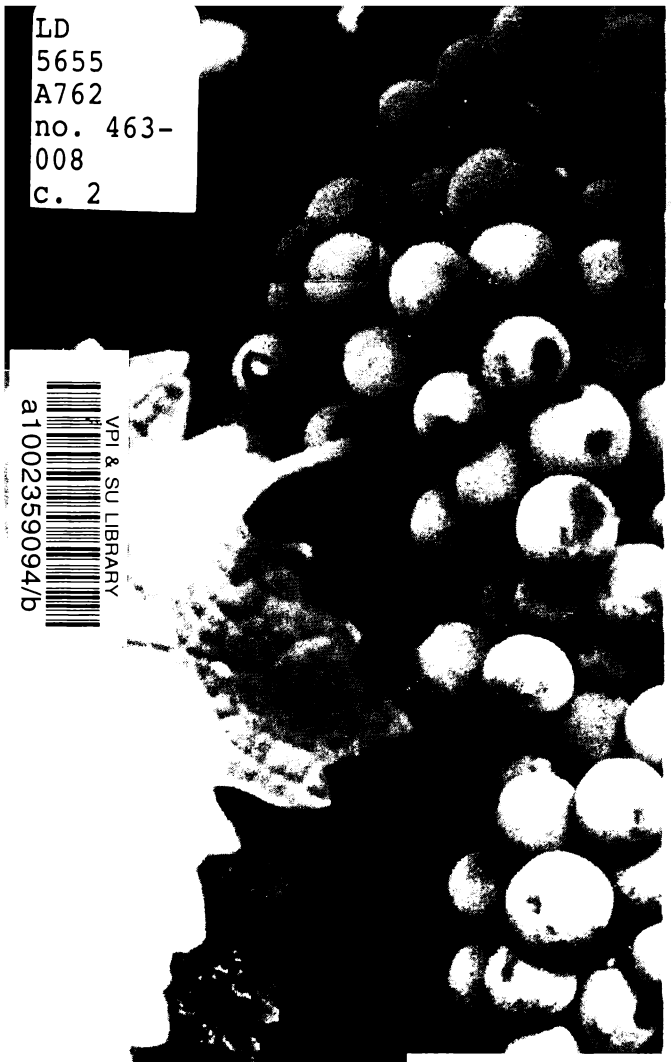

The Economics of Wine Grape Production in Virginia

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The Economics of Wine Grape Production in Virginia

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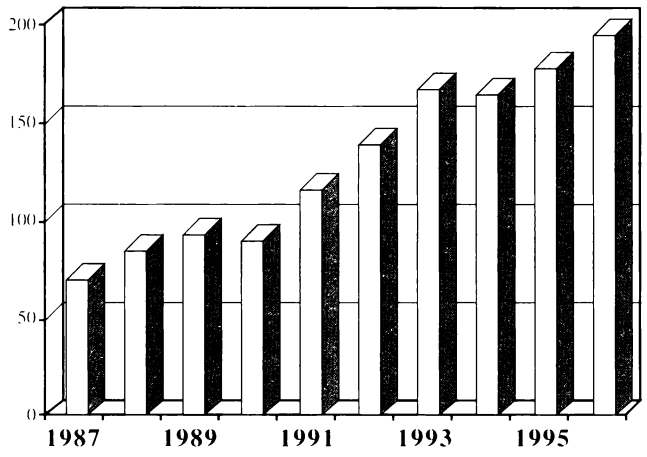
The Economics of Wine Grape Production in Virginia

CONTENTS

Introduction

Grape and wine production are expanding sectors of Virginia's diverse agriculture. Grape acreage increased from 1100 acres in 1987 to 1560 in 1997, while the number of wineries increased from 35 to 50 over the same period. Case sales of wine, a more direct indicator of consumer demand, have shown excellent growth over the same period (Fig. 1). Expansion of Virginia farm wine sales depends upon an increased supply of Virginia grapes. Given the historic and anticipated future value of high quality wine grapes,

Figure 1. Case sales of Virginia Wine (in thousands) by year.



grape production represents a profitable, intensive use of small land parcels. Budgets are needed to provide potential growers, Cooperative Extension workers, and lending institutions with accurate cost and return analyses for wine grape production. This bulletin considers the relative costs and returns of small (e.g., 10- to 20-acre) vineyards operated under one of four different training and trellising systems. The choice of vineyard size for budget modeling is somewhat arbitrary. Many of Virginia's vineyards are less than 10 acres in size and are operated as secondary income enterprises. Those who aspire to establish small vineyards typically own their land and may have some of the equipment needed for vineyard operation. The cost of mechanized harvesters, pruning systems, and canopy management equipment (e.g., leaf puller) would be prohibitively expensive to operate in such small operations. By contrast, large vineyards would likely profit from the reduction in hand labor costs afforded by such machinery; however, analyses have not been performed in Virginia to determine the size operation needed to justify the purchase of mechanical harvesters, pruners, etc. The budgets were prepared using Microsoft Excel® spreadsheets. As with previous budgets (Vaden and Wolf, 1994), the budgets contain a column for the prospective grower to record his own cost estimate or data for each input or return.

Assumptions

There are a number of assumptions that were made in developing the following budgets that must be understood by the reader. No two enterprises will be identically operated. Some prospective growers will choose to substitute materials and may own some if not all of the needed equipment. Some will not require outside financing; others may choose not to record their own labor. While these may be legitimate business decisions, they would create an endless number of possible scenarios to describe. Therefore, the budgets were developed using practices and materials that have proved both practical and cost-effective under a wide range of growing conditions. Enterprising growers might find alternative materials or practices to reduce operating costs without impairing vineyard productivity or grape quality.

Fixed *vs.* variable costs: As with other businesses, vineyard costs are either fixed or variable. In this publication, we consider only the establishment and annual or variable costs. We do not attempt to factor in fixed costs such as land, the initial equipment investment, or other fixed costs such as insurance, payroll costs, or business taxes. We do, however, include trellis and vines as "variable" costs even though these are technically fixed costs. Machinery and equipment expenses only reflect operating costs; no charges have been included for ownership items such as insurance, taxes, or depreciation/capital recovery. Annual repairs can be estimated at one to three percent of purchase price, depending upon initial equipment cost and hours of annual use; however, repair costs are not included in actual cost of operation due to the variability of repair costs. No

costs are included for major land preparation such as timber clearing, rock removal, or land leveling. Those operations, if required, should be considered in your own cost analysis. In addition, many vineyards will benefit from supplemental irrigation and electric deer fencing, which were not included in these budgets. The added capital expense of irrigation or deer fencing will likely be quickly recovered by accelerated or more consistent grape production. In particular, irrigation may have its greatest benefit during the vineyard's first year. Similarly, the use of bird scare devices or netting, and the use of "grow tubes" or vine shelters, which may be of benefit, have not been included.

Labor: The input with the greatest variability is the time involved in doing certain tasks. Figures used here for specific vineyard tasks are a synthesis of actual data obtained from growers, similar data used in other states' publications, and our own estimates where other data were lacking. Labor is calculated at two different rates: $7.00/hour for "unskilled" labor, and $9.00/hour for "skilled" labor, where "skilled" typically denotes machinery operation and vineyard design. Labor represents over 20% of the establishment cost and over 40% of the annual operating cost of the established vineyard. A trained individual, doing most of the work on weekends and evenings, can operate a five-acre planting. Vineyards of 10 or more acres typically have one full-time owner or operator, plus full- or part-time labor as needed. Harvest usually poses the most critical labor demand as fruit must be removed within a relatively short period. Vineyard site, grape variety, vineyard design, pest management, and other cultural practices will also affect vineyard establishment, productivity and operational costs and returns.

Vineyard specifics: The hypothetical vineyard is established at an excellent site where the hazards of winter cold injury and spring frosts are minimal. Costs of hilling and de-hilling graft unions, special frost protection measures, and winter injury compensation strategies are not included. Even the best vineyard sites in many areas of Virginia should expect one significant crop reduction due to winter injury or frost in a 10-year period. While we have not attempted to factor such a loss into the capital recovery period for any of the budgets, we have used conservative yields that, over time, may account for some crop reduction.

The vineyard receives optimal management, and cultural practices are similar to those recommended in *The Mid-Atlantic Winegrape Growers Guide* (Wolf and Poling, 1995). A nominal crop is obtained in the third year, with full production attained in either the fourth or fifth year, depending upon training system used. The proposed yields are realistic and are currently being achieved by Virginia's better producers (Vaden and Wolf, 1994). The proposed crop yields are, however, greater than current *average* yields obtained by Virginia producers.

The detailed budgets are extended through the amortization period for each training system, which is either the sixth or seventh season. Summary tables extend the annual expense and income analyses through the tenth year, and evaluate the internal rate of return for each farming system. Vineyards that are well managed, that are generally free of lethal diseases and insects, and that use modern trellis components, should exceed 25 years of profitable operation.

Material costs, grape prices and debt service: The model budgets are based on production of premium varietal grapes, such as 'Chardonnay' or 'Cabernet Franc.' As such, grapes are priced at the vineyard at $1,300 per ton, a competitive price in 1997. Rental of a refrigerated transport is typically required, but has not been included in production costs. Material costs, including grapevines, trellis materials, and pesticides, were based on the lowest quoted figures for bulk purchases in the Winchester, Virginia area and were current in 1997[1]. All material inputs are tabulated on an Excel® price file, which is transparent to the reader. Interest on annual and accumulated operating costs is computed at 9%. Interest on annual operating costs is based on one-half of the initial year of the loan, the assumption being that borrowed funds are needed only for the growing season. This will, of course, vary with individual needs and among lending institutions.

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[1] *Commercial products are named in this publication for informational purposes only. Virginia Cooperative Extension does not endorse these products to the exclusion of other products that might also be suitable.*

Training Systems and Vine Spacing

Vine spacing and training decisions will have long-term consequences on the productivity and profitability of the vineyard. Given their importance, spacing and training decisions must be carefully considered well before the vineyard is established. The following discussion provides a brief overview of the principles involved in vine spacing and training concepts.

Row, vine and canopy spacing: Traditional grape training and trellising systems have undergone extensive evolution in the last 10 to 20 years, primarily in response to the need to minimize the cost of production but also to increase the quality of the crop. Typical of that evolution is the move towards vertically shoot-positioned canopies that optimize fruit and foliage exposure, promote better disease control, and which are adapted to mechanization. To increase profitability, growers may also decrease row spacing or divide vine canopies into two or more discrete canopies in order to increase the linear feet of vine canopy per acre. The goals and principles of grapevine training and trellising are described in detail in other publications (Smart and Robinson, 1991; Wolf, 1991; Wolf and Poling, 1995), and should be fully understood before choosing a training and trellis support system. For the purposes of this publication, the following brief review may be considered.

The terms used in this publication are based on the following definitions:

Row spacing: The distance from one line of grape trunks to the next.

Vine spacing: The distance from one vine to the next in a given row.

Canopy: The leaf and shoot system of the vine; it may be described in terms of height (base to top), width, or per unit length of row (e.g., 2x for Geneva double curtain and lyre), or by density (e.g., 15 shoots per meter of canopy).

Canopy spacing: The distance from one canopy to the next, either on the same row or from row to row.

Row spacing or width in most Virginia vineyards varies from nine to over 12 feet. Differences in topography, existing machinery width, and grower attitudes contribute to that variation. Nevertheless, fundamental principles should be applied to row space decisions. One important principle states that ***vineyard productivity (e.g., tons per acre) is increased by increasing the linear feet of well exposed canopy per acre.*** Note that "feet of canopy" equates with "feet of row" for non-divided canopy training systems, and that canopy division results in two or more canopies per row. Vine spacing varies from about three feet to around 12 feet. In general, vine spacing in the row is increased under conditions where high vigor may be expected, and is decreased where low vigor can be anticipated. Factors which may contribute to increased vine vigor include moist, deep soils with high inherent fertility, use of rootstocks, use of irrigation, and use of a naturally high vigor variety, such as 'Cabernet Sauvignon.' Vine spacing may also be determined by pruning method: cane-pruned vines should not be spaced more than eight feet apart in the row, as horizontally-positioned canes longer than four feet may fail to produce shoots of uniform vigor. The maximum vine spacing for cordon-trained vines is governed by practical considerations of how long it takes to develop cordons. Cordons should not be lengthened more than about two feet per year to ensure good spur development.

To reiterate the statement made earlier, an acre of land that supports many linear feet of canopy will be more productive than an acre that has relatively few canopies (rows) with wide alleys between rows. Some of the underlying research that contributed to this fact was done 30 years ago in the development of the Geneva Double Curtain training system (Shaulis et al., 1966). That research showed very clearly ***that vine spacing mainly affected yield per vine, whereas row spacing mainly affected yield per acre.*** Higher yields per unit area of vineyard were therefore achieved by decreasing row width, or by increasing the number of canopies or curtains per unit length of row — as by canopy division.

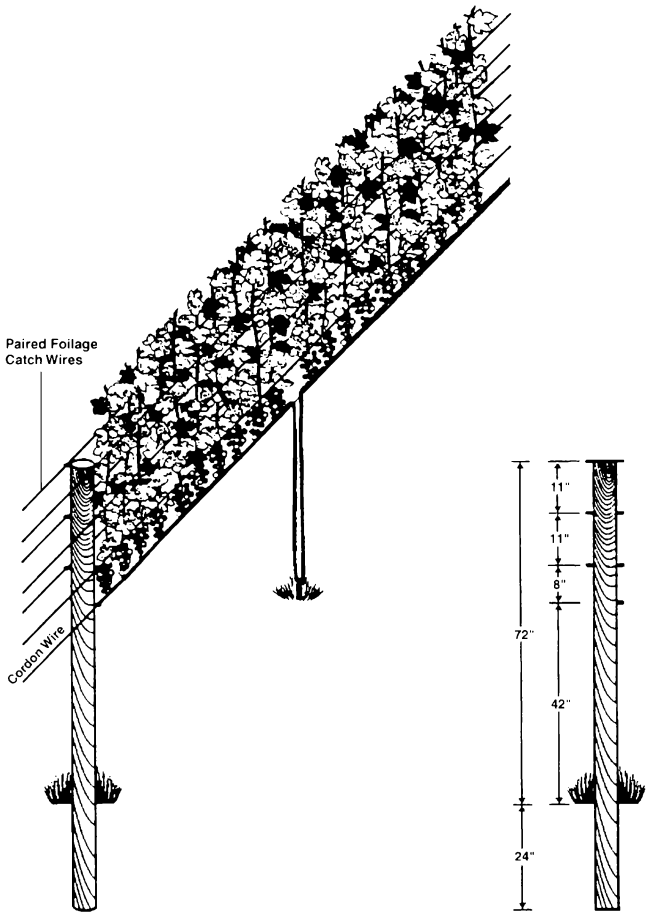
The question then becomes, "How closely can the canopies (or rows) be spaced?" Spaced too closely, one canopy shades that of the next row. Computer modeling as well as field experience suggest that canopies be spaced no closer than the canopy height dimension. Canopy height is the distance from the canopy's base (not the ground) to the top of the canopy. This distance is typically 4 to 5 feet. Theoretically, the canopies could therefore be spaced about 6 feet apart (an extra foot is allowed because the canopy is at least one foot wide). The practical consideration with narrow canopy or row width often hinges on availability of narrow farm equipment that will traverse the row middles. Narrow equipment is available, but growers should look critically at availability of parts and service. Furthermore, established growers often already own larger equipment and find it difficult to justify purchasing more specialized, narrow-axled equipment. Due to these real or perceived limitations, row width in Virginia has tended towards "wide" rather than "narrow" spacing. The price of these wide rows is unrealized production: sunlight that is intercepted by row middles rather than by vine canopies is of no use to the grapevines. Growers should realize, therefore, that increased profits can be achieved by more efficiently using land area. Accordingly, one of the systems illustrated in this bulletin is based on narrow (7') row spacing. While a row spacing of 7' makes for efficient use of land, the choice of machinery to operate in such rows becomes extremely limited. There are, however, contemporary tractors, sprayers, and mowers that are 48" to 52" wide, and therefore suitable for these narrow rows. Row spacing should be widened somewhat on slopes to avoid potential problems with implement drift.

The Vineyard Models

The establishment and operational costs and returns associated with each of the four training systems are based on the model dimensions shown in Table 1. The costs and returns of all four systems are based on a roughly rectangular area of land, approximately one-acre in size. Note that the feet of canopy per row, and the feet of canopy per acre, increase with the 7' row spacing and with canopy division (Table 1).

The non-divided canopy training system is based on a bi-lateral, cordon-trained vine, with a vertically shoot positioned (VSP) canopy (Fig. 2). Both a narrow (7') and wide (10') row width are compared with this training system. Yield per acre, when vines are in full production, is estimated at 5.6 tons per acre for the 7' row space, and 4.0 tons per acre for the 10' row space. The VSP 10' (row) x 7' (vine) system is as close to a "standard" system as exists in Virginia.

Figure 2. Bi-lateral cordon-trained vine with vertically shoot-positioned (VSP) canopies. Vines are spaced 7 feet apart in the row. Row width either 10 feet (10 x 7 VSP) or 7 feet (7 x 7 VSP).



Two divided canopy training systems are also compared. Both use cordon training and a row space of 10'. The lyre system uses upright-trained shoots and yields an estimated 6.8 tons per acre when in full production (Fig. 3). The Smart-Dyson system uses a

vertically divided canopy and ultimately yields an estimated 6.0 tons per acre (Fig. 4). The Smart-Dyson training system is a relatively recent introduction and is the one system for which we lack experience and research-based yield data. We have therefore used a somewhat liberal estimate of canopy management labor and a conservative estimate of crop yield for the Smart-Dyson system.

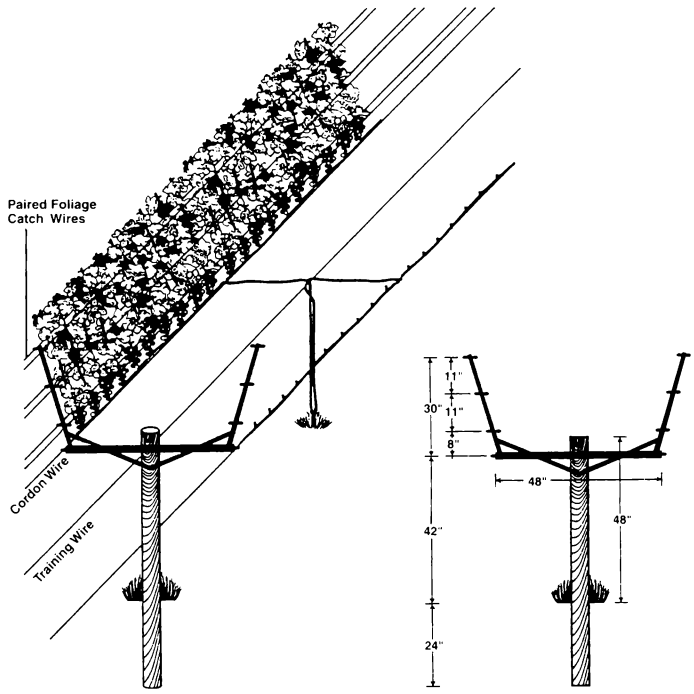
Costs and Returns

The annual, estimated costs and net returns for three of the four alternative systems are detailed in Tables 2 through 6. For economy of space, we have not included a detailed budget description for the VSP 7' x 7' system. Materials and costs associated with the VSP 7' x 7' are similar but somewhat greater than those shown for the VSP 10' x 7' system (Table 2). We have, however, provided a 10-year summary of costs and returns associated with VSP 7' x 7' system, which illustrates how row spacing affects costs and returns (Table 7).

VSP 10' x 7': Annual costs for the VSP 10' x 7' system are detailed in Table 2. The highest annual costs are borne in the first year and are approximately $6,800 per acre. These costs include $1,856 in grapevines and $1,601 in trellis materials. Year 2 cash expenses decrease to about $1,100 per acre. A partial crop of 2.5 tons per acre in year 3 results in a net investment of about $8,000 per acre, and a net return of about $3,100 per acre is achieved in year 7. Machinery inventory and annual hourly use for the VSP 10' x 7' system are shown in Table 3 and are approximately $58,000. The corresponding hourly cost and annual cost per acre are shown in Table 4.

Lyre 10' x 7': The lyre system uses an intricate system of foliage catch wires and support structures to assist with canopy separation (Fig. 3). The extra hardware makes the lyre the most expensive system to install among the systems compared here. Year 1 establishment costs for the lyre are detailed in Table 5 and exceed $9,000 per acre. The total investment in the lyre system is approximately $15,600 per acre in year 3 and is offset by a 2.5-ton per acre partial crop that results in a net investment of $12,300 per acre that year. Full production of 6.8 tons per acre is attained in year 5, and a net return of over $5,000 per acre is achieved in year 7 (Table 5). Machinery purchase costs and annual hourly use for the 10' x 7' based lyre system are comparable to the VSP 10' x 7' system, and are shown in Tables 3 and 4.

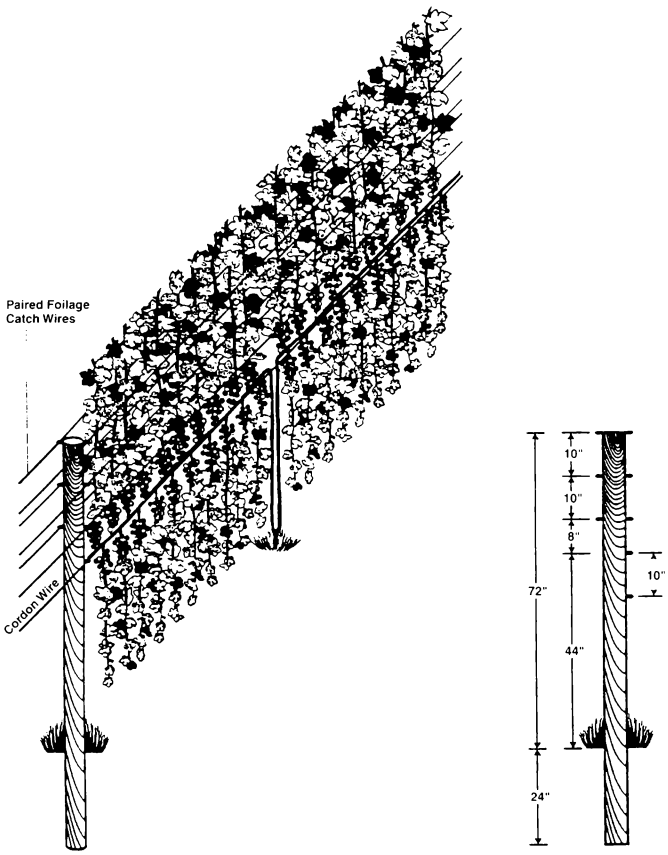
Figure 3. Divided canopy, cordon-trained vine (lyre) with upright shoot growth. Vines are spaced 7 feet apart in the row. Row width is 10 feet (Lyre 10 x 7).



Smart-Dyson 10' x 7': Establishment costs of the Smart-Dyson system are comparable to those of the VSP 10' x 7' system and, as detailed in Table 6, approach $7,000 per acre. The total investment in the Smart-Dyson 10' x 7' system is approximately $12,000 per acre in year 3 and is offset by a 2.5-ton per acre partial crop that results in a net investment of approximately $9,000 per acre in the third year. Full production of 6.0 tons per acre is attained in year 5,

and a net return of over $2,000 per acre is achieved in year 6 (Table 6). Machinery purchase costs and annual hourly use for the Smart-Dyson 10' x 7' system are comparable to the VSP 10' x 7' system, and are shown in Tables 3 and 4.

Figure 4. Divided canopy, cordon-trained vine (Smart-Dyson). The opposing canopies are vertically divided from a common cordon. Vines are spaced 7 feet apart in the row. Row width is 10 feet (Smart-Dyson 10 x 7).



Summary

Expense and revenue summaries for each of the four systems are presented in Tables 7 through 10. It is critical that the reader recognize that land and equipment purchase prices have not been factored into these investment analyses. The reason for this omission is that the majority of clientele who investigate grape growing opportunities in Virginia already own land, and most own some farm equipment. It is only fair to say, however, that grape production will be far less profitable if prospective growers must include land and new equipment purchases in their original investment.

Annual costs and returns for the **VSP 7' x 7'** system are shown in Table 7. As previously detailed, the most significant expenses are plants and trellis materials, as well as the labor associated with their installation. Annual operating expenses stabilize in the fifth year and equal $2,346 per acre. Beyond that point, dormant pruning, canopy and pest management, harvest labor and machinery operation represent the major annual labor expenses. Vineyard revenues commence in the third year and stabilize at $7,280 per acre in the fourth season, assuming consistent yields of 5.6 tons per acre and a constant crop value of $1,300/ton. Analyzed in this simple fashion, the VSP 7' x 7' system generates a 21.42% rate of return after 10 years. The internal rate of return is the interest rate received for an investment that consists of regular payments (establishment and annual operating expenses) and income (crop payments). The predicted, cumulative cash flow after 10 years of operation is $21,557 per acre. This and the other cumulative figures presented in summary tables assume that costs and returns remain constant. As this is rather unlikely, the cumulative returns should only be used for comparison, and not for predictive purposes.

Annual operating expenses for the **VSP 10' x 7'** system are $1,847 per acre after the fourth year (Table 8). The VSP 10' x 7' system produces a 17.90% rate of return after 10 years. The relative inefficiency of the VSP 10' x 7' is illustrated by the retarded cumulative return, $13,155 per acre, the lowest of the systems evaluated.

Annual operating expenses for the **Lyre 10' x 7'** system are $2,835 per acre after the fifth year (Table 9). The higher cost of operation of the lyre-trained vines reflects the extra labor in canopy management, pruning and fruit harvest. The lyre system generates a 19.65% rate of return after 10 years. The 10-year cumulative cash flow is $23,233 per acre.

Annual operating expenses for the **Smart-Dyson 10' x 7'** system are $2,413 per acre in the sixth and subsequent

years (Table 10). The Smart-Dyson system generates a 25.03% rate of return after 10 years, the highest rate of return among the systems compared. Cumulative cash flow after 10 years of operation is $23,827 per acre.

For brevity, we have considered only 4 possible training and spacing systems. One could visualize that a Smart-Dyson system, coupled with a more narrow row spacing, would be superior to either the VSP 7' x 7' or the Smart-Dyson 10' x 7' system. Similarly, Geneva double curtain training, which has far less material costs, should be superior to the lyre for varieties that adapt to downward shoot positioning.

We remind the reader that the labor costs associated with each of the different training and spacing systems are somewhat anecdotal, especially for the divided canopy training systems. Long-term research comparisons of the different training systems described here are lacking in Virginia. While data for specific variety and training system comparisons are lacking, the concepts of increased productivity, and profit, afforded by increased linear feet of exposed canopy per acre, are universal.

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Table 1. Training and vine spacing dimensions and expected yields of the four training systems evaluated in the budget.

Parameter	Non-divided canopy VSP 7'x7'	Non-divided canopy VSP 10'x7'	Divided canopy lyre 10'x7'	Divided canopy Smart-Dyson 10'x7'
Row width (ft)	7	10	10	10
Vine spacing in row (ft)	7	7	7	7
Post spacing in row (ft)	28	28	28	28
Row length (ft)	448	448	448	448
Posts per row	17	17	17	17
Rows per acre	14	10	10	10
Vines per row	64	64	64	64
Vines per acre (based on model)	896	640	640	640
Feet of canopy per row	448	448	896	896
Feet of canopy per acre	6,272	4,480	8,960	8,960
Model area (43,560 ft^2 per acre)	43,904	44,800	44,800	44,800
Yield at maturity (tons/acre)	5.6	4.0	6.8	6.0

Table 2. Establishment and annual operational costs associated with vines spaced 7 feet apart in rows 10 feet wide. Vines are bi-lateral cordon-trained and spur-pruned. Canopies are vertically shoot-positioned in an upward direction (VSP 10 x 7). Costs and returns are shown for seven years.

Year 1 Preproduction Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Site Preparation				
Soil sampling-labor (unskilled)	$ 7.00	1.5	$ 10.50	
Soil testing (1 test per 10 acres)	$ 9.00	0.1	$ 0.90	
Lime (3 tons per acre)	$ 18.00	3	$ 54.00	
Liming-labor (skilled)	$ 9.00	2	$ 18.00	
Plow and disc-labor (skilled)	$ 9.00	3	$ 27.00	
Cover crop seed (50 lbs. per acre of turf type fescue)	$ 1.60	50	$ 80.00	
Sow cover crop-labor (skilled)	$ 9.00	1	$ 9.00	
Vineyard Layout				
Markers (post and vines)	$ 0.07	810	$ 56.70	
Mark vine and post locations-labor (skilled)	$ 9.00	4.8	$ 43.20	
Planting				
Vines	$ 2.90	640	$ 1,856.00	
Auger vine holes-labor (skilled at 3 minutes per hole)	$ 9.00	32	$ 288.00	
Planting vines-labor (unskilled at 2 minutes per vine)	$ 7.00	21.33	$ 149.31	
Weed Control				
Herbicide cost (oryzalin and glyphosate)	$ 28.18	1	$ 28.18	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing of vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Fertilizer	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	2.13	$ 14.91	
Canopy Management				
Tying materials (tape)	$ 0.85	2	$ 1.70	
Shoot thinning and shoot tying to stakes-labor (unskilled)	$ 7.00	21.33	$ 149.31	
Flower cluster removal-labor (unskilled)	$ 7.00	2.13	$ 14.91	
Disease and Insect control				
Spray materials cost	$ 86.70	1	$ 86.70	
Spray application-labor for 6 sprays (skilled)	$ 9.00	2	$ 18.00	

Year 1 Preproduction Expenses (VSP 10 X 7): *(continued)*	Unit cost	Units/acre	Cost/acre	Your estimate
Trellising Materials				
3"x 8' CCA-treated line posts	$ 3.47	150	$ 520.50	
6"x 8' CCA-treated end posts	$ 5.88	20	$ 117.60	
12.5 ga.HT cordon and foliage wire	$ 68.00	8.23	$ 559.64	
10.5 ga. anchor support wire	$ 55.00	0.26	$ 14.30	
End post anchors	$ 5.95	20	$ 119.00	
In-line ratchet wire strainers for cordon wires	$ 1.58	10	$ 15.80	
Wirevise wire strainers for foliage wires	$ 1.43	60	$ 85.80	
Fencing staples for cordon and foliage wires	$ 1.90	25	$ 47.50	
Wire crimping sleeves	$ 0.10	60	$ 6.00	
Bamboo stakes for trunk support	$ 0.18	640	$ 115.20	
Trellis Construction Labor				
Distribute and drive posts (1 skilled, 1 unskilled at 6 minutes per post)	$ 16.00	15	$ 240.00	
Auger and set end post (1 skilled, 1 unskilled at 4 minutes per post)	$ 16.00	2.66	$ 42.56	
Mark line post for cordon and foliage wires (unskilled)	$ 7.00	1.8	$ 12.60	
Mark end post for wire strainers and wirevises (unskilled)	$ 7.00	0.24	$ 1.68	
Drill end post for wirevises (unskilled)	$ 7.00	2	$ 14.00	
Install line post staples for cordon and foliage wire (unskilled)	$ 7.00	4	$ 28.00	
Install end post anchor structure (skilled)	$ 9.00	8	$ 72.00	
String and tighten cordon and foliage wire (unskilled)	$ 7.00	9.6	$ 67.20	
Install bamboo stakes (unskilled)	$ 7.00	2.66	$ 18.62	
Safety Equipment				
Personal Protective Equipment and warning signs			$ 191.35	
First aid, chemical spill, and decontamination kits			$ 195.00	
Hand Tools				
Total cost			$ 617.95	
Machinery				
Cash operating expenses only			$ 465.42	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 6,508.10	$ 292.86	
Annual Cash Expenses - Year 1			**$ 6,800.97**	

Year 2 Preproduction Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Pruning and tying of canes prior to budbreak-labor (unskilled)	$ 7.00	10.24	$ 71.68	
Tying material (tape)	$ 0.85	2	$ 1.70	
Weed Control				
Herbicide cost (oryzalin and paraquat)	$ 23.99	1	$ 23.99	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing of vineyard aisles-labor 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Replanting				
Vines (2% of initial planting)	$ 2.90	13	$ 37.70	
Replanting-labor (unskilled at 4 minutes per vine)	$ 7.00	0.87	$ 6.09	
Canopy Management				
Tying materials (tape)	$ 0.85	2	$ 1.70	
Shoot thinning and tying-labor (unskilled)	$ 7.00	30.93	$ 216.51	
Flower cluster removal-labor (unskilled)	$ 7.00	8.2	$ 57.40	
Disease and Insect Control				
Spray materials cost	$ 214.26	1	$ 214.26	
Spray application-labor for 12 sprays (skilled)	$ 9.00	4	$ 36.00	
Safety Equipment				
Personal Protective Equipment			$ 162.35	
Machinery				
Cash operating expenses only			$ 172.19	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 1,018.04	$ 45.81	
Interest on Year 1 Accrued Cash Expense	9.00%	$ 6,800.97	$ 612.09	
Annual Cash Expense -Year 2			$ 1,675.94	
Total Accumulated Cash Expense			**$ 8,476.90**	

Year 3 Production Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Spur pruning and cane removal-labor (unskilled)	$ 7.00	32	$ 224.00	
Cordon training and tying-labor (unskilled)	$ 7.00	10.66	$ 74.62	
Tying material (tape)	$ 0.85	2	$ 1.70	
Weed Control				
Herbicide cost (simazine and glyphosate)	$ 28.18	1	$ 28.18	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Leaf petiole sampling-labor (unskilled)	$ 7.00	0.3	$ 2.10	
Processing of tissue sample (1 test per 10 acres)	$ 21.00	0.1	$ 2.10	
Fertilizer (materials and rates will vary)	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	0.75	$ 5.25	
Canopy Management				
Tying material (tape)	$ 0.85	3	$ 2.55	
Shoot thinning-labor (unskilled)	$ 7.00	5	$ 35.00	
Shoot positioning and tying-labor (unskilled)	$ 7.00	10	$ 70.00	
Leaf removal-labor (unskilled)	$ 7.00	10	$ 70.00	
Vine trimming/hedging-labor (unskilled)	$ 7.00	10	$ 70.00	
Disease and Insect Control				
Spray materials cost	$ 347.78	1	$ 347.78	
Spray application-labor for 12 sprays (skilled)	$ 9.00	4	$ 36.00	
Safety Equipment				
Similar to year 2			$ 162.35	
Harvest Cost				
Harvest lugs (half required for 2.5 tons)	$ 5.85	100	$ 585.00	
Picking-labor (25 pound lug)	$ 1.25	200	$ 250.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs per hour)	$ 14.00	1.54	$ 21.56	

Year 3 Production Expenses (VSP 10 X 7): *(continued)*	Unit cost	Units/acre	Cost/acre	Your estimate
Machinery				
Cash operating expense only			$ 221.15	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,243.40	$ 100.95	
Interest on Year 2 Accrued Cash Expense	9.00%	$ 8,476.90	$ 762.92	
Annual Cash Expense -Year 3			$ 3,107.28	
Total Accumulated Cash Expense			$11,584.18	
Harvest Income				
2.5-tons/acre	$1,300.00	2.5	$ 3,250.00	
Net Investment at End of Year 3			**$ 8,334.18**	

Year 4 Production Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Spur pruning and cane removal-labor (unskilled)	$ 7.00	32	$ 224.00	
Cordon training and tying-labor (unskilled)	$ 7.00	4	$ 28.00	
Tying material (tape)	$ 0.85	1	$ 0.85	
Weed Control				
Herbicide cost (simazine and glyphosate)	$ 11.30	1	$ 11.30	
Herbicide application-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Fertilizer (materials and rates will vary)	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	0.75	$ 5.25	
Canopy Management				
Similar to year 3			$ 247.55	
Disease and Insect Control				
Similar to year 3			$ 383.78	
Safety Equipment				
Similar to year 2			$ 162.35	
Harvest Costs				
Harvest lugs (half required for 4.0 tons, minus 100)	$ 5.85	60	$ 351.00	
Picking-labor (25 pound lug)	$ 1.25	320	$ 400.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs/hour)	$ 14.00	2.46	$ 34.44	
Machinery				
Cash operating expenses only			$ 235.16	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,117.74	$ 95.30	
Interest on Year 3 Accrued Investment	9.00%	$ 8,334.18	$ 750.08	
Annual Cash Expense -Year 4			$ 2,963.12	
Total Accumulated Cash Expense			$11,297.30	
Harvest Income				
4.0-ton/acre	$1,300.00	4	$ 5,200.00	
Net Investment at End of Year 4			**$ 6,097.30**	

Year 5 Production Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expenses Similar to Year 4, minus lug costs			$ 1,766.74	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 1,766.74	$ 79.50	
Interest on Year 4 Accrued Investment	9.00%	$ 6,097.30	$ 548.76	
Annual Cash Expense - Year 5			$ 2,395.00	
Total Accumulated Cash Expense			$ 8,492.30	
Harvest Income				
4.0-ton/acre	$1,300.00	4	$ 5,200.00	
Net Investment at End of Year 5			**$ 3,292.30**	

Year 6 Production Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expense Similar to Year 5 with 1/2 yr. Interest			$ 1,846.25	
Interest on Year 5 Accrued Investment	9.00%	$ 3,292.30	$ 296.31	
Annual Cash Expense - Year 6			$ 2,142.56	
Total Accumulated Cash Expense			$ 5,434.86	
Harvest Income				
4.0-ton/acre	$1,300.00	4	$ 5,200.00	
Net Investment at End of Year 6			**$ 234.86**	

Year 7 Production Expenses (VSP 10 X 7)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expense Similar to Year 6 with 1/2 yr. Interest			$ 1,846.25	
Interest on Year 6 Accrued Investment	9.00%	$ 234.86	$ 10.57	
Annual Cash Expense - Year 6			$ 1,856.82	
Total Accumulated Cash Expense			$ 2,091.68	
Harvest Income				
4.0-ton/acre	$1,300.00	4	$ 5,200.00	
Net *Return* at End of Year 7			**+$ 3,108.32**	

Table 3. Machinery purchase cost and annual hourly use for VSP 10 x 7, lyre 10 x 7, or Smart Dyson 10 x 7.

Machine	Initial cost	Year 1	Year 2	Year 3	Year 4-10
50-horsepower tractor (standard)	$ 18,000.00	67.71	6.12	15.92	18.72
4WD, 3/4-ton, pickup (cost/mile and mile/acre)	$ 20,000.00	500	500	500	500
50 gallon herbicide sprayer	$ 1,800.00	0.33	0.33	0.33	0.33
300 gallon air blast sprayer	$ 9,725.00	2	4	4	4
7-foot rotary mower	$ 2,300.00	1.5	1.5	1.5	1.5
Fertilizer/seed spreader	$ 1,200.00	3			
Post driver	$ 1,800.00	10			
PTO driven auger 12"	$ 1,200.00	34.66			
8-foot flatbed trailer	$ 1,800.00	10		9.33	12
Total machinery purchase expense:	**$ 57,825.00**				

Table 4. Machinery inventory, cost of operation per hour, and annual cost per acre for the first 10 years for VSP 10 x 7, lyre 10 x 7, or Smart Dyson 10 x 7.

Machine	Cost/Hour	Year 1	Year 2	Year 3	Year 4-10
50-horsepower tractor (standard)	$ 4.15	$281.02	$25.40	$66.06	$77.69
4WD, 3/4-ton, pickup (cost/mile and mile/acre)	$ 0.28	$140.00	$140.00	$140.00	$140.00
50 gallon herbicide sprayer	$ 0.89	$0.29	$0.29	$0.29	$0.29
300 gallon air blast sprayer	$ 1.20	$2.40	$4.80	$4.80	$4.80
7-foot rotary mower	$ 1.13	$1.70	$1.70	$1.70	$1.70
Fertilizer/seed spreader	$ 0.59	$1.77	$0.00	$0.00	$0.00
Post driver	$ 0.89	$8.90	$0.00	$0.00	$0.00
PTO driven auger 12"	$ 0.59	$20.45	$0.00	$0.00	$0.00
8-foot flatbed trailer	$ 0.89	$8.90	$0.00	$8.30	$10.68
Total machinery cash expense:		**$465.42**	**$172.19**	**$221.15**	**$235.16**

Machinery capital recovery
Machinery investment financed at 9% for ten years: $57,825.00 x 0.1559* = $9,014.92
Annual cost per acre (10-acre vineyard): $9,014.92/10acres = $901.49

* 0.1559 is the Capital Recovery Factor for the financing terms specified above.

Table 5. Establishment and annual operational costs associated with vines spaced 7 feet apart in rows 10 feet wide and trained to a divided canopy system (Lyre 10 x 7). Costs and returns are shown for seven years.

Year 1 Preproduction Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Site Preparation				
Soil sampling-labor (unskilled)	$ 7.00	1.5	$ 10.50	
Soil testing (1 test per 10 acres)	$ 9.00	0.1	$ 0.90	
Lime (3 tons per acre)	$ 18.00	3	$ 54.00	
Liming-labor (skilled)	$ 9.00	2	$ 18.00	
Plow and disc-labor (skilled)	$ 9.00	3	$ 27.00	
Cover crop seed (50 lbs. per acre of turf type fescue)	$ 1.60	50	$ 80.00	
Sow cover crop-labor (skilled)	$ 9.00	1	$ 9.00	
Vineyard Layout				
Markers (post and vines)	$ 0.07	810	$ 56.70	
Mark vine and post locations-labor (skilled)	$ 9.00	4.8	$ 43.20	
Planting				
Vines	$ 2.90	640	$ 1,856.00	
Auger vine holes-labor (skilled at 3 minutes per hole)	$ 9.00	32	$ 288.00	
Planting vines-labor (unskilled at 2 minutes per vine)	$ 7.00	21.33	$ 149.31	
Weed Control				
Herbicide cost (oryzalin and glyphosate)	$ 28.18	1	$ 28.18	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing of vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Fertilizer	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	2.13	$ 14.91	
Canopy Management				
Tying materials (tape)	$ 0.85	3	$ 2.55	
Shoot thinning and shoot tying to stakes-labor (unskilled)	$ 7.00	28.44	$ 199.08	
Flower cluster removal-labor (unskilled)	$ 7.00	2.84	$ 19.88	
Disease and Insect control				
Spray materials cost	$ 86.70	1	$ 86.70	
Spray application-labor for 6 sprays (skilled)	$ 9.00	2	$ 18.00	

Year 1 Preproduction Expenses (Lyre): *(continued)*	Unit cost	Units/acre	Cost/acre	Your estimate
Trellising Materials				
3"x 8' CCA-treated line posts	$ 3.47	150	$ 520.50	
6"x 8' CCA-treated end posts	$ 5.88	20	$ 117.60	
12.5 ga.HT cordon and foliage wire	$ 68.00	16.46	$ 1,119.28	
10.5 ga. anchor support wire	$ 55.00	0.26	$ 14.30	
End post anchors	$ 5.95	20	$ 119.00	
In-line ratchet wire strainers for cordon wires	$ 1.58	20	$ 31.60	
Wirevise wire strainers for foliage wires	$ 1.43	60	$ 85.80	
Wire crimping sleeves	$ 0.10	80	$ 8.00	
Bamboo stakes for trunk support	$ 0.18	1280	$ 230.40	
Lyre frame and hardware	$ 10.00	150	$ 1,500.00	
Trellis Construction Labor				
Distribute and drive posts (1 skilled, 1 unskilled at 6 minutes per post)	$ 16.00	15	$ 240.00	
Auger and set end post (1 skilled, 1 unskilled at 4 minutes per post)	$ 16.00	2.66	$ 42.56	
Mark line post for lyre frames (unskilled)	$ 7.00	0.6	$ 4.20	
Mark end post for wire strainers and wirevises (unskilled)	$ 7.00	0.49	$ 3.43	
Drill end post for wirevises (unskilled)	$ 7.00	4.63	$ 32.41	
Install end post anchor structure (skilled)	$ 9.00	8	$ 72.00	
String and tighten cordon and foliage wire (unskilled)	$ 7.00	19.2	$ 134.40	
Install bamboo stakes (unskilled)	$ 7.00	5.32	$ 37.24	
Install lyre frames (unskilled)	$ 7.00	25	$ 175.00	
Safety Equipment				
Personal Protective Equipment (PPE) and warning signs			$ 191.35	
First aid, chemical spill, and decontamination kits			$ 195.00	
Hand Tools				
Total cost			$ 617.95	
Machinery				
Cash operating expenses only			$ 465.42	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 8,953.41	$ 402.90	
Annual Cash Expense - Year 1			**$ 9,356.32**	

Year 2 Preproduction Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Pruning and tying of canes prior to budbreak-labor (unskilled)	$ 7.00	20.48	$ 143.36	
Tying material (tape)	$ 0.85	4	$ 3.40	
Weed Control				
Herbicide cost (oryzalin and paraquat)	$ 23.99	1	$ 23.99	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing of vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Replanting				
Vines (2% of initial planting)	$ 2.90	13	$ 37.70	
Replanting-labor (unskilled at 4 minutes per vine)	$ 7.00	0.87	$ 6.09	
Canopy Management				
Tying materials (tape)	$ 0.85	4	$ 3.40	
Shoot thinning and tying-labor (unskilled)	$ 7.00	61.86	$ 433.02	
Flower cluster removal-labor (unskilled)	$ 7.00	16.4	$ 114.80	
Disease and Insect Control				
Spray materials cost	$ 214.26	1	$ 214.26	
Spray application-labor for 12 sprays (skilled)	$ 9.00	4	$ 36.00	
Safety Equipment				
Personal Protective Equipment			$ 162.35	
Machinery				
Cash operating expenses only			$ 172.19	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 1,367.03	$ 61.52	
Interest on Year 1 Accrued Cash Expense	9.00%	$ 9,356.32	$ 842.07	
Annual Cash Expense -Year 2			$ 2,270.61	
Total Accumulated Cash Expense			**$11,626.93**	

Year 3 Production Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Spur pruning and cane removal-labor (unskilled)	$ 7.00	64	$ 448.00	
Cordon training and tying-labor (unskilled)	$ 7.00	21.32		
Tying material (tape)	$ 0.85	4	$ 3.40	
Weed Control				
Herbicide cost (simazine and glyphosate)	$ 28.18	1	$ 28.18	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Leaf petiole sampling-labor (unskilled)	$ 7.00	0.3	$ 2.10	
Processing of tissue sample (1 test per 10 acres)	$ 21.00	0.1	$ 2.10	
Fertilizer (materials and rates will vary)	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	0.75	$ 5.25	
Canopy Management				
Tying Material (tape)	$ 0.85	8	$ 6.80	
Shoot thinning-labor (unskilled)	$ 7.00	10	$ 70.00	
Shoot positioning and tying (twice)-labor (unskilled)	$ 7.00	40	$ 280.00	
Leaf removal-labor (unskilled)	$ 7.00	20	$ 140.00	
Vine trimming/hedging-labor (unskilled)	$ 7.00	20	$ 140.00	
Disease and Insect Control				
Spray materials cost	$ 347.78	1	$ 347.78	
Spray application-labor for 12 sprays (skilled)	$ 9.00	4	$ 36.00	
Safety Equipment				
Similar to year 2			$ 162.35	
Harvest Cost				
Harvest lugs (half required for 2.5 tons)	$ 5.85	100	$ 585.00	
Picking-labor (25 pound lug)	$ 1.25	200	$ 250.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs per hour)	$ 14.00	1.54	$ 21.56	

Year 3 Production Expenses (Lyre): *(continued)*	Unit cost	Units/acre	Cost/acre	Your estimate
Machinery				
Cash operating expenses only			$ 221.15	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,783.73	$ 125.27	
Interest on Year 2 Accrued Cash Expense	9.00%	$ 11,626.93	$ 1,046.42	
Annual Cash Expense -Year 3			$ 3,955.42	
Total Accumulated Cash Expense			$15,582.35	
Harvest Income				
2.5-tons/acre	$1,300.00	2.5	$ 3,250.00	
Net Investment at End of Year 3			**$12,332.35**	

Year 4 Production Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Spur pruning and cane removal-labor (unskilled)	$ 7.00	64	$ 448.00	
Cordon training and tying-labor (unskilled)	$ 7.00	8	$ 56.00	
Tying material (tape)	$ 0.85	2	$ 1.70	
Weed Control				
Herbicide cost (simazine and glyphosate)	$ 11.30	1	$ 11.30	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Fertilizer (materials and rates will vary)	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	0.75	$ 5.25	
Canopy Management				
Similar to year 3			$ 636.80	
Disease and Insect Control				
Similar to year 3			$ 383.78	
Safety Equipment				
Similar to year 2			$ 162.35	
Harvest Costs				
Harvest lugs (half required for 4.5 tons, minus 100)	$ 5.85	80	$ 468.00	
Picking-labor (25 pound lug)	$ 1.25	360	$ 450.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs/hour)	$ 14.00	2.77	$ 38.78	
Machinery				
Cash operating expenses only			$ 235.16	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,931.18	$ 131.90	
Interest on Year 3 Accrued Investment	9.00%	$ 12,332.35	$ 1,109.91	
Annual Cash Expense -Year 4			$ 4,173.00	
Total Accumulated Cash Expense			$16,505.35	
Harvest Income				
4.5-tons/acre	$1,300.00	4.5	$ 5,850.00	
Net Investment at End of Year 4			**$10,655.35**	

Year 5 Production Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expenses Similar to Year 4, minus harvest costs			$ 1,974.40	
Harvest Cost				
Harvest lugs (half required for 6.8 tons, minus 180)	$ 5.85	92	$ 538.20	
Picking-labor (25 pound lug)	$ 1.25	544	$ 680.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs/hour)	$ 14.00	4.18	$ 58.52	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 3,251.12	$ 146.30	
Interest on Year 4 Accrued Investment	9.00%	$ 10,655.35	$ 958.98	
Annual Cash Expense - Year 5			$ 4,356.41	
Total Accumulated Cash Expense			$15,011.76	
Harvest Income				
6.8-tons/acre	$1,300.00	6.8	$ 8,840.00	
Net Investment at End of Year 5			**$ 6,171.76**	

Year 6 Production Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expense Similar to Year 5, minus lug cost			$ 2,712.92	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,712.92	$ 122.08	
Interest on Year 5 Accrued Investment	9.00%	$ 6,171.76	$ 555.46	
Annual Cash Expense - Year 6			$ 3,390.46	
Total Accumulated Cash Expense			$ 9,562.22	
Harvest Income				
6.8-tons/acre	$1,300.00	6.8	$ 8,840.00	
Net Investment at End of Year 6			**$ 722.22**	

Year 7 Production Expenses (Lyre)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expense Similar to Year 6 with 1/2 yr. Interest			$ 2,835.00	
Interest on Year 6 Accrued Investment	9.00%	$ 722.22	$ 65.00	
Annual Cash Expense - Year 7			$ 2,900.00	
Total Accumulated Cash Expense			$ 3,622.22	
Harvest Income				
6.8-tons/acre	$1,300.00	6.8	$ 8,840.00	
Net *Return* at End of Year 7			**+ $ 5,217.78**	

Table 6. Establishment and annual operational costs associated with vines spaced 7 feet apart in rows 10 feet wide. Vines are trained to a vertically divided canopy training system (Smart-Dyson 10 x 7). Costs and returns are shown for six years.

Year 1 Preproduction Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Site Preparation				
Soil sampling-labor (unskilled)	$ 7.00	1.5	$ 10.50	
Soil testing (1 test per 10 acres)	$ 9.00	0.1	$ 0.90	
Lime (3 tons per acre)	$ 18.00	3	$ 54.00	
Liming-labor (skilled)	$ 9.00	2	$ 18.00	
Plow and disc-labor (skilled)	$ 9.00	3	$ 27.00	
Cover crop seed (50 lbs. per acre of turf type fescue)	$ 1.60	50	$ 80.00	
Sow cover crop-labor (skilled)	$ 9.00	1	$ 9.00	
Vineyard Layout				
Markers (post and vines)	$ 0.07	810	$ 56.70	
Mark vine and post locations-labor (skilled)	$ 9.00	4.8	$ 43.20	
Planting				
Vines	$ 2.90	640	$ 1,856.00	
Auger vine holes-labor (skilled at 3 minutes per hole)	$ 9.00	32	$ 288.00	
Planting vines-labor (unskilled at 2 minutes per vine)	$ 7.00	21.33	$ 149.31	
Weed Control				
Herbicide cost (oryzalin and glyphosate)	$ 28.18	1	$ 28.18	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing of vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Fertilizer	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	2.13	$ 14.91	
Canopy Management				
Tying materials (tape)	$ 0.85	2	$ 1.70	
Shoot thinning and shoot tying to stakes-labor (unskilled)	$ 7.00	21.33	$ 149.31	
Flower cluster removal-labor (unskilled)	$ 7.00	2.13	$ 14.91	
Disease and Insect control				
Spray materials cost	$ 86.70	1	$ 86.70	
Spray application-labor for 6 sprays (skilled)	$ 9.00	2	$ 18.00	

Year 1 Preproduction Expenses (Smart-Dyson): *(continued)*	Unit cost	Units/acre	Cost/acre	Your estimate
Trellising Materials				
3"x 8' CCA-treated line posts	$ 3.47	150	$ 520.50	
6"x 8' CCA-treated end posts	$ 5.88	20	$ 117.60	
12.5 ga.HT cordon and foliage wire	$ 68.00	10.6	$ 720.80	
10.5 ga. anchor support wire	$ 55.00	0.26	$ 14.30	
End post anchors	$ 5.95	20	$ 119.00	
In-line ratchet wire strainers for cordon wires	$ 1.58	10	$ 15.80	
Wirevise wire strainers for foliage wires	$ 1.43	80	$ 114.40	
Fencing staples for cordon and foliage wires	$ 1.90	3	$ 5.70	
Wire crimping sleeves	$ 0.10	80	$ 8.00	
Bamboo stakes for trunk support	$ 0.18	640	$ 115.20	
Trellis Construction Labor				
Distribute and drive posts (1 skilled, 1 unskilled at 6 minutes per post)	$ 16.00	15	$ 240.00	
Auger and set end post (1 skilled, 1 unskilled at 4 minutes per post)	$ 16.00	2.66	$ 42.56	
Mark line post for cordon and foliage wires (unskilled)	$ 7.00	2.25	$ 15.75	
Mark end post for wire strainers and wirevises (unskilled)	$ 7.00	0.31	$ 2.17	
Drill end post for wirevises (unskilled)	$ 7.00	2.57	$ 17.99	
Install line post staples for cordon and foliage wire (unskilled)	$ 7.00	5.14	$ 35.98	
Install end post anchor structure (skilled)	$ 9.00	8	$ 72.00	
String and tighten cordon and foliage wire (unskilled)	$ 7.00	12.34	$ 86.38	
Install bamboo stakes (unskilled)	$ 7.00	2.66	$ 18.62	
Safety Equipment				
Personal Protective Equipment (PPE) and warning signs			$ 191.35	
First aid, chemical spill, and decontamination kits			$ 195.00	
Hand Tools				
Total cost			$ 617.95	
Machinery				
Cash operating expenses only			$ 465.42	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 6,692.85	$ 301.18	
Annual Cash Expenses - Year 1			**$ 6,994.03**	

Year 2 Preproduction Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Pruning and tying of canes prior to budbreak-labor (unskilled)	$ 7.00	10.24	$ 71.68	
Tying material (tape)	$ 0.85	2	$ 1.70	
Weed Control				
Herbicide cost (oryzalin and paraquat)	$ 23.99	1	$ 23.99	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing of vineyard aisles-labor 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Replanting				
Vines (2% of initial planting)	$ 2.90	13	$ 37.70	
Replanting-labor (unskilled at 4 minutes per vine)	$ 7.00	0.87	$ 6.09	
Canopy Management				
Tying materials (tape)	$ 0.85	4	$ 3.40	
Shoot thinning and tying-labor (unskilled)	$ 7.00	30.93	$ 216.51	
Flower cluster removal-labor (unskilled)	$ 7.00	13.66	$ 95.62	
Disease and Insect Control				
Spray materials cost	$ 214.26	1	$ 214.26	
Spray application-labor for 12 sprays (skilled)	$ 9.00	4	$ 36.00	
Safety Equipment				
Personal Protective Equipment			$ 162.35	
Machinery				
Cash operating expenses only			$ 172.19	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 1,057.96	$ 47.61	
Interest on Year 1 Accrued Cash Expense	9.00%	$ 6,994.03	$ 629.46	
Annual Cash Expense -Year 2			$ 1,735.03	
Total Accumulated Cash Expense			**$ 8,729.06**	

Year 3 Production Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Spur pruning and cane removal-labor (unskilled)	$ 7.00	53.33	$ 373.31	
Cordon training and tying-labor (unskilled)	$ 7.00	10.66	$ 74.62	
Tying material (tape)	$ 0.85	2	$ 1.70	
Weed Control				
Herbicide (simazine and glyphosate)	$ 28.18	1	$ 28.18	
Herbicide application to vineyard rows-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Leaf petiole sampling-labor (unskilled)	$ 9.00	0.3	$ 2.70	
Processing of tissue sample (1 test per 10 acres)	$ 21.00	0.1	$ 2.10	
Fertilizer (materials and rates will vary)	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 9.00	0.75	$ 6.75	
Canopy Management				
Tying material (tape)	$ 0.85	4	$ 3.40	
Shoot thinning-labor (unskilled)	$ 7.00	5	$ 35.00	
Shoot positioning and tying-labor (unskilled)	$ 7.00	20	$ 140.00	
Leaf removal-labor (unskilled)	$ 7.00	20	$ 140.00	
Vine trimming/hedging-labor (unskilled)	$ 7.00	15	$ 105.00	
Disease and Insect Control				
Spray materials cost	$ 347.78	1	$ 347.78	
Spray application-labor for 12 sprays (skilled)	$ 9.00	4	$ 36.00	
Safety Equipment				
Similar to year 2			$ 162.35	
Harvest Cost				
Harvest lugs (half the number required for 2.5 tons)	$ 5.85	100	$ 585.00	
Picking-labor (25 pound lug)	$ 1.25	200	$ 250.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs/hour)	$ 14.00	1.54	$ 21.56	
Machinery				
Cash operating expenses only			$ 221.15	

Year 3 Production Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,570.66	$ 115.68	
Interest on Year 2 Accrued Cash Expense	9.00%	$ 8,729.06	$ 785.62	
Annual Cash Expense -Year 3			$ 3,471.96	
Total Accumulated Cash Expense			$12,201.02	
Harvest Income				
2.5-tons/acre	$1,300.00	2.5	$ 3,250.00	
Net Investment at End of Year 3			**$ 8,951.02**	

Year 4 Production Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Dormant Pruning				
Spur pruning and cane removal-labor (unskilled)	$ 7.00	53.33	$ 373.31	
Cordon training and tying-labor (unskilled)	$ 7.00	4	$ 28.00	
Tying material (tape)	$ 0.85	1	$ 0.85	
Weed Control				
Herbicide (simazine and glyphosate)	$ 11.30	1	$ 11.30	
Herbicide application-labor (skilled)	$ 9.00	0.33	$ 2.97	
Mowing vineyard aisles-labor for 6 mowings (skilled)	$ 9.00	1.5	$ 13.50	
Fertilization				
Fertilizer (materials and rates will vary)	$ 0.11	160	$ 17.60	
Fertilizer application to vineyard rows-labor (unskilled)	$ 7.00	0.75	$ 5.25	
Canopy Management				
Similar to year 3			$ 423.40	
Disease and Insect Control				
Similar to year 3			$ 383.78	
Safety Equipment				
Similar to year 2			$ 162.35	
Harvest Costs				
Harvest lugs (half required for 4.0 tons, minus 100)	$ 5.85	60	$ 351.00	
Picking-labor (25 pounds lug)	$ 1.25	320	$ 400.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs/hour)	$ 14.00	2.46	$ 34.44	
Machinery				
Cash operating expenses only			$ 235.16	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,442.90	$ 109.93	
Interest on Year 3 Accrued Investment	9.00%	$ 8,951.02	$ 805.59	
Annual Cash Expense -Year 4			$ 3,358.43	
Total Accumulated Cash Expense			$12,309.44	
Harvest Income				
4.0-ton/acre	$1,300.00	4	$ 5,200.00	
Net Investment at End of Year 4			**$ 7,109.44**	

Year 5 Production Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expenses Similar to Year 4, minus harvest costs			$ 1,657.46	
Harvest Costs				
Harvest lugs (half required for 6.0 tons, minus 160)	$ 5.85	80	$ 468.00	
Picking-labor (25 pounds lug)	$ 1.25	480	$ 600.00	
Distribute and remove lugs-labor (2 unskilled at 130 lugs/hour)	$ 14.00	3.69	$ 51.66	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,777.12	$ 124.97	
Interest on Year 4 Accrued Investment	9.00%	$ 7,109.44	$ 639.85	
Annual Cash Expense - Year 5			$ 3,541.94	
Total Accumulated Cash Expense			$10,651.39	
Harvest Income				
6.0-tons/acre	$1,300.00	6	$ 7,800.00	
Net Investment at End of Year 5			**$ 2,851.39**	

Year 6 Production Expenses (Smart-Dyson)	Unit cost	Units/acre	Cost/acre	Your estimate
Management Expense Similar to Year 5, minus lug costs			$ 2,309.12	
Operating Interest				
Interest charged on yearly cash expenses for 1/2 yr.	9.00%	$ 2,309.12	$ 103.91	
Interest on Year 5 Accrued Investment	9.00%	$ 2,851.39	$ 256.62	
Annual Cash Expense - Year 6			$ 2,669.65	
Total Accumulated Cash Expense			$ 5,521.04	
Harvest Income				
6.0-tons/acre	$1,300.00	6	$ 7,800.00	
Net *Return* at end of Year 6			**$ (2,278.96)**	

Table 7. Projected grape production cost and return estimates associated with vines spaced 7 feet apart in rows 7 feet wide and trained to a bi-lateral cordon, spur-pruned, with canopies vertically shoot positioned (VSP 7 x 7).

							Anticipated results if costs remain constant			
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Revenue										
Production Tons Per/Acre	0.00	0.00	3.50	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Price Per/Ton	0	0	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Total Revenue			4,550	7,280	7,280	7,280	7,280	7,280	7,280	7,280
Operating Expenses[z]										
Site Preparation	199									
Vineyard Layout	139									
Plants/planting	3,211									
Trellis Material	2,241									
Trellis Construction	694									
Dormant Pruning		103	473	355	355	355	355	355	355	355
Weed Control	61	55	61	38	38	38	38	38	38	38
Replanting		61								
Fertilization	46		50	46	46	46	46	46	46	46
Canopy Management	232	386	347	347	347	347	347	347	347	347
Disease/insect Control	112	265	398	398	398	398	398	398	398	398
Harvest - Lugs			819	491	0	0	0	0	0	0
Picking Labor (25lb. lug @ $1.25)			350	560	560	560	560	560	560	560
Labor - Distribute/Remove Lugs			30	48	48	48	48	48	48	48
Machinery	663	189	268	291	291	291	291	291	291	291
Operating Interest @ 9.00%	387	55	133	123	101	101	101	101	101	101
Safety Equipment	386	162	162	162	162	162	162	162	162	162
Hand Tools	618									
Total Operating Expenses[y]	8,990	1,276	3,091	2,860	2,346	2,346	2,346	2,346	2,346	2,346
Accrued interest on borrowed capital @ 9.0%	0	809	997	955	643	257				
Total Expenses	8,990	2,085	4,087	3,815	2,989	2,603	2,346	2,346	2,346	2,346
Annual Cash Flow	(8,990)	(2,085)	463	3,465	4,291	4,677	4,934	4,934	4,934	4,934
Cumulative Cash Flow	(8,990)	(11,075)	(10,612)	(7,147)	(2,856)	1,821	6,755	11,689	16,623	21,557
10 Year Internal Rate of Return	21.42%									

[z] Expenses do not include purchase cost of land or equipment, nor are costs associated with irrigation, deer fencing, or other capital improvements included.

[y] Due to rounding, total operating expenses may vary slightly from the sum of operating expenses.

Table 8. Projected grape production cost and return estimates associated with vines spaced 7 feet apart in rows 10 feet wide and trained to a bi-lateral cordon, spur-pruned, with canopies vertically shoot positioned (VSP 10 x 7).

							Anticipated results if costs remain constant			
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Revenue										
Production Tons Per/Acre	0.00	0.00	2.50	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Price Per/Ton	0	0	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Total Revenue			3,250	5,200	5,200	5,200	5,200	5,200	5,200	5,200
Operating Expenses[z]										
Site Preparation	199									
Vineyard Layout	100									
Plants/planting	2,293									
Trellis Material	1,601									
Trellis Construction	497									
Dormant Pruning		73	300	253	253	253	253	253	253	253
Weed Control	45	40	45	28	28	28	28	28	28	28
Replanting		44								
Fertilization	33		27	23	23	23	23	23	23	23
Canopy Management	166	276	248	248	248	248	248	248	248	248
Disease/insect Control	105	250	384	384	384	384	384	384	384	384
Harvest - Lugs			250	351	0	0	0	0	0	0
Picking Labor (25lb. lug @ $1.25)			585	400	400	400	400	400	400	400
Labor - Distribute/Remove Lugs			22	34	34	34	34	34	34	34
Machinery	465	172	221	235	235	235	235	235	235	235
Operating Interest @ 9.00%	293	46	101	95	80	80	80	80	80	80
Safety Equipment	386	162	162	162	162	162	162	162	162	162
Hand Tools	618									
Total Operating Expenses[y]	6,801	1,064	2,344	2,213	1,847	1,847	1,847	1,847	1,847	1,847
Accrued interest on borrowed capital @ 9%	0	612	763	750	549	296	21			
Total Expenses	6,801	1,676	3,107	2,963	2,396	2,143	1,868	1,847	1,847	1,847
Annual Cash Flow	(6,801)	(1,676)	143	2,237	2,804	3,057	3,332	3,353	3,353	3,353
Cumulative Cash Flow	(6,801)	(8,477)	(8,334)	(6,097)	(3,293)	(236)	3,096	6,449	9,802	13,155
10-Year Internal Rate of Return	17.90%									

[z] Expenses do not include purchase cost of land or equipment, nor are the costs associated with irrigation, deer fencing, or other capital improvements included.

[y] Due to rounding, total operating expenses may vary slightly from the sum of operating expenses.

Table 9. Projected grape production cost and return estimates associated with vines spaced 7 feet apart in rows 10 feet wide and trained to a divided canopy (lyre) system (Lyre 10 x 7).

							Anticipated results if costs remain constant			
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Revenue										
Production Tons Per/Acre	0.00	0.00	2.50	4.50	6.80	6.80	6.80	6.80	6.80	6.80
Price Per/Ton	0	0	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Total Revenue			3,250	5,850	8,840	8,840	8,840	8,840	8,840	8,840
Operating Expenses[z]										
Site Preparation	199									
Vineyard Layout	100									
Plants/planting	2,293									
Trellis Material	3,746									
Trellis Construction	741									
Dormant Pruning		147	451	506	506	506	506	506	506	506
Weed Control	45	40	45	28	28	28	28	28	28	28
Replanting		44								
Fertilization	33		27	23	23	23	23	23	23	23
Canopy Management	222	551	637	637	637	637	637	637	637	637
Disease/insect Control	105	250	384	384	384	384	384	384	384	384
Harvest - Lugs			585	468	538	0	0	0	0	0
Picking Labor (25lb lug @ $1.25)			250	450	680	680	680	680	680	680
Labor - Distribute/Remove Lugs			22	39	59	59	59	59	59	59
Machinery	465	172	221	235	235	235	235	235	235	235
Operating Interest @ 9.00%	403	62	125	132	146	122	122	122	122	122
Safety Equipment	386	162	162	162	162	162	162	162	162	162
Hand Tools	618									
Total Operating Expenses[y]	9,356	1,429	2,909	3,063	3,397	2,835	2,835	2,835	2,835	2,835
Accrued interest on borrowed capital @ 9.0%	0	842	1,046	1,110	959	555	65			
Total Expenses	9,356	2,271	3,955	4,173	4,356	3,390	2,900	2,835	2,835	2,835
Annual Cash Flow	(9,356)	(2,271)	(705)	1,677	4,484	5,450	5,940	6,005	6,005	6,005
Cumulative Cash Flow	(9,356)	(11,627)	(12,332)	(10,655)	(6,172)	(722)	5,218	11,223	17,228	23,233
10 Year Internal Rate of Return	19.65%									

[z] Expenses do not include purchase cost of land or equipment, nor are the costs associated with irrigation, deer fencing, or other capital improvements included.

[y] Due to rounding, total operating expenses may vary slightly from the sum of operating expenses.

Table 10. Projected grape production cost and return estimates associated with vines spaced 7 feet apart in rows 10 feet wide and trained to a divided canopy (Smart-Dyson 10 x 7).

							Anticipated results if costs remain constant			
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Revenue										
Production Tons Per/Acre	0.00	0.00	2.50	4.00	6.00	6.00	6.00	6.00	6.00	6.00
Price Per/Ton	0	0	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Total Revenue			3,250	5,200	7,800	7,800	7,800	7,800	7,800	7,800
Operating Expenses[z]										
Site Preparation	199									
Vineyard Layout	100									
Plants/planting	2,293									
Trellis Material	1,751									
Trellis Construction	531									
Dormant Pruning		73	450	402	402	402	402	402	402	402
Weed Control	45	40	45	28	28	28	28	28	28	28
Replanting		44								
Fertilization	33		29	23	23	23	23	23	23	23
Canopy Management	166	316	423	423	423	423	423	423	423	423
Disease/insect Control	105	250	384	384	384	384	384	384	384	384
Harvest - Lugs			585	351	468	0	0	0	0	0
Picking Labor (25lb lug @ $1.25)			250	400	600	600	600	600	600	600
Labor - Distribute/Remove Lugs			22	34	52	52	52	52	52	52
Machinery	465	172	221	235	235	235	235	235	235	235
Operating Interest @ 9.00%	301	48	116	110	125	104	104	104	104	104
Safety Equipment	386	162	162	162	162	162	162	162	162	162
Hand Tools	618									
Total Operating Expenses[y]	6,994	1,106	2,686	2,553	2,902	2,413	2,413	2,413	2,413	2,413
Accrued interest on borrowed capital @ 9.0%	0	629	786	806	640	257				
Total Expenses	6,994	1,735	3,472	3,358	3,542	2,670	2,413	2,413	2,413	2,413
Annual Cash Flow	(6,994)	(1,735)	(222)	1,842	4,258	5,130	5,387	5,387	5,387	5,387
Cumulative Cash Flow	(6,994)	(8,729)	(8,951)	(7,109)	(2,851)	2,279	7,666	13,053	18,440	23,827
10 Year Internal Rate of Return	25.03%									

[z] Expenses do not include purchase cost of land or equipment, nor are the costs associated with irrigation, deer fencing, or other capital improvements included.

[y] Due to rounding, total operating expenses may vary slightly from the sum of operating expenses.

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