	4794.91	4794.91	4794.91	4794.91	4794.91	4794.91	4794.91	4794.91	4794.91	4794.91	4794.91
16772.78	21567.69	26362.60	31157.51	35952.42	40747.33	45542.24	50337.15	55132.06	59926.97	64721.88	69516.79
1729.09	1543.83	1378.42	1230.73	1098.87	981.13	876.01	782.15	698.35	623.53	556.72	497.07
4863.53	6407.36	7785.79	9016.52	10115.39	11096.52	11972.53	12754.69	13453.04	14076.57	14633.29	15130.36
	32.50					35.90					36.50
912.78	1134.00	1311.25	1455.60	1574.74	1674.15	1757.86	1828.89	1889.57	1941.68	1986.66	2025.63
10103.93	10103.93	10103.93	10103.93	10103.93	10103.93	10103.93	10103.93	10103.93	10103.93	10103.93	10103.93
44541.04	54644.97	64748.90	74852.83	84956.76	95060.69	105164.62	115268.55	125372.48	135476.41	145580.34	155684.27
3643.58	3253.20	2904.64	2593.43	2315.56	2067.46	1845.95	1648.17	1471.58	1313.91	1173.13	1047.44
17798.83	21052.02	23956.66	26550.09	28865.65	30933.11	32779.06	34427.23	35898.81	37212.72	38385.86	39433.30
	54.80					56.60					56.80
3340.46	3725.87	4034.67	4286.16	4493.72	4666.92	4812.76	4936.52	5042.23	5133.02	5211.38	5279.28
11905.71	11905.71	11905.71	11905.71	11905.71	11905.71	11905.71	11905.71	11905.71	11905.71	11905.71	11905.71
54334.91	66240.62	78146.33	90052.04	101957.75	113863.46	125769.17	137674.88	149580.59	161486.30	173392.01	185297.72
4293.32	3833.32	3422.61	3055.90	2728.48	2436.14	2175.13	1942.08	1734.00	1548.21	1382.33	1234.23
22448.23	26281.55	29704.15	32760.05	35488.53	37924.68	40099.81	42041.89	43775.89	45324.10	46706.43	47940.66
	58.60					60.30					60.40
4213.06	4651.42	5002.64	5288.68	5524.76	5721.74	5887.62	6028.39	6148.62	6251.88	6341.01	6418.24

APPENDIX E

FIXED AND VARIABLE COST FOR MACHINERY AND EQUIPMENT

ESTIMATED MACHINERY AND EQUIPMENT FIXED AND VARIABLE COST FOR ESTIMATED ANNUAL USE ON A PER HOUR, ACRE, GALLON, OR BUSHEL BASIS

Type of Machine or Equipment	New Cost	Yrs.	Hrs.	Storage Space in Sq. Feet	Storage Rate Factor	Depre- ciation	Insur- ance	Interest @ 12 %	Fixed Cost Per	Energy Consumption Rate Per Hr.	Energy Cost Per	Repairs % of New Cost	Variable Cost Per
	(dollars)												
Tractor, 40 HP	12,000	10	6000	100	.193	1200.00	72	720	3.35/hr.	2 gal.	1.10/gal.	60	3.40/hr.
Tractor, 60 HP	18,000	10	6000	120	.193	1800.00	108.00	1080.00	5.02/hr.	3 gal.	1.10/gal.	60	5.10/hr.
Truck, PU	9,135	10	3000	220	.193	913.50	54.81	548.10	4.16/hr.	3 gal.	1.06/gal.	60	5.01/hr.
Truck, 2 ton	20,212	10	3000	295	.193	2021.27	121.27	1212.72	11.37/hr.	6 gal.	1.06/gal.	60	10.40/hr.
Mower/chopper 5'8"	4,150	8	400	33	.193	518.75	24.90	249	15.98/h4.	-	-	80	8.30/hr.
Mower/chopper 7'5"	4,695	8	400	52	.193	586.88	28.17	281.70	18.14/hr.	-	-	80	9.39/hr.
Air Blast Sprayer, 300 gal.	5,060	5	1000	100	.193	1012.00	30.36	303.60	6.82/hr.	-	-	80	4.05/hr.
Air Blast Sprayer, 500 gal.	9,707	5	1000	120	.193	1941.40	58.24	582.42	13.03/hr.	-	-	80	7.77/hr.
Sprayer w/boom	644	8	320	40	.193	80.50	3.86	38.64	3.27/hr.	-	-	60	1.21/hr.
Spreader	1,175	6	360	39	.193	195.83	7.05	70.50	4.68/hr.	-	-	20	.65/hr.
Pruners, pneumatic	1,207.5	10	1000	40	.193	120.75	7.25	72.50	2.08/hr.	-	-	70	.85/hr.
Front End Forklift	2,784	10	1000	37	.193	278.40	16.70	167.04	4.69/hr.	-	-	40	1.11/hr.
Forklift	12,000	10	6000	200	.254	1200	72.00	720.00	3.40/hr.	2 gal.	1.10/gal.	60	3.40/hr.
Wagon	1,050	15	1500	2412	.193	70	6.30	63.00	6.05/hr.	-	-	25	.18/hr.
Irrigation:													
Frost	656	20	800	-	-	32.80	3.94	39.36	13.44/hr.	2 gal.	1.10/gal.	40	2.68/hr.
	1,989.4	20	400	-	-	99.47	11.94	119.36		-	-	3	
Drip, Standard	656	20	800	-	-	32.80	3.94	39.36		2 gal.	1.10/gal.	40	
	56	20	200	-	-	8.80	.53	5.28	2.66/hr.	-	-	3	2.66/hr.
	88	10	200	-	-	8.80	.53	5.28		-	-	30	
Drip, Semi-dwarf I	656	20	800	-	-	32.80	3.94	39.36		2 gal.	1.10/gal.	40	
	56	20	400	-	-	2.80	.34	3.36	3.35/hr.	-	-	3	2.73/hr.
	135	10	200	-	-	13.50	.81	8.10		-	-	30	
Drip, Semi-dwarf II	656	20	800	-	-	32.80	3.94	39.36		2 gal.	1.1/gal.	40	
	56	20	400	-	-	2.80	.34	3.36	3.37/hr.	-	-	3	2.74/hr.
	138	10	200	-	-	13.80	.83	8.28		-	-	30	
Drip, Dwarf	656	20	800	-	-	32.80	3.94	39.36		2 gal.	1.1/gal.	40	
	56	20	400	-	-	2.80	.34	3.36	4.19/hr.	-	-	3	2.89/hr.
	237	10	200	-	-	23.70	1.42	14.22		-	-	30	

Type of Machine or Equipment	New Cost	Yrs.	Hrs.	Storage Space in Sw. Feet	Storage Rate Factor	Depre- ciation	Insur- ance	Interest % 12 %	Fixed Cost Per	Energy Consumption Rate Per Hr.	Energy Cost Per	Repairs % of New Cost	Variable Cost Per
	(dollars)												
Bins	42	5	-	4	.193	8.40	.25	2.52	11.94/ 150 bu.	-	-	2	.17/150 bu.
Pallets	6.75	5	-	.5	.254	1.35	.04	.41	.01/ 150/bu.	-	-	-	-
Grader	18,089	35	42000	1850	.254	516.83	108.53	1085.34	.02/bu.	2.33 k2	.047 kwh	60	2.83/hr.
Refrigerated Bulk Tank	7,945	15	9000	300	.254	529.67	47.67	476.70	.05/gal.	5 kw	.047 kwh	60	.02/gal.
Jug Filler	1,604.55	15	9000	224	.254	106.97	9.63	96.27	.45/hr.	-	-	40	.07/hr.
Press	17,085	15	9000	400	.254	1139.00	102.51	1025.10	.03/gal.	7 kwh	.047 kwh	80	1.85/hr.
Market Cooler, Used	1,198	10	43800	26	.254	119.80	7.19	71.88	.04/gal.	.25 kWh	.047 kwh	80	.03/hr.
Stappler, hand	115	15	9000	-	-	7.67	.69	6.90	.03/hr.	-	-	-	-
Cold Storage	21,292	30	129000	-	-	709.73	127.75	1277.52	.21/bu.	15 kwh	.047 kwh	2	.02/Bu./Mo.
Fruit Pickers	170	5	-	.5	.193	34.00	1.02	10.20	45.32/ac.	-	-	-	-
Trellis	387	25	-	-	-	15.48	2.32	23.22	41.02/ac.	-	-	-	-
Check Facilities[b]													
Packing Shed[c]													

[a]Includes a charge for water and wax.

[b]Assumed a 200 ft. shed build for $4 per ft. that will last for 30 years. A 1.5% annual maintenance charge was added. It was also assumed a minimum of 25 acres per shed.

[c]Assumed a 3000 ft. packing shed built for $15,750 with a life of 30 years. A 1.5% maintenance charge was added. This gave a storage factor of .254 used in computing fixed cost for items housed in the packing shed.

APPENDIX F

COMPUTER PROGRAM FOR IRR

```
      DIMENSION AC(30),T(30)
      WRITE(5,1)
      READ(5,122)N
  122 FORMAT(I10)
    1 FORMAT(1X,'NUMBER OF YEARS')
      DO 2 I=1,N
      WRITE(5,14)
   14 FORMAT(1X,'AC')
      READ(5,4)AC(I)
    4 FORMAT(F10.2)
    2 CONTINUE
      DO 7 M=1,900000
      TOT=0.0
      DO 3 I=1,N
      R=M/1000.
      T(I)=AC(I)/((1+R)**I)
    3 TOT=TOT+T(I)
    7 IF(TOT.LT..001)GO TO 10
      GO TO 100
   10 WRITE(5,20)R
   20 FORMAT(1X,'IRR=',F10.4)
      GO TO 999
  100 WRITE(5,15)
   15 FORMAT(1X,'NO SOLUTION')
  999 STOP
      END
```

APPENDIX G

RELATIONSHIP BETWEEN THE DISCOUNTED RETURNS ABOVE VARIABLE COST AND BREAKEVEN ACREAGE

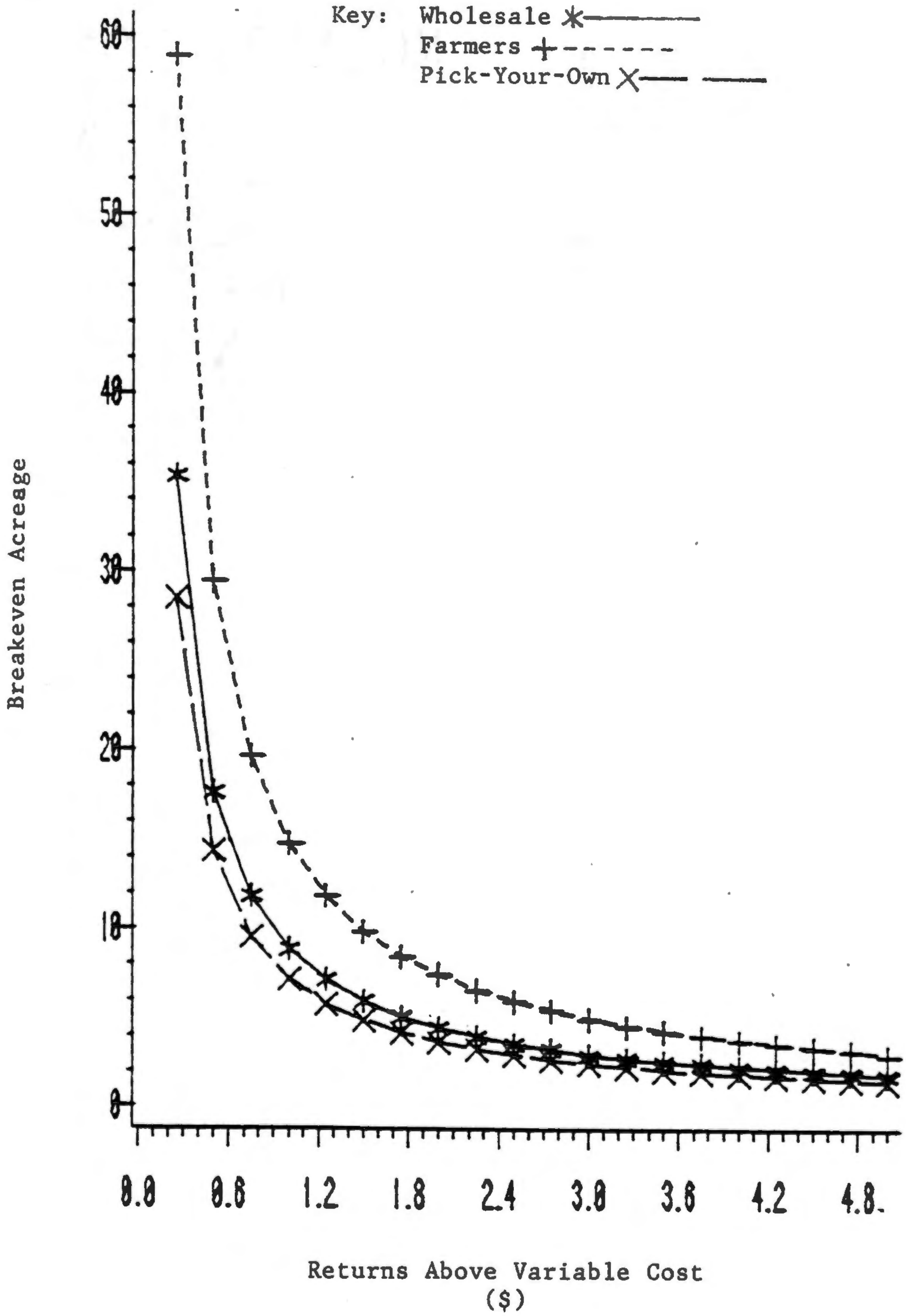

Figure 9. Relationship between the discounted returns above variable cost per bushel and breakeven acreages for the Semi-Dwarf I orchard.

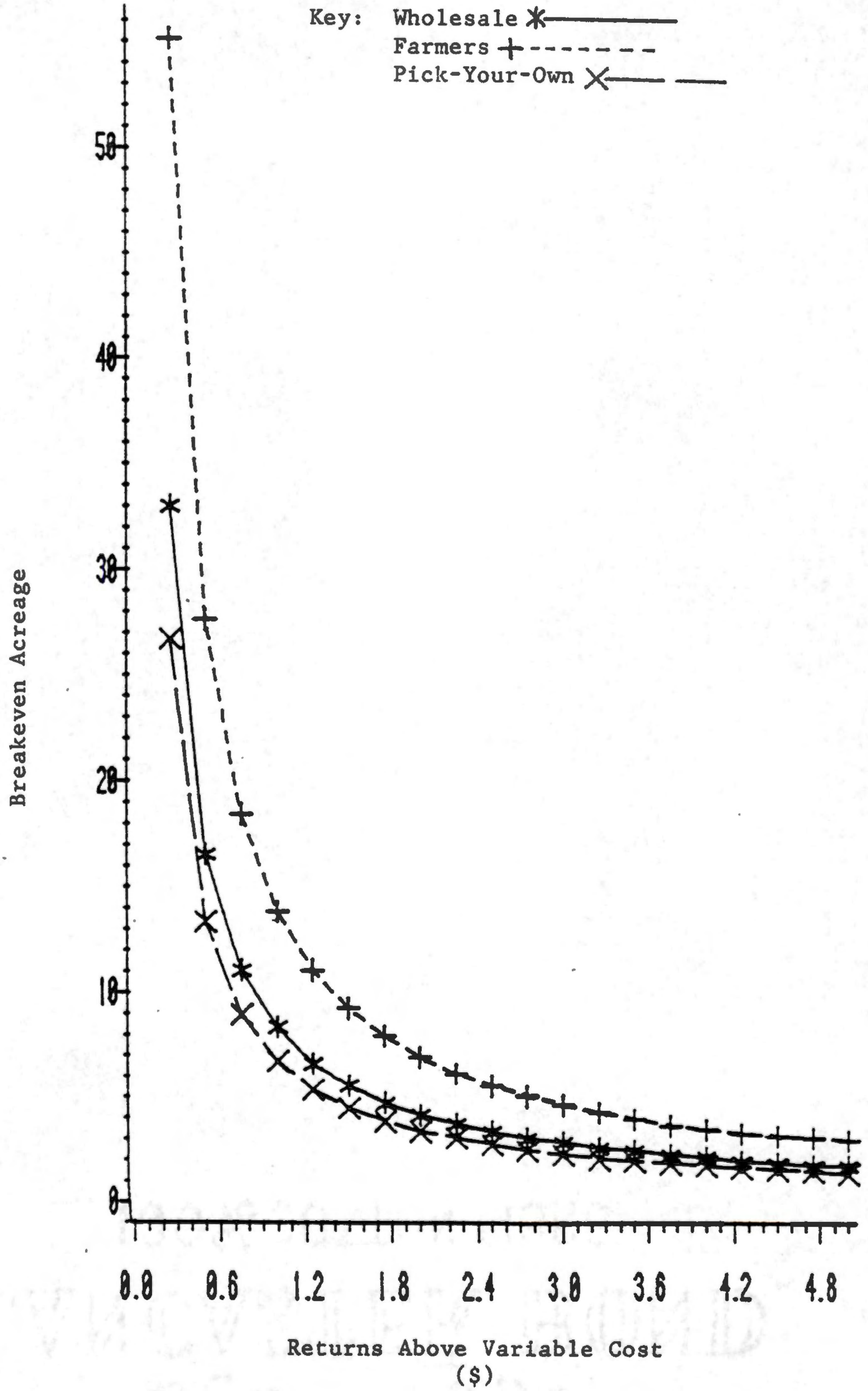

Figure 10. Relationship between the discounted returns above variable cost per bushel and breakeven acreage for the Semi-dwarf II orchard.

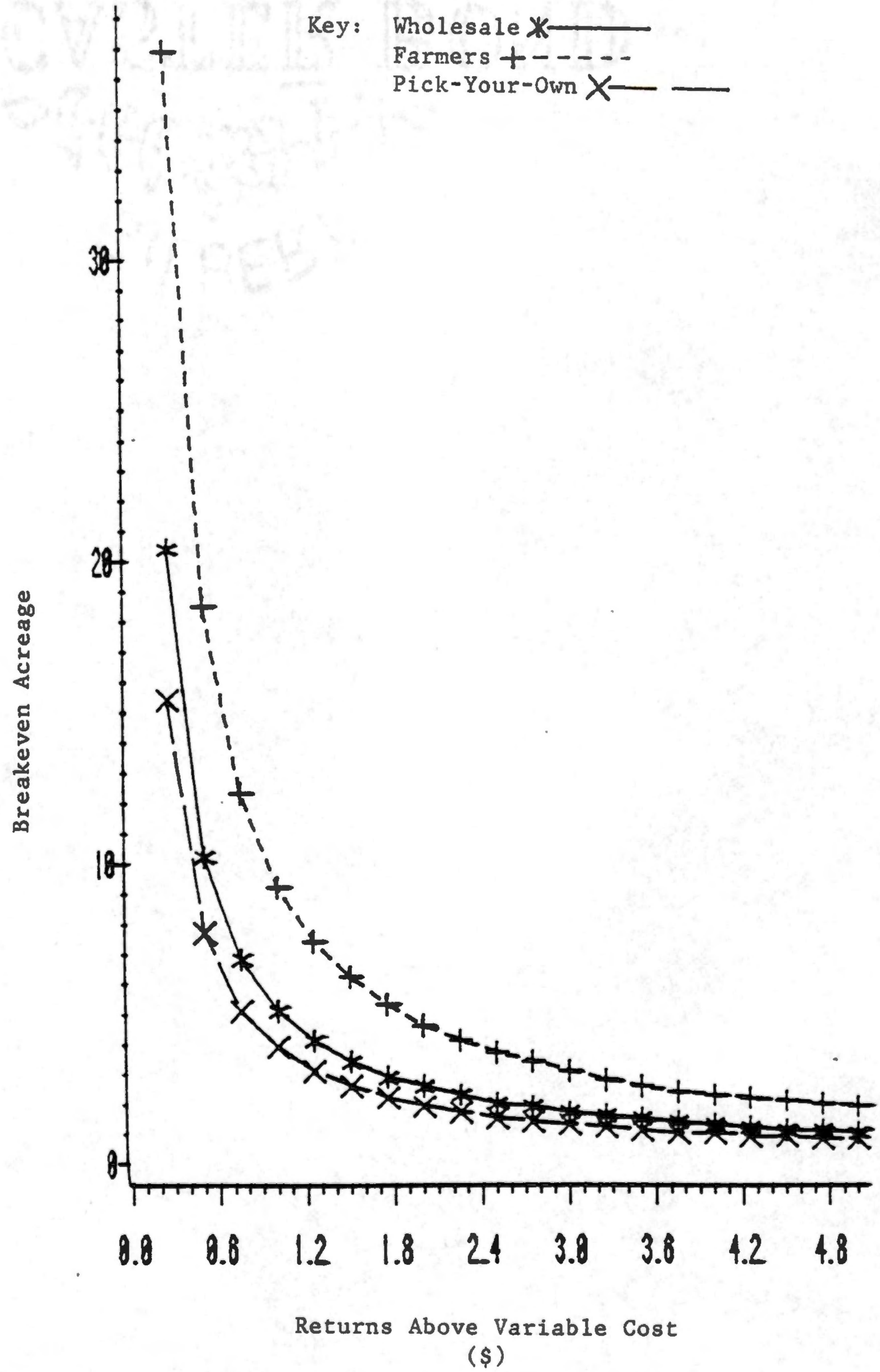

Figure 11. Relationship between the discounted returns above variable cost per bushel and breakeven acreage for the Dwarf orchard.

APPENDIX H

RELATIONSHIP BETWEEN THE DISCOUNT RATE AND ANPV

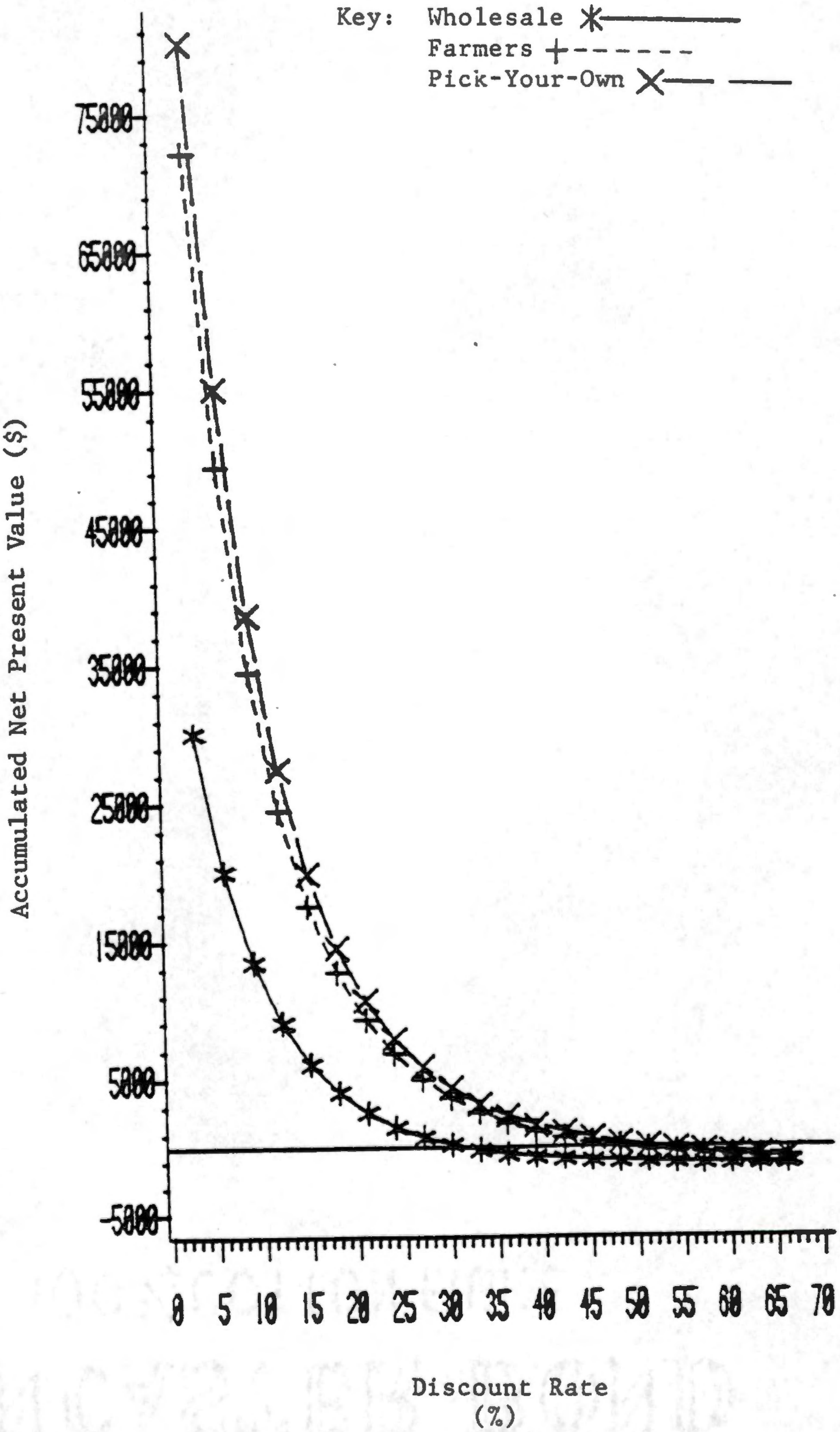

Figure 12. Relationship between the discount rate and ANPV for the Semi-dwarf I orchard with three marketing alternatives.

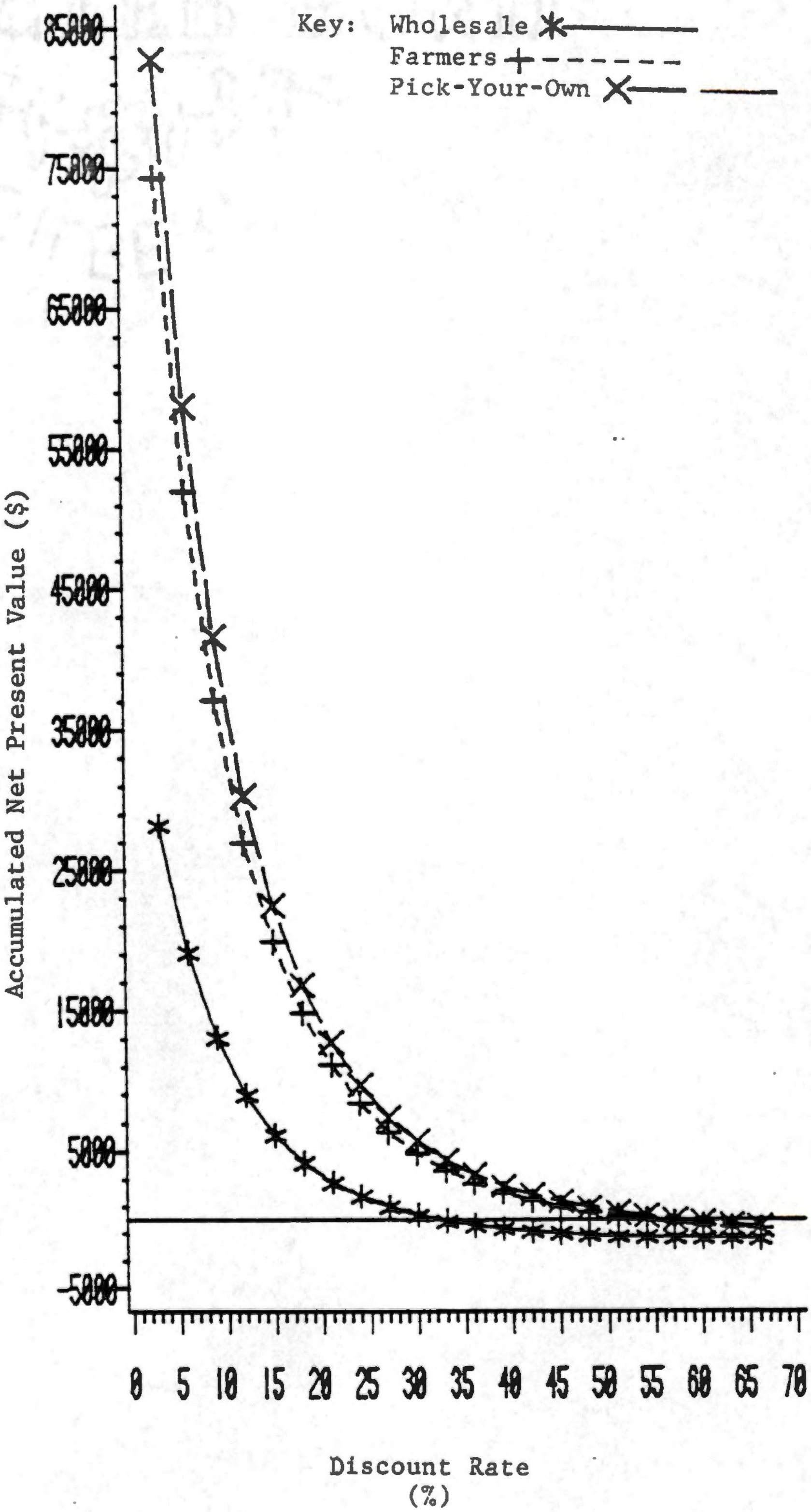

Figure 13. Relationship between the discount rate and ANPV for the Semi-dwarf II orchard with three marketing alternatives.

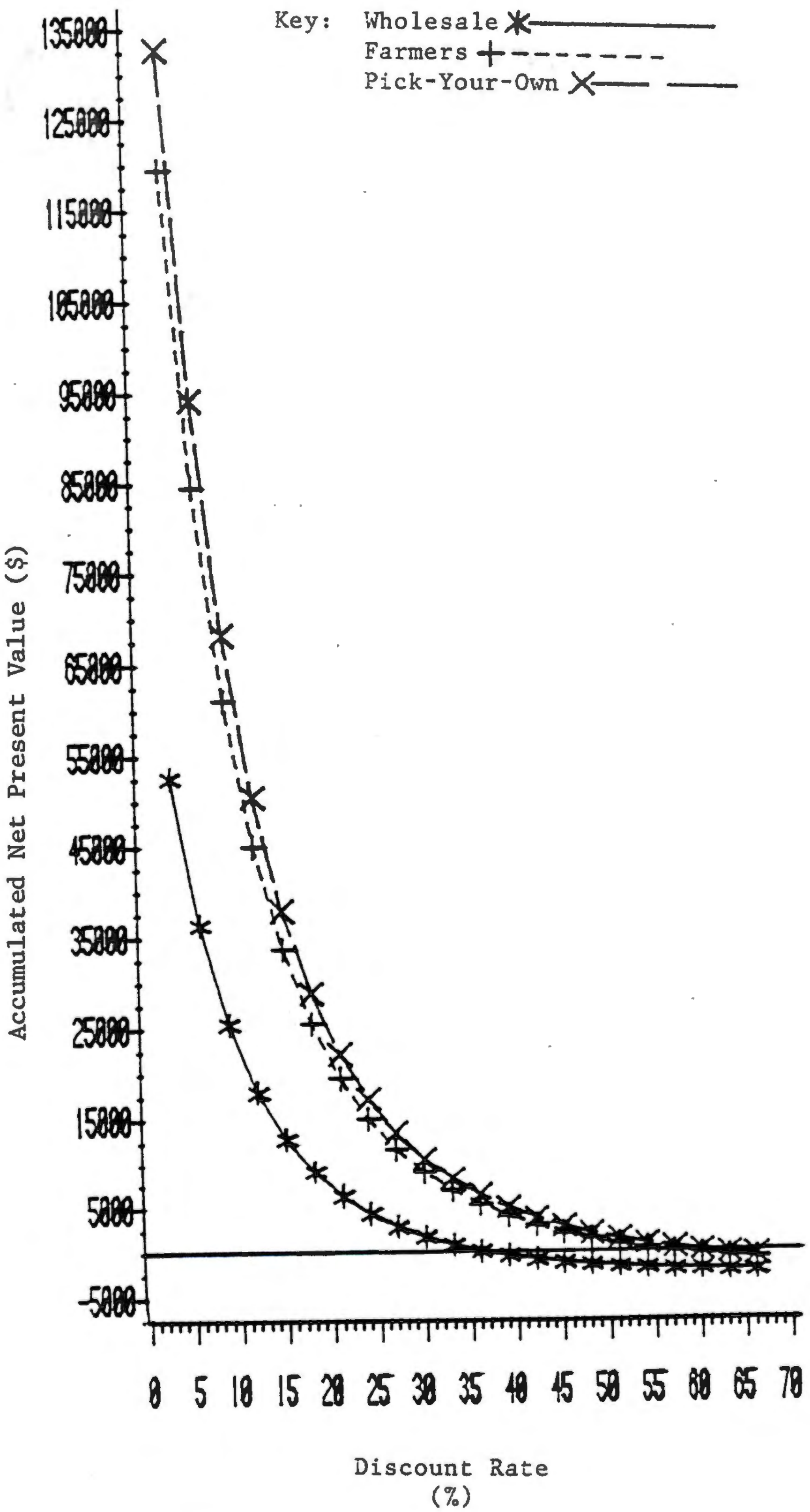

Figure 14. Relationship between the discount rate and ANPV for the Dwarf orchard with three marketing alternatives.

VITA

James Richard Bacon was born in Johnson City, Tennessee, on July 15, 1951. He is the oldest son of Mr. and Mrs. James S. Bacon. He attended grade school in Johnson City and graduated from high school in 1970 from Georgia-Cumberland Academy in Calhoun, Georgia. The following September he entered Southern Missionary College in Collegedale, Tennessee and studied journalism for two years.

He worked as a mid-level manager in business and industry from 1972-1979.

He was married to the former Martha Jane Moretz of Kernersville, North Carolina, on March 20, 1976.

In July 1979 he re-entered college at The University of Tennessee, Knoxville, and received his B. S. in Agricultural Economics in August of 1982. He was awarded an assistantship in Agricultural Economics which permitted him to work toward his Master's degree in Agricultural Economics which he completed in September 1985.

The author is a member of Alpha Zeta, a professional agricultural fraternity.

After graduation he will be employed as a research associate at The University of Delaware.