COST OF PRODUCING GRAPES FOR WINE AND JUICE PROCESSING IN ARKANSAS 1995

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FOREWORD

Land and management costs are excluded in the budgets. Although estimated total costs include overhead labor for all grape vineyards, there has been no attempt to approximate other general farm overhead costs. The figures in the budget line item "Income Above Variable Costs" will be a useful planning tool when fixed costs can be disregarded as they may be in any one year's forecast. However, long-run decisions such as investments in new vineyards should be based on the estimated "Net Returns Above Specified Costs," which includes major direct fixed costs other than land and management.

INTRODUCTION

Estimates are needed to provide data to aid growers in planning and forecasting the potential costs, yields and revenues from wine and juice grape vineyards. The primary cost and production estimates in this publication are intended for use as guides for investments in vineyards where the grapes produced are intended for utilization in the wine and juice processing segment of Arkansas's agricultural industry. To provide reference points for plans and decisions, enterprise budgets are presented in a series showing production costs for the following species of grapes utilized for wine and juice production in Arkansas: (1*) Vitis vinifera*, (2) French-American Hybrids, (3) *Vitis labruscana* and *Vitis aestivalis* and (4) *Vitis rotundifolia*.

For cost analysis, species were grouped by similarity of cultural practices and resource requirements. In this way, *Vitis labruscana* and *Vitis aestivalis* will be considered together because they have the same production operational costs. The other species groups will be discussed separately. When the market price changes between different cultivars, the estimates illustrate the contrasts in returns.

The budgets are organized so that following each entry of the value calculated from the research data there is space provided for "Your Estimate" or the user's forecast of the cost and/or price. Objectives of the budgets are to provide for the following individuals and purposes:

1. Grape Producers
    a. Planning for production
    b. Disease and insect control guidelines
    c. Determination of profit potentials
2. Extension and Research Workers
    a. Evaluation of returns from alternative crops
    b. Advising new and established growers
3. Personnel at Banks, Lending Agencies, etc.
    a. Extending annual production credit
    b. Loans for expansion/new purchases
    c. Real estate development
4. Winery managers and others (e.g. investors in grape production, etc.)

Recent fiends in Acreages of Wine and Juice Grapes

The 1992 Arkansas Agricultural Statistics, Fruit and Nut Supplement, reported 1220 acres of grape vineyards in the state (3). County estimates were not reported separately in this 1992 report, which listed the three leading Arkansas Crop Reporting Districts as accounting for 86% of the grape acreage. Based on those estimates the following distribution of

Table 5. Wine type grapes: Three wire-bilateral cordon trellis system establishment costs, 40-acre vineyard, 1995 prices

Item	Expected Years of Life	New Cost ($)	Amortization Charge ($)[1]
Line Posts (3 in. x 8 ft)	30	20,400.00	2,140.15
End Posts (6 in. x 8 ft)	30	4,480.00	469.99
Stakes (1 in x 8 ft)	15	22,428.00	2,352.91
Anchors	0	1,820.00	190.93
# 9 Wire HT	30	264.00	27.50
# 11 Wire HT	30	3,187.00	334.57
# 13 Wire HT	30	3,852.00	404.11
Staples	30	140.00	14.69
Installation	30	4.340.00	455.31
Totals		60,911.00	6,390.16

Total Cost = $56,571.00
Total Cost + Installation = $60,911.00

Annual Fixed Costs - Trellis System, Three Wire

			Cost per acre ($)
Annual Amortization Charge	6,390.16 / 40 acres	=	159.75
Taxes[2]	(60,911.00/2)(.005) / 40 acres	=	3.81
Insurance[2]	(60,911.00/2)(.006) / 40 acres	=	4.57
Total Annual Fixed Costs Per Acre			168.13

Annual Variable Costs - Trellis System, Three Wire

Trellis System	Initial Cost	Maintenance & Repair Coefficient	Annual Cost	Cost Per Acre ($)
Total Variable	$56,571.00	0.007	395.99	9.90

[1] New costs amortized at 9.5% for the expected years of life.
[2] For average annual tax and insurance costs per acre, new costs were divided by two to determine average investment over the life of the system.

The exceptions to equal operations equal cost, that is, Year 4 preharvest costs and Year 5 fixed costs, are explained as follows:

Year 3 is within the establishment period and is also the first harvest season. Due to differences in either market prices or yield (and harvest costs) or both, total cumulative costs for Year 3 may vary among cultivars within a group. Preharvest variable costs for Year 4 will vary because they include the interest charge on different balances resulting from the previous year's harvest, revenue and cumulative cost. This balance must be carried forward to the end of the establishment period, Year 4. Although cultural operations are the same for cultivars within a species or group, preharvest costs may differ for Year 4.

At the end of the four-year "establishment" stage, the investment by which accumulated per-acre annual costs had exceeded revenues were amortized as an annual establishment charge for the remaining 26-year expected life of the vineyard. This charge was added as a fixed cost in budgets for the remaining productive life of the vineyard, Years 5 through 30. Because of variations in cumulative cost balances in Year 4, the fixed cost in Year 5 varies among cultivars within groups in which operation and nonharvest costs are the same. The narrative discussion for each species group will cover the cultivar given as an example in the Appendix. Differences in the cost and revenue structure for the other cultivars within groups will be only summarized in the budget tables.

Table 6. Wine type grapes: Single wire-bilateral cordon trellis system establishment costs, 40-acre vineyard, 1995 prices.

Item	Expected Years of Life	New Cost ($)	Amortization Charge ($)[1]
Line Posts (3 in. x 8 ft)	30	20,400.00	2,140.15
End Posts (6 in. x 8 ft)	30	4,480.00	469.99
Stakes (1 in x 8 ft)	15	22,428.00	2,352.91
Anchors	30	1,820.00	190.93
# 9 Wire HT	30	264.00	27.50
# 11 Wire HT	30	3,187.00	334.57
Staples	30	47.00	4.93
Installation	30	3.750.00	93.41
Totals		56,376.00	5,914.39

Total Cost = $52,626.00
Total Cost + Installation = $56,376.00

Annual Fixed Costs -Trellis System, Single Wire

			Cost per acre ($)
Annual Amortization Charge	5,914.39 / 40 acres	=	147.85
Taxes[2]	(56,376.00/2) (.005) / 40 acres	=	3.52
Insurance[2]	(56,376.00/2) (.006) / 40 acres	=	4.22
Total Annual Fixed Costs Per Acre			155.59

Annual Variable Costs-Trellis System, Single Wire

Trellis System tem	Initial Cost	Maintenance & Repair Coefficient	Annual Cost	Cost Per Acre
Total Variable	$52,626.00	.006	315.76	7.89

[1] New costs amortized at 9.5% for the expected years of life.
[2] For average annual interest, tax and insurance costs per acre, new costs were divided by two to determine average investment over the life of the system.

I. *Vitis Vinifera*
Budget Summary

ESTABLISHMENT YEARS
1 THROUGH 4

First year establishment costs were $4071.16 per acre for the three cultivars in this group (Table 7). In addition to special cultural practice requirements for Vitis vinifera, the size of the initial investment reflects the $1869 per acre cost for the grafted rootstock grape plants at $4.00 each. Year 1 cumulative costs were $4071.16 per acre, which includes the $109.67 for land preparation incurred in the previous year and the interest for carrying the balance. At the end of Year 2, estimated cumulative costs would be $5520.54 per acre for all cultivars in this group (Table 7).

In Year 3 yields were estimated to be 1.8 tons per acre for all cultivars in this group. Preharvest and harvest variable costs as well as fixed costs were the same so that total production costs for Year 3 would be $2094.77 per acre for each. However, when the estimated market price to be received for raw product is considered, a different cost structure for each cultivar begins to emerge.

White Riesling

The following narrative includes White Riesling only. (See Appendix B Tables 1-11 B): The $1125 revenue generated from 1.8 tons of grapes selling at $625 per ton would be $969.71 less than Year 3 production costs and would increase the cumulative costs to $6490.31 per acre (Table 7; Appendix B Table 5B).

In Year 4, revenue of $2531.25 would be provided by the 4.05 ton yield per acre. This would be $57.35 less than the $2588.60 per acre total production cost. Cumulative costs would be increased to $6547.66 per acre for this cultivar (Table 7 and Appendix B Table 7B).

Table 7.
Cont'd.

Fruit Enterprise, Cultural/ Trellis System, and Revenue Cost Items[1]	Years of Establishment and Production 1	2	3	4	5 - 30
Annual Fixed Costs ($)	460.20	346.41	361.44	361.44	851.08
Interest on Cumulative Cost($)	10.41	386.75	524.44	552.44	
Total Costs ($)[4]	3961.49	1449.38	2094.77	2452.02	2512.21
Net Returns Above Specified Costs Items ($)			-294.77	1147.96	1987.79
Total Cumulative Costs	4071.16[5]	5520.54	5815.31	4667.35[6]	

[1] For details on equipment operations, spray schedule, revenue and costs, see budgets in appendix.
[2] White Riesling is the cultivar shown in Appendix B as an example of *Vitis vinifera*.
[3] In all years, yields were reduced by 10% from expected yield to reflect the risk of crop loss due to adverse weather and other factors.
[4] Overhead labor or supervision costs of $27.45 were added to each year's total cost (See Appendix B for details).
[5] Year 1 costs must include the $109.67 expenses of land preparation in the previous season.
[6] This total cumulative establishment cost at Year 4 was amortized over the remaining 26 years of the vineyard as an annual establishment charge (White Riesling $686.89, Cabernet Sauvignon $454.73, and Chardonnay $489.64). This annual establishment charge is included in the annual fixed costs for years 5 through 30.

At the end of Year 4, the following annual "Establishment Charges" were entered as Fixed Costs in the budgets:

PER ACRE ESTABLISHMENT CHARGES

Vitis vinifera Cultivars	Total Cumulative Investment Per Acre[1]	Annual Establishment Charge[1]
a. Pinot Chardonnay	$4667.35	$489.64
b. Cabernet Sauvignon	4334.58	454.73
c. White Riesling	6547.66	686.89

[1]Table 7.

Productive Years 5 through 30

In the years following vineyard establishment for *Vitis vinifera* cultivars, the estimated net returns above specified costs would be as follows (also in Table 7):

Cultivar	Estimated Market Price Per Ton	Expected Yields: Tons Per Acre	Expected Costs Per Acre	Expected Returns: Per Acre	Estimated Break Even Points* Price Per Ton	Yield Tons Per Acre
a. Pinot Chardonnay	$1000	4.5	$2512.21	$1987.79	$558.27	2.291
b. Cabernet Sauvignon	1000	5.6	2527.29	2472.71	505.45	2.252
c. White Riesling	625	5.4	2799.41	575.59	518.40	4.303

*Breakeven formula:

$$\text{Yield} = \frac{\text{Costs (other than harvesting)}}{\text{Selling price – per unit harvest cost}}$$

$$\text{Price} = \frac{\text{Total cost}}{\text{yield}}$$

Returns could be maintained as stated as long as both resource costs and market prices remained at the same levels. If prices received by growers were to become lower than estimated or if costs increased, the structure of net returns would change.

II. **French-American Hybrids**
Budget Summary

ESTABLISHMENT YEARS
1 THROUGH 4

Year 1 costs were estimated at $2174.19 per acre for establishing a vineyard for the six cultivars in this group (Table 8). This is 46 percent less than that required for the *Vitis vinifera* cultivars. The budgeting of grape plant costs at $1.75 each explains the major portion of the difference in Year 1 establishment costs between that for these cultivars and the previous group. Cumulative costs of $2283.76 per acre for Year 1 reflect the $109.67 per acre previous year's land preparation costs, which were estimated to be the same for all cultivars and vineyards. For this group cumulative costs were estimated to be $3443.50 per acre at the end of Year 2 (Table 8). This would be 40% less or approximately equal to two-thirds of the cumulative cost for *Vitis vinifera* at the end of the second season.

In Year 3 yields were estimated to be 2.7 tons per acre for Chambourcin, Chancellor, Seyval, Vidal, Villard Blanc and Villard Noir and 1.8 tons per acre for Vignoles. For all cultivars, preharvest costs would be equal to $873.86 per acre, and fixed costs would be the same for each at $357.61 per acre. Because of the difference in the quantity to be harvested and harvesting costs, total production costs for Year 3 were $1707.56 per acre for the first six cultivars and $1667.06 per acre for Vignoles (Table 8).

Table 8. Cont'd.

Vignoles (White)					
Revenue:					
Yield per Acre (tons)[a]	0	0	1.8	4.05	5.0
Market Price ($)	500	500	500	500	500
Total Revenue ($)	0	0	900.00	2025.00	2500.00
Cost					
Annual Variable Costs ($)					
Preharvest	1708.04	573.27	873.86	1012.74	1014.38
Harvest	0	0	81.00	182.25	225.00
Total	1708.04	573.27	954.86	1194.94	1239.38
Annual Fixed Costs ($)	428.29	342.05	357.61	357.61	803.89
Interest on Cumulative Cost($)	10.41	216.97	327.14	399.85	

Vidal (White)					
Revenue:					
Yield per Acre (tons)[3]	0	0	2.7	4.5	5.4
Expected Market Price ($)	450	450	450	450	450
Expected Total Revenue ($)	0	0	1215.00	2025.00	2430.00
Cost					
Annual Variable Costs ($)					
Preharvest	1708.04	573.27	873.86	1012.74	1014.38
Harvest	0	0	121.50	202.50	243.00

Table 8. Cont'd.

Fruit Enterprise, Cultural/ Trellis System, and Revenue	Years of Establishment and Production				
Cost Items[1]	1	2	3	4	5 - 30
Total	1708.04	573.27	995.36	1215.24	1257.38
Annual Fixed Costs ($)	428.29	342.05	357.61	352.61	765.20
Interest on Cumulative Cost($)	10.41	216.97	327.14	373.93	
Total Costs ($)[4]	2174.19	1159.74	1707.56	1974.23	2050.03
Net Returns Above Specified Costs Items ($)			-492.56	50.77	379.97
Total Cumulative Costs[2]	2283.76[5]	3443.50	3936.06	3885.29[6]	

[1] For details on equipment operations, spray schedule, revenue and costs see budgets in appendix.
[2] Chancellor is the cultivar shown in Appendix C as an example of the French American Hybrid group.
[3] In all years, yields were reduced by 10% from expected yield to reflect the risk of crop loss due to adverse weather and other factors.
[4] Overhead labor or supervision costs of $27.45 were added to each year's total costs (See Appendix C for details).
[5] Year 1 costs must include the $109.67 expenses of land preparation-in the previous season.
[6] This total cumulative establishment cost at Year 4 was amortized over the remaining 26 years of the vineyard as an annual establishment charge (Chancellor $457.21, Seyval $446.72, Vignoles $446.28, Villard Blanc $568.06, Chambourcin $325.52, and Vidal $407.60). This annual establishment charge is included in the annual fixed costs for years 5 through 30.

Chancellor

For Chancellor, the cultivar given details in Appendix C Tables 1-11C as an example for this group, the following cost structure was formed when the estimated market price was applied to Year 3 yield: Revenue of $945 per acre would be generated as a result of 2.7 tons of raw product of Chancellor selling at a market price of $350 per ton. After subtracting production costs this would leave $762.56 to be added to the $3443.50 per acre cumulative cost bringing the balance to $4206.06 (Table 8 and Appendix C Table 5C).

The structure of Year 4 costs for this group of cultivars was influenced by differences in yields and the values in Year 3 cumulative costs. As noted previously, preharvest variable costs include charges for cultural practice and resource input requirements as well as interest on the previous year's cumulative cost balance. For this reason, preharvest variable costs will vary among cultivars even though the cultural operations, hours of labor, and application of chemicals and fertilizers would be performed in the same fashion for each.

The $1890 per acre in revenue provided by the estimated Year 4 yield of Chancellor (5.4 tons selling for $350 per ton) would be $152.02 less than production costs of $2042.02. This would raise cumulative costs to $4358.08 per acre (Table 8 and Appendix C Table 7C).

After the four-year establishment stage, the following fixed costs would be added to the budgets as Establishment Charges:

PER ACRE ESTABLISHMENT CHARGES

French-American Hybrid Cultivars	Total Cumulative Investment Per Acre[1]	Annual Establishment Charge
a. Vignoles	$4254.01	$446.28
b. Chambourcin	3102.96	325.52
c. Seyval	4258.10	446.72
d. Chancellor	4358.18	457.21
e. Vidal	3885.29	407.60
f. Villard Blanc	5414.80	568.06

[1]Table 8.

Productive Years 5 through 30

Following vineyard establishment, French-American Hybrid cultivars would have the following estimated net returns above specified costs (Table 8):

	Estimated Market Price Per Ton	Expected Yield: Tons Per Acre	Expected Costs Per Acre	Expected Returns Per Acre	Estimated Break Even Points' Price Per Ton	Yield Tons Per Acre
a. Vignoles	$500	5.0	$2042.77	$457.23	$408.55	3.99
b. Chambourcin	500	6.3	2008.46	1141.54	318.80	4.85
c. Seyval	400	5.4	2089.16	70.84	386.88	5.20
d. Chancellor	350	6.3	2140.15	63.20	339.71	6.08
e. Vidal	450	5.4	2050.03	379.97	379.63	5.06
f. Villard Blanc	220	9.0	2345.05	365.05	260.56	13.4

Break-even formula:

$$\text{Yield} = \frac{\text{Costs (other than harvesting}}{\text{Selling price - per unit harvest cost}}$$

$$\text{Price} = \frac{\text{total cost}}{\text{yield}}$$

Returns such as these would be maintained as long as resource cost and market prices are either constant or continue in the same relationship.

III. Vitis labruscana and *Vitis aestivalis*
Budget Summary

ESTABLISHMENT YEARS
1 THROUGH 4

For the five cultivars in this group, operational requirements for Years 1 and 2 were estimated to be the same as for the French-American hybrids, but costs were different. Year 1 fixed costs were the same for all these cultivars, but cumulative costs varied as follows because of the charges for grape plants: 1) Cynthiana - $2043.45 per acre ($1.50 each for plants); 2) Catawba, Delaware and Niagara - $1875.05 per acre ($1.25 each for plants); and 3) Concord - $1624.52 per acre ($1.00 each for plants). The cumulative costs also reflect the same $109.67 land preparation costs as previously mentioned for other cultivars.

In Year 2 fixed costs continued to be equal for all cultivars, while preharvest variable costs were $548.13 per acre for Concord, $556.51 for Delaware, Niagara and Catawba and $564.89 for Cynthiana. The differences in cumulative costs at the end of Year 2 ranged from $3171.97 per acre for Cynthiana to $2704.29 for Concord (Table 9).

In Year 3 yields were estimated to be 2.7 tons per acre for Catawba and Niagara followed by 1.8 tons for Delaware, 4.0 tons for Concord and 1.4 tons for Cynthiana. Preharvest variable costs and fixed costs were the same for Catawba, Delaware and Niagara with continuing differences for Concord and Cynthiana. However, with differences- in the quantities to be harvested, Year 3 total production costs ranged from $1470.40 for Catawba and Niagara to $1512.96 for Concord, $1428.26 for Delaware and $1427.84 for Cynthiana. Year 3 total cumulative costs were $3344.97 per acre (Concord), $3639.60 (Niagara and Catawba), $3822.45 (Delaware) and $3549.91 (Cynthiana). (Table 9).

Delaware

Delaware was the cultivar listed in Appendix D as an example for this species group. When the estimated market prices were applied to Year 3 yields, the following cost structure developed:

1. The estimated yield for Delaware was 1.8 tons per acre in Year 3 and the selling price was $325 per ton. That would produce $585 in revenue. This would be $843.26 less than Year 3 production costs and would bring cumulative costs to $3822.45 per acre (Table 9 and Appendix D Table 5D).

Table 9: *Vitis labruscana*: Estimated revenue, costs, and returns per acre by year of production, 1995.

Fruit Enterprise, Cultural/ Trellis System, and Revenue Cost Items[1]	Years of Establishment and Production 1	2	3	4	5 - 30
Delaware (Pink)[2]					
Revenue:					
Yield per Acre (tons)[3]	0	0	1.8	3.6	5.4

2. Delaware's Year 4 production costs of $1627.08 would be $457.08 greater than the $1170 in revenue provided by the 3.6 ton yield per acre. Cumulative cost would be increased to $4279.53 per acre, and the Establishment Charge added to Fixed Costs would be $451.09 per acre. (Table 9 and Appendix D Table 7D).

As with the previous groups of cultivars, some of the Year 4 cost totals would be different because of the interest on the cumulative cost balance, Year 3, as well as differences in market prices and yields. However, the recommended cultural operations and resource requirements remain the same within a group.

PER ACRE ESTABLISHMENT CHARGES

Vitis labruscana and *Vitis aestivalis* Cultivars	Total Cumulative Investment Per Acre[1]	Annual Establishment Charge
a. Cynthiana	$3122.11	$323.34
b. Niagara	3712.86	389.51
c. Catawba	3942.36	413.31
d. Concord	3746.91	393.09
e. Delaware	4279.62	451.09

[1]Table 9

Productive Years 5 through 30

After attaining full productivity, the cultivars in this group would have average net returns above specified costs as follows (also in Tables 11 and 12):

	Estimated Market Price Per Ton	Expected Yields: Tons Per Acre	Expected Costs: Per Acre	Expected Returns: Per Acre	Estimated Break Even Points* Price Per Ton	Yield: Tons Per Acre
a. Cynthiana	$750	4.05	$1606.52	$1430.98	$396.67	2.17
b. Niagara	300	7.2	1821.21	338.79	252.94	5.87
c. Delaware	325	5.4	1797.49	-42.49	333.66	5.56
d. Catawba	300	6.3	1804.51	85.49	286.43	5.96
e. Concord	225	8.0	1861.24	-61.24	232.65	8.34

*Break-even formula:

$$\text{Yield} = \frac{\text{Costs (other than harvesting)}}{\text{Selling price - per unit harvest cost}}$$

$$\text{Price} = \frac{\text{total cost}}{\text{yield}}$$

The structure of these returns will be maintained only so long as resource costs and market prices continue at the same level or are in the same relationship as stated in this report.

IV Vitis Rotundifolia
Budget Summary

ESTABLISHMENT YEARS
1 THROUGH 4

Year 1 costs were estimated at $1514.80 per acre for establishing a vineyard for the cultivars in this group (Table 10). This is less than that required for any of the other cultivars. The budgeting of grape plant costs at $2.50 each with only 180 plants required explains one of the major portions of the difference in Year 1 establishment costs between that for these cultivars and the others. Cumulative costs of $1514.80 per acre for Year 1 also reflect the $109.67 per acre previous year land preparation costs, which were estimated to be the same for all cultivars and vineyards. For this group cumulative costs were estimated to be $2556.89 per acre at the end of Year 2 (Table 10). This would be 37.2, 25.7 and 14.2 percent less than the end of the second season cumulative cost for the *Vitis vinifera,* French-American Hybrid and *Vitis labruscana* cultivars.

In Year 3, yields were estimated to be 3.0 tons per acre for Carlos and Noble cultivars. Preharvest costs would be equal to $674.55 per acre, and fixed costs would be $354.06 per acre. Carlos and Noble cultivars are given in Appendix E Tables 1-11E as an example for this group, and the following costs structure was formed when the estimated market price was applied to Year 3 yield: Revenue of $900 per acre would be generated as a result of 3.0 tons of raw product selling at a market price of $300 per ton. After subtracting production costs this would leave $398.96 to be added bringing the cumulative cost balance to $2955.85 for this cultivar (Table 10 and Appendix E Table 5E). The $1500 per acre in revenue provided by the estimated Year 4 yield of 5.0 tons selling for $300 per ton would be $53.40 more than production costs of $1446.60. This would lower cumulative costs to $2902.45 per acre (Table 10 and Appendix E Table 7E). In Years 5-30, the fully mature vineyards for this cultivar were estimated to return an average of $1297.40 per acre.

Table 10: Vitis rotundifolia[2]: Estimated revenue, costs, and returns per acre by year of production, 1995.

Fruit Enterprise, Cultural/ Trellis System, and Revenue Cost Items[1]	Years of Establishment and Production 1	2	3	4	5 - 30
Carlos/Noble					
Revenue:					
Yield per Acre (tons)[3]	0	0	3	5	10
Market Price ($)	300	300	300	300	300
Total Revenue ($)	0	0	900	1500	3000
Cost					
Annual Variable Costs ($)					
Preharvest	951.88	523.39	539.55	559.29	556.61
Harvest	0	0	135.00	225.00	450.00
Total	951.88	523.39	674.55	784.29	1016.61
Annual Fixed Costs ($)	415.39	347.34	354.06	354.06	658.54
Interest on Cumulative Costs ($)	10.41	143.91	242.90	280.80	
Total Costs ($)[4]	1405.13	1042.09	1298.96	1446.60	1702.60
Net Returns Above Specified Costs ($)			-398.96	53.40	1297.40
Total Cumulative Costs'	1514.80[5]	2556.89	2955.85	2902.45[6]	

[1] For details on equipment operations, spray schedule, revenue and costs see budgets in appendix.
[2] Carlos is the cultivar shown in Appendix E as an example of Vitis *rotundifolia*.
[3] In all years yields were reduced by 10% from expected yield to reflect the risk of crop loss due to adverse weather and other factors.
[4] Overhead labor or supervision costs of $27.45 were added to each year's total costs (See Appendix E for details).
[5] Year 1 costs must include the $109.67 expenses of land preparation in the previous season.
[6] This total cumulative establishment cost at Year 4 was amortized over the remaining 26 years of the vineyard as an annual establishment charge (Carlos/Noble $304.48). This annual establishment charge is included in the annual fixed costs for years 5 through 30.

PER ACRE ESTABLISHMENT CHARGES

Vitis rotundifolia Cultivars	Total Cumulative Investment Per Acre[1]	Annual Establishment Charge[1]
a. Carlos/Noble	$2902.45	$304.48

[1]Table 10

Productive Years 5 through 30

In the years following vineyard establishment for Vitis rotundifolia cultivars, the estimated net returns above specified costs would be as follows (also in Table 13):

Cultivar	Estimated Market Price Per Ton	Expected Yield Tons Per Acre	Expected Costs Per Acre	Expected Returns Per Acre	Estimated Break Even Points[1] Price Per Ton	Yield Tons Per Acre
a. Carlos/Noble	$300	10	$1702.60	$1297.40	$170.26	4.91

[1]Break-even formula:

$$\text{Yield} = \frac{\text{Costs (other than harvesting)}}{\text{Selling price - per unit harvest cost}}$$

$$\text{Price} = \frac{\text{total cost}}{\text{yield}}$$

SUMMARY

Consideration of the risks involved must precede an investment in wine grape vineyards. As can be determined readily from Tables 5 and 6, there are substantial establishment costs for the trellis systems. Also, other trellising systems may be selected for any of several given species or cultivars. Because of the limitation of space in this publication, costs for only the three-wire and single-wire bilateral cordon systems were analyzed. Examples of different yield responses between trellising systems for Concord grapes were reported in Special Report 125, April 1987.

Grapes require a few years after establishment before positive returns to management are received. In any year there is the risk of loss due to any one or combination of factors influencing yield or prices or both.

The figures in Tables 7, 8, 9 and 10 are examples from which there are possible variations and illustrate that returns from good management are often in proportion to hazards in production. Increased risks on investment may be reflected in the potentially high but variable returns from a specific wine grape vineyard enterprise. Severe pest damage could lower returns disastrously because quality standards are critical. Weather conditions could reduce the value of an otherwise excellent crop through prohibiting harvest during the optimum stages or through physical damage to the fruit.

The greatest returns per acre were projected for the *Vitis vinifera* species, but the potential investor/grower must be reminded of the following limitations or restrictions:

1. There are major differences in topography and climate among the potential vineyard sites across Arkansas.
2. Alternating warm and freezing winter temperatures can result in serious injury to wine grape cultivars especially of the *Vitis vinifera* species.
3. Vineyards of *vinifera* cultivars in Arkansas have been successful only in carefully selected mesoclimates.
4. The majority of these best mesoclimates are found in the foothills of the Ozark Mountains and other similarly protected areas of the state.

Growers who are considering establishing new wine grape vineyards may want to consider negotiating long-term marketing contracts with local wineries. If a contract agreement can be made to establish a range in prices and quantities of acceptable qualities, some degree of insurance can be provided the grower for recovering vineyard investments and making a profitable return. Contracting may be one way of minimizing the mutual dependency risks of (1) the grower looking for a profitable market and (2) the winery processor looking for a stable supply of quality wine grapes. Estimates in this report are consistent with the most current knowledge and research results of the scientists at the University of Arkansas Agricultural Experiment Station.

These cost estimates may appear to be higher than actual operating expenses because (1) in some seasons all the projected cultural operational costs may not be required; (2) many growers do not purchase the new required items of equipment and structure and are able to obtain used implements or to manufacture items on the farm at a considerable savings; (3) innovators are always developing new alternative technologies and methods of application to reduce costs and increase output and profits; and (4) future mechanization of vineyard cultural requirements will be directed to reduce costs and increase revenues.

As new techniques and improvements become available, the individual researcher and Cooperative Extension specialist dealing with that problem area will have this information. Contact your Cooperative Extension Service personnel for information concerning production or marketing information.

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the state's total would be evident: District 4 (Franklin County, et al.) - 494 acres (40%); District 1 (Washington and Benton Counties, et al.) -327 acres (27%); and District 3 (White County, et al.) - 234 acres (19%, almost all of which are table grape cultivars).

From a 1995 telephone survey of commercial juice processing firms, the Ozark Food Processor's Association (OFPA) reported that 500 acres of juice grapes were under contract in District 4 alone. In addition, OFPA reported that: (1) 100 acres of juice grapes had been planted in Benton County in 1993 and (2) that in 1995 there were 60 acres of newly planted wine type grapes in the District 2 area (Baxter, Cleburne, Stone and surrounding counties). Also, from contacts with managers at Arkansas wineries, it was estimated that 120 acres of wine grapes had been established in Franklin County in 1993. Based on the 1992 published report, OFPA's 1995 telephone surveys and industry contacts, there would be a collective estimate of 1500 acres of grapes in Arkansas. Using these figures, the distribution would be wine grapes-674 acres (44.7%), juice grapes-600 acres (39.8%) and table grapes-234 acres (15.5%).

Evidence of changes in the composition of grape acreage in Arkansas comes from the Arkansas Agricultural Statistical Service data in the 1976 and 1981 fruit surveys and their 1992 report plus grape industry telephone survey data.

For example, in the 1976 fruit survey the 2760 acres of grapes in Arkansas were reported with 60% juice type and 40% wine type. In that survey, Franklin County reported 854 acres (31 % of total) and Washington and Benton counties reported 1845 acres (67% of total). A continuing trend is observed in that in District 1, some of these acreages were originally planted for use in Concord grape juice but are now utilized for wine.

In the 1981 fruit survey, there were 1969 acres of grapes reported with three counties accounting for 96% of the total. For example, Franklin County in District 4 reported 695 acres of vineyards (35% of the state's total), all of which were wine grape cultivars. In District 1, Washington and Benton counties reported 285 acres of wine type and 924 acres of juice type grapes with the combined acreages representing 61% of the 1981 total. Thus, 50% of the 1981 grape acreage was utilized for producing wine.

Currently, 17 counties have commercial vineyards, but many of the counties not mentioned in the above discussion have vineyards consisting of relatively small plantings with unofficial estimates of a cumulative 200 acres. These vineyards tend to be either wine or table grapes, not juice grapes. Therefore, based on those collective estimates, there are more than 1700 acres of commercial grape vineyards in Arkansas.

Production Requirements

Vineyard management is assumed to be near the optimum level because the number and type of operations outlined in the budgets include all recommended practices. The recommendations were drawn from those with expertise in grape production and research at the Agricultural Experiment Station, National Grape Cooperative Association, and wine industry management level. If all operations were put into practice as listed, it would be considered a relatively high level of management. The assumption was that all recommended activities would be included. The costs are calculated as if the farmer started with a bare field and followed the budgeted pattern.

Grapes are planted in the spring. The first harvest is usually in the third year after planting, and maximum production is reached about the fifth year. As reported by local vineyards, a vineyard with proper care should remain productive for 30 years or longer. Harvest mechanization is projected for all juice and most wine type vineyards. However, because of industry practice and relative value, hand harvest costs are included in the budgets for *Vitis vinifera* cultivars. Land preparation, planting, cultivation, spraying, etc. through 30 years of vineyard life were included in the budget requirements, resource inputs, and resulting costs and revenue. After the information was assembled and processed, the authors, working as an interdepartmental committee, again checked each estimate to insure its accuracy. Several producers and juice and wine industry representatives participated in making some of the estimates.

Yield Estimates

Experiences of growers and research specialists were used to project the yield obtainable with each cultivar. The estimated quantities represent an average of the marketable product that some growers currently attain. Research results were utilized where applicable.

Whole analysis assumes good management in terms of production, technology, and disease and insect control measures. The projected yield for each cultivar, although higher than Arkansas's average, is attainable and can be exceeded if growers follow recommended practices. To address risk of yield variations, the averages were reduced by 10% to reflect potential loss due to natural disasters, adverse weather, such as hail, and other unavoidable environmental variations. The average of a 10% reduction in yield potential was hypothetical but was applied to all cultivars although it was recognized that each would not necessarily be at equal risk to hazards such as frost/freeze damage. In general, improved management should increase the yield of grapes to the level estimated while reducing the variability of yield and quality.

Disease and Insect Considerations

Loss of wine grapes to disease and insect pests are no more of a problem in Arkansas than in other states with similar environmental conditions. Economically feasible and technologically sound control programs have been devised for most pests.

Black rot, downy mildew, powdery mildew, bunch rot and anthracnose are the most serious diseases of wine grapes in Arkansas. In black rot, the fruit rots, blackens, shrivels, and is covered with tiny black pimples. Leaves show

brown spots having gray centers with black pimples. It is prevalent and will cause complete destruction of the crop if not controlled. Downy mildew and powdery mildew are primarily foliar diseases. Leaves infected with downy mildew have indefinite yellowish areas on the surface of the leaves with white downy patches beneath. Powdery mildew appears as a powder like dusting over the entire upper surface of the grape leaf. Fruit can have poor size, color and flavor, and some berries cease development and show gray mold on the surface. Although significant fruit damage can result from infection during or near bloom period, loss of plant vigor from premature defoliation is usually the most significant factor in failure to control downy and powdery mildew. All grape species, especially the *Vitis vinifera* and French-American Hybrid vines, can suffer serious winter injury from premature defoliation. Anthracnose is a problem on *Vitis vinifera* and French-American Hybrid grapes, a moderate problem on some *Vitis labruscana* and little or no problem for *Vitis rotundifolia* grapes. It is caused by a fungus and can attack all parts of the vine. Other disease problems may be significant in a specific year and/or vineyard, however, many of these diseases are controlled by the same sprays that control downy and powdery mildew.

The grape berry moth is a small brown worm that attacks the fruit, causing fruit to color prematurely, crack open or shrivel and drop from the bunch. The yield loss is small, but, if not controlled, damage from this pest may result in unacceptable quality of the crop to a processor or for fresh market. Climbing cutworms and flea beetles can reduce yields by destroying the buds. These insects are often present, but infestation levels are not always high, and they can be controlled with insecticides. Grape scale has been a major insect problem in the past but has not been a major problem since the drought of 1980. However, grape scale outbreaks should be monitored, since a population buildup is occurring in a few isolated vineyards. Control measures should be implemented when scale is observed. Grape root borer can attack the root system of the vine and reduce the vigor and vine numbers to a point that the vineyard is no longer an economic enterprise.

The means for effectively controlling grape diseases and insects is provided by available pesticides and fungicides along with good viticultural practices. Cooperative Extension Service spray leaflets provide recommendations for selection of materials and timing of application. Cooperative Extension agents and State Extension Specialists can help in developing a spray schedule if the one printed along with each year's budget is not applicable to an individual situation. The sequence and timing of pesticide applications given in this report were suggested by the Agricultural Experiment Station, Arkansas Cooperative Extension Service and wine industry representatives and should apply to a broad range of grape growers.

Location and Site Considerations

Three major factors that dictate where the various species and cultivars of grapes can be grown are 1) climate, 2) site and 3) soil. However, the most significant of these factors is climate.

The winter weather in Arkansas can change from mild to extremely cold. These fluctuations in temperature can result in serious injury to wine grape cultivars of the *Vitis vinifera* and *Vitis rotundifolia* species. The hardiest of the *Vitis vinifera* cultivars can be successfully grown only in the best macroclimates. The majority of the best macroclimates are located in the foothills of the Ozarks and other similarly protected areas in the state. The *Vitis rotundifolia* cultivars are usually considered adaptable in regions that can grow cotton and pecans.

Cultivars of the *Vitis labruscana* species and their hybrids are not as susceptible to winter temperature fluctuations as the *Vitis vinifera* cultivars and can be grown over a wider range of climatic conditions. However, the Concord cultivar *(Vitis labruscana)* has proven to be best adapted to the climatic region of northwestern Arkansas. Concord grapes will not ripen properly or uniformly in the warmer regions of the state. This problem of uneven ripening has not been a limiting factor in the production of the Niagara, Catawba and Delaware cultivars in the warmer regions of the state. However, the Arkansas Agricultural Experiment Station has recently released a new high-quality juice cultivar "Sunbelt" for the southern regions of Arkansas. In general, the French-American Hybrid cultivars fit somewhere between the Vitis vinifera and the Vitis labruscana species in terms of susceptibility to winter injury and ability to adapt to various climatic regions of the state. Vitis rotundifolia has winter hardiness levels similar to Vitis vinifera. Summer climate can be extremely hot and humid and, therefore, conducive to disease growth. This puts a further limitation on the best macroclimate for wine grapes.

Cynthiana (*Vitis aestivalis*) is native to Arkansas and is adapted to most regions of the state. One of the major limiting factors to production of this species has been extremely low yields (around two tons/acre). However, recent research at the Agricultural Experiment Station has shown that yields in the four to six ton range are possible when Geneva Double Curtain Trellising Systems are used with optimum viticultural practices. Site selection, or mesoclimate, is extremely important within an acceptable macroclimate area.

The site elevation is important from the standpoint of air drainage, a determining factor in frost prevention. Favorable vineyard sites are on hilltops or hillsides with elevations above adjacent valleys and with unobstructed airflow from the site. Site exposure, or orientation, may impart an additional advantage in terms of wind protection and temperature moderation at harvest. To gain advantages of elevation and exposure, choice vineyard sites are frequently found on sloping lands that provide for both water and air drainage. However, excessive slope on a site may impose serious limitations on vineyard layouts, erosion control and machinery operations.

Soil is of prime consideration, and the most important factors are surface and internal drainage and moisture retention. Well-drained, moderately fertile sandy or gravelly loam soils with a deep rooting area (four to six feet) and high organic matter with permeable subsoil are best. For grape vineyards, soil with a pH of 5.5 or 6.5 is preferred. Review soil

maps with a Cooperative Extension Agent and/or State Extension Specialist. Consideration must be given to adequate water of a suitable quality for irrigation.

In selecting a location, consideration should be given to marketing services and adequate transportation, storage and handling facilities. The more desirable sites will include availability to vineyard supplies and equipment service and repair. Also, vineyards with access to public services, such as research programs, will have advantages over remote locations.

Production of Muscadine (Vitis rotundifolia) Grapes

There has been interest in expanding commercial plantings of muscadine grapes *(Vitis rotundifolia)* in central and southern Arkansas. Muscadine grapes can be successfully produced in these regions, since they are not as seriously affected by disease or insects as other grape species and can be produced with approximately one-half the sprays required by French-American Hybrid grapes.

There are two types of muscadine grape cultivars planted in Arkansas. The pistillate or female flowering vines have flowers that produce only ovaries (fruit) and contain no anthers or pollen. Pollen for the female flowering vines must be provided by interplanting of self-fertile. The self-fertile or perfect-flowered vines have both ovaries (fruit) and pollen and can pollinate themselves and female-flowered cultivars.

Carlos and Noble cultivars have been commercially planted for juice and wine production in Arkansas. Carlos is a bronze cultivar of excellent quality and aromatic flavor; it ripens fairly uniformly and produces quality wine. The plant is vigorous, open, upright in growth, productive and somewhat more hardy than most other popular cultivars. It is suitable for mechanical harvesting. Noble is a black cultivar that is relatively winter hardy and makes into a quality red wine. Noble ripens uniformly and is adapted to mechanical harvesting. Both the cultivars have perfect flowers and are self-fertile.

Muscadine grapes are adapted to almost any well-drained, moderately fertile soil with a pH of 5.5 to 6.5. They are adaptable and native in many regions of the state. The minimum temperature the vines can withstand depends on vine condition and weather conditions that precede low temperatures. Fluctuations of temperatures from high to low can be as damaging as an absolute low temperature because grape vines tend to deaclimate (lose their winter hardiness). It is best to plant muscadines in regions where the temperatures rarely go lower than 0°F.

Unlike other grape species and cultivars produced in Arkansas, the width of the rows in muscadine vineyards may vary from 10 to 12 feet but are usually 12 feet. The minimum spacing of vines in the row is 20 feet. This 12 x 20 foot spacing only requires 180 vines per acre. The *Vitis vinifera, Vitis labruscana* and French-American Hybrid cultivars require 544 to 623 plants per acre depending, on species and cultivar.

Prices for Resource Purchases and Grape Sales

Data on the cost of material inputs were collected from a representative sample of farm supply firms in northwestern Arkansas beginning in January 1995. Considering the necessary time lag and assuming no major changes, the average prices as reported should be representative of conditions at retail. When identical items were considered, the rates and/or prices were made parallel to those reported in recent publications (Windham et al., 1995).

Selling prices that growers receive for wine type grapes will depend on the pattern and distribution of sales of the various wine varietals and supply of the final product. Wineries adjust their raw product purchase price in accordance with changes in supply and demand in their distribution channels. Table 1 shows grower prices that are used in the budgets and are most current and have recently been offered by Arkansas's wineries and juice processors. These prices closely reflect a five-year average of historical data for wine grapes in Arkansas and approximate future expected prices offered to growers by wineries. These prices are illustrative only and are not projections of future prices.

Table 2 lists the prices of inputs required for developing the enterprise budgets. The data in Table 2 are average retail prices quoted by area suppliers in May 1995 for services and materials required for grape production.

The 1995 prices for fuel and labor plus other costs and rates are also listed in Table 2. These are needed for generating the budgets of estimated revenue, costs and net returns by year of production. As in other budget publications, the $6.25 hourly rate for irrigation and $7.50 for machinery operation labor reflects an estimate of the costs of unemployment insurance, social security and other expenses that must be paid by the employer.

Equipment Costs

Table 3 lists the items of machinery and equipment used in the operations in the enterprise budgets. The field efficiency usage rates given for each implement were used in calculating the cost per hour of use. If a producer's actual annual hours of use are less than the engineering estimates in Table 3, then actual fixed costs for those items would be underestimated in the budget results reported. Because only dealer list prices for 1995 were included, the fixed costs represent replacement value with new equipment (Windham et al., 1995). Depending upon availability of used machinery, hours used annually, maintenance and remaining expected life, an individual farmer may have higher or lower fixed costs than these estimates. The "Your Estimate" column can be used to reflect each individual situation.

The repair and maintenance costs reflect a linear average of costs over the useful life of the equipment. As the standard usage for production budgeting, these costs are used to reflect an average cost of repair and maintenance. However, it should be noted that due to the cost rising over the useful life of the equipment, the projected costs will be overstated in the first few years and understated in the last few years.

Table 1. Estimated average prices for Arkansas wine grapes by species and cultivar.

Species/Cultivar/ Type of Grape	Price in Dollars per Ton to the Grower in 1995*	Your Estimate
1. Vitis vinifera		
Pinot Chardonnay (White)	1000	
White Riesling (White	625	
Cabernet Sauvignon (Red)	1000	
2. French-American Hybrid		
Vignoles (White)	500	
Vidal (White)	450	
Seyval (White)	400	
Villard Blanc (White)	220	
Chambourcin (Red)	500	
Chancellor (Red)	350	
3. *Vitis aestivalis*		
Cynthiana (Red)	750	
4. *Vitis labruscana*		
Delaware (Pink or White)	325	
Catawba (Pink)	300	
Concord (Red)	225	
Niagara (White)	300	
5. *Vitis rotundifolia*		
Carlos (White)	300	
Noble (Black)	300	

*These estimates, which are based on experience in a given year, can be expected to vary based on supply and demand for the raw product. Therefore, the prices used in this report are only prices at one point in time and are not projections of future prices.

Irrigation Costs

The budgets were prepared so as to estimate performance of irrigated grape vineyards. Rainfall in Arkansas is not sufficient on the average for producing optimal grape yields. Irrigation increases both the quality and the quantity of grapes and reduces the variability between harvests (Morris and Cawthon, 1982, 1983; Spayd and Morris, 1978). The budget estimates reflect the cost of applying an average of 15 acre-inches of water per growing season. Requirements will vary depending on the site and the soil's texture and moisture retention capabilities. Water acquisition is assumed to 'be from an on-farm or nearby surface source, such as a pond or spring. If a grower must get water from a well, costs would have to reflect any additional expenses. Engineering data on physical requirements and input formulas were used to calculate the fixed and variable irrigation costs. The system identified as most efficient for this type of operation included a diesel engine with "trickle irrigation" distribution.

In the "Fixed Cost" section of each budget, the irrigation machinery entry was calculated as described in Table 4. The "Variable Cost" sections include an entry for irrigation machinery and irrigation labor. The per-acre cost for irrigation machinery was calculated as outlined in Table 4. Irrigation labor was charged at 0.134 hours/acre-inch of water applied.

For an estimated 40-acre vineyard, the following assumptions would apply to the irrigation system:

1. A diesel, two-cycle, 80 cubic in. engine is the pump power source (20 hp manufacturer's rating).
2. Pumping head is 80 psi with a water flow rate of 300 gal/min.
3. Pump efficiency is rated at 60% with a 14-year life for the pumping system with zero salvage value.
4. Although manufacturers have limited warranties, the "trickle irrigation" delivery system is expected to last 10 years with proper maintenance.
5. Emitters in the trickle system operate at 15 psi.
6. The irrigation laterals are suspended 18 in. above the ground by #11 wire with clips placed every 4 feet.
7. Rates for insurance, taxes and annual interest are 0.6, 0.5 and 9.5%, respectively, on average investment.

The irrigation system for a typical vineyard is shown in Figure 1. It consists of a power set (pump), which is directly connected to the main header or irrigation pipe that lies across one end of the vineyard. Suspended above the ground, along the rows, are smaller, lateral pipes with in-line emitters. This particular layout will provide ample irrigation for optimum grape production throughout the season. The vineyard also consists of 24-ft turnrows and 20-ft endrows for ease of machinery operation and maneuvering. With this additional spacing it is noted that land acreage needed to cultivate 40 acres of plants is increased to 44.2 acres, which accounts for the added spacing.

Table 3. Field efficiency, estimated price, hours used per year, and years owned for machinery, wine rapes, Arkansas, 1995.

Line No.	Name of Machine	Width Feet	Field Efficiency	List Price	Hours Used/Year	Years Owned
1	Cab for Tractor	NA	0.000	7500	600	10
2	Tractor, 45 HP[1]	NA	0.880	17000	600	10
30	MBPLOW 3 BOTTOM	2.3	0.800	3250	120	15
35	Tandem Disk	5.0	0.800	3300	180	10
36	Spike Harrow	15.8	0.700	1200	125	10
40	Skibbe Spreader	NA	0.700	1400	50	10
43	Transplanter	4.0	0.800	925	120	10
45	Tractmount Spray	6.0	0.650	3300	200	8
46	Gun Sprayer	NA	1.000	350	0	5
48	Bush Hog	5.0	0.850	1200	167	10
49	Orchard Sprayer	8.0	0.750	11300	250	8
51	Grape Hoe	9.0	0.500	1300	90	5
52	Post Hole Auger	NA	0.800	1100	40	15
95	Trailer 6 X 10 ft	7.0	0.900	1500	200	10
96	Post Driver	NA	1.000	1700	120	15

[1]Fuel multipler = 0.054

For wine grapes the budgets project the cost of trellis systems adapted for bilateral cordon pruning techniques. For vinifera cultivars, the trellis consists of a strong, low, No. 11 gauge wire strand between posts to bear most of the weight of the vine and grapes. Two upper No. 13 gauge strands are added as "catch wires" to hold and prevent the breaking of vertical branches growing from the main vine. For the other cultivars, the bilateral cordon pruning techniques requires only a single No. 11 gauge wire strand. Tables 5 and 6 outline the material and labor cost for those trellis systems.

For both 40-acre vineyard trellis systems, the following assumptions would apply:

1. Treated line posts (3 in. x 8 ft) - 204/acre
2. Treated end posts (6 in. x 8 ft) - 14/acre
3. Anchors to stabilize end posts - 14/acre
4. Treated stakes (1 in. x 8 ft) - 623/acre
5. #9 wire HT (tie off end posts) - 200 ft/acre
6. #11 wire HT (1 wire) - 4356 ft/strand/acre
7. #13 wire HT (2 upper catch-wires) - 4356 ft/strand/acre *(vinifera* cultivars only)

The investments in the trellis system are depreciated over the 30-year expected useful life of the vineyard. The amortization is entered as an annual fixed cost, not as an annual variable cost in the year of installation. In each succeeding year only annual trellis maintenance requirements are included in variable cost. This treatment conforms to economic and accounting principles and, to some extent, to income tax guidelines.

Enterprise Budget Summary

Estimated revenue, costs and net returns above specified costs are summarized by year of production for four different species groups of wine grapes. In the Appendix* there are detailed budgets that list cost estimates for the following cultivars as examples for each of the four general groups: 1) White Riesling-*Vitis vinifera* (grafted rootstock), 2) Chancellor-French-American Hybrid (nongrafted rootstock), 3) Delaware-*Vitis labruscana* and *Vitis aestivalis* (nongrafted rootstocks) and (4) *Vitis rotundifolia* (nongrafted rootstock). Because the cultural practices and resource requirements would be the same for the other cultivars within each species group, it would be repetitious to give Appendix tables for each. Therefore, the Appendix contains only one set of tables to describe operations and costs for the selected example of each species. For each year of production in each of the four categories, separate Appendix tables summarize expectations for the following: 1) a comparison of revenue with material, equipment and labor costs, 2) equipment operations and associated costs and 3) spray schedule and pesticides.

Cost Structure Analysis

Within the groupings of (1) *Vitis vinifera, (2*) French-American Hybrids, (3) *Vitis labruscana* and *Vitis aestivalis* and (4) *Vitis rotundifolia* the cultural practices and resource requirements are the same. That is, the materials and structures, field operations, hours of nonharvest labor and applications of chemicals and fertilizers would be identical among cultivars within each of the four groups. This results in an equality in all costs for Years I and 2 within each of the four divisions. Also costs would be equal for (1) preharvest variable costs (Years 1, 2, 3, and 5) and (2) fixed costs (Years 1, 2, 3 and 4). In this way, the budgets that follow can be observed to reflect many costs that are equal for cultivars within a group, especially the uniformity of totals including cumulative costs for Years 1 and 2.