
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2009

SAMPLE COSTS TO
ESTABLISH A VINEYARD AND PRODUCE
WINEGRAPES

Cabernet Sauvignon



NORTH COAST REGION
NAPA COUNTY

Karen M. Klonsky

UC Cooperative Extension Specialist, Department of Agricultural and Resource Economics, UC Davis

Richard L. De Moura

Staff Research Associate, Department of Agricultural and Resource Economics, UC Davis

SAMPLE COSTS TO ESTABLISH A VINEYARD AND PRODUCE WINEGRAPES
Cabernet Sauvignon
NORTH COAST REGION – Napa County 2009

CONTENTS

INTRODUCTION.....	2
ASSUMPTIONS	3
Establishment Cultural Practices and Material Inputs.....	3
Production Cultural Practices and Material Inputs.....	6
Labor, Equipment and Interest Costs.....	8
Cash Overhead	8
Non-Cash Overhead.....	9
REFERENCES.....	11
Table 1. SAMPLE COSTS PER ACRE TO ESTABLISH A VINEYARD.....	12
Table 2. COSTS PER ACRE TO PRODUCE WINEGRAPES.....	14
Table 3. COSTS AND RETURNS PER ACRE TO PRODUCE WINEGRAPES.....	15
Table 4. MONTHLY PER ACRE CASH COSTS TO PRODUCE WINEGRAPES	16
Table 5. RANGING ANALYSIS – INCOME AND YIELD.....	17
Table 6. WHOLE FARM EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS.....	18
Table 7. HOURLY EQUIPMENT COSTS	19
Table 8. OPERATIONS WITH EQUIPMENT	20

Acknowledgment. Appreciation is expressed to the Napa Valley Grapegrowers members who provided time and input for this study. Thank you to Pete Richmond, Steve Smit, Garrett Buckland, Dave Michul, and Ron Wicker of the Napa Valley Grapegrowers and Jennifer Putman, Executive Director, for coordinating the data collection and providing facilities for the meetings.

INTRODUCTION

Sample costs to establish a vineyard and produce winegrapes under drip irrigation in the North Coast Region, Napa County are presented in this study. This study is intended as a guide only, and can be used to make production decisions, determine potential returns, prepare budgets and evaluate production loans. Practices described are based on production practices considered typical for the crop and area, but these same practices will not apply to every situation. The sample costs for labor, materials, equipment and custom services are based on current figures. A blank column, “*Your Costs*”, in Tables 2 and 3 is provided for entering your farming costs.

The hypothetical farm operation, production practices, overhead, and calculations are described under the assumptions. For additional information or an explanation of the calculations used in the study call the Department of Agricultural and Resource Economics, University of California, Davis, (530) 752-3589 or your local UC Cooperative Extension office.

Sample Cost of Production Studies for many commodities are available and can be requested through the Department of Agricultural and Resource Economics, UC Davis or downloaded from the department website at <http://coststudies.ucdavis.edu> or obtained from selected county UC Cooperative Extension offices.

ASSUMPTIONS

The assumptions refer to Tables 1 to 8 and pertain to sample costs to establish a vineyard and produce winegrapes in the North Coast – Napa County or Napa Valley Appellation. Within the Napa Valley Appellation are 13 subappellations. For district location and other related information see the websites www.napagrowers.org and www.napavintners.com. The cultural practices shown represent operations and materials considered typical in a well-managed vineyard in the region. The costs, materials, and practices shown in this study will not be applicable to all situations. Establishment and cultural practices vary by grower and the differences can be significant. The study is intended as a guide only. *The trade names and cultural practices shown in this report do not constitute an endorsement or recommendation by the University of California nor is any criticism implied by omission of similar products or practices.*

Farm. The hypothetical farm, located on land with less than a 5% slope, is owned and operated by the grower. The 35 contiguous acre farm consists of 30 acres on which winegrapes are being replanted, and five acres occupied by roads, irrigation systems, fencing, and farmstead. Management companies farm approximately 40% of the farms in the area (NVG). In this study we incorporated information from both farmer and management company operations to present a farm managed by the owner. Management companies will charge a fee for their services, but farms operated by management companies will not have an equipment inventory as shown in Table 6.

Establishment Cultural Practices and Material Inputs

The following practices refer to table 1.

Environmental Preparation. The Napa County Conservation, Development, and Planning Department administer regulations for planting and replanting vineyard sites that have a 5% or greater slope. If planting on slopes, contact the Napa office for further information.

Vineyard Conversion and Site Preparation. The new vineyard is being planted on land that had an existing vineyard. A hand crew separates out the wood and steel components prior to vine removal. The old grapevines are removed, stacked and burned. Rock removal may be required on some new plantings, but is not accounted for in this study. A company is hired to collect, crush and remove the old steel trellis components. A hand crew cleans and hauls miscellaneous debris left in the field using the grower's tractor and trailer. The field is ripped four to five feet deep in three passes - line of planting, crossways, diagonally. The field is again hand cleaned using the grower's tractor and trailer to remove debris pulled up from the ripping. A custom operator then disks the land in two directions and landplanes the site. Landplaning is assumed to be necessary on the site. Soil amendments (lime or gypsum and compost) are commercially applied. A commercial company is hired to layout the field, mark/stake vine sites and irrigation lines. In the row middles, a cover crop (Bell bean, oat, vetch mix) is planted. The trellis system endposts and stakes are installed. All operations that prepare the vineyard for planting are done in the fall, beginning in the year prior to planting, but costs are shown in the first year.

Vines. Field-grown dormant benchgraft vines, Cabernet Sauvignon variety, are planted on 7 X 4-foot spacing at 1,555 vines per acre. Vines will be trained to a bilateral cordon and spur pruned. Cordons are the horizontal branches, and spurs are the bearing units on the cordon. The grapevines are assumed to begin yielding fruit in three years and to produce for an additional 22 years.

Planting. Planting in this study occurs in mid-April and is done by hand. Holes are dug and the dormant vines are planted to the appropriate depth. The hole is filled with soil, and the vine is protected with a milk carton. In the following year an average of 2% or 31 vines per acre will be replanted.

Trellis System. The trellis is a vertical shoot positioning system (VSP). The system in this study utilizes 3-inch X 8-foot notched steel line posts spaced 16-feet apart (every 4th vine), with three training stakes (1/2-inch rebar rod X 4-feet) at the vine locations in between. Two clips for each rebar. End posts are 3-7/8 inch X 10-foot steel tube (well casing) with a spade. No additional anchors are required. Seven permanent wires are secured to the end posts – 12-gauge fruit wire and 14 gauge drip wire, 2 pairs of 13 gauge canopy wires and a single canopy wire at the top. Grippers are put on all wires except the cordon wire and drip wires. The trellis is considered as part of the vineyard since it will be removed when the vines are removed. Therefore it is included in the establishment cost. The trellis system cost (materials and labor) are shown in the first year and is installed during the first 2 years as follows:

First Year. In the fall of the year prior to planting, end-posts and stakes are laid out by the grower and installed by a trellis company. The grower lays out the stakes and end-posts, using a tractor and trailer. Hauling the posts takes 2 men and 1 tractor driver approximately 0.83 hours per acre but uses a total of 2.5 man-hours per acre. The drip wire is installed after planting.

Second Year. Two pairs of canopy wires, a single canopy wire at the top and the fruit wire are installed.

Drip System (Irrigation). Mainlines are laid out in the fall prior to trellis installation. After planting the drip line is attached to the drip wire on the trellis system and emitters are punched. Drip system labor is included in the total drip system costs. The system is considered part of the vineyard since it will be removed when the vines are removed; therefore it is included in the establishment costs.

Training/Pruning. Training and pruning establish the vine framework and these techniques will vary with variety and trellis system. In this study training includes pruning, tying, suckering, and shoot positioning and thinning. The prunings are placed in between the vine rows and are incorporated during the first discing.

First Year. The vines are allowed to grow freely the first year with minimal pruning and training. A good root system should develop this year to support vine training in the second year. Twenty hours of hand labor (miscellaneous labor) are allocated to the budget for topping throughout the year.

Second Year. In February the vines are pruned back to two buds. In June, the vines are suckered to one shoot. Vines are trained by tying one shoot to the post to become the main trunk. Later in the season this shoot is topped at or slightly below the cordon wire. Two lateral shoots are selected from the trunk as the bilateral cordons. Any remaining lower laterals are removed. In July and August, two passes are made to top the vines, remove extra shoots (suckering) and tie the canes loosely on the wire.

Third Year. In February, cordons are pruned back to the appropriate length as determined by girth. These canes are then tied trimly to the fruiting wire. Training vines in the third year includes extending the cordons along the permanent cordon wire and selecting spur positions. Suckering is done in May; shoot positioning in June and July. Crop thinning is done in June and August to remove about 50% of the crop from these young vines. Slower growing vines continue to be trained; however, year three is the last year that the vines are trained in this study. After the vines are trained, canopy management begins and includes suckering trunks and cordons, shoot positioning, and thinning.

Irrigation. Pumping costs from grower input approximated \$16.50 per acre inch (\$0.0006 per gallon). During the first and second year, irrigation is from late May to late September/early October, a total of 20 weeks, (2 irrigations per week at 2.5 gallons per vine per irrigation). No assumption is made about effective rainfall. In the third year five gallons per week per vine at one irrigation per week are applied over a 20-week period (155,865 gallons per acre or 5.74 acre inches). Labor is calculated at 0.33 hours per acre per irrigation.

Frost Protection. Three propane powered wind machines are installed in the summer of the second year for frost protection. The machine begins operation in the third year. It is assumed that the wind machine will run 50 hours per season (March, April, May) at five hours per night.

Pest Management. The pesticides and rates mentioned in this cost study as well as other materials are listed in *UC Integrated Pest Management Guidelines, Grapes*, available at www.ipm.ucdavis.edu. Pesticides mentioned in the study are commonly used, but may not be university recommendations.

Insects. Leafhoppers and mites are the most common insect pests in the North Coast. In Napa County, populations are usually below treatment thresholds. In this study, we assume that no insecticides are needed.

Diseases. Many pathogens attack grapevines, but the major disease assumed is powdery mildew (*Uncinula necator*). Powdery mildew control begins in May of the second year with Stylet Oil (paraffinic oil), Rally (myclobutanil) in June, and Pristine (pyraclostrobin/boscalid) in July. In the third year, wettable sulfur is applied in March and mid-April, Stylet Oil in May, Rally in June, and Flint (trifloxystrobin) in July. All are applied by ground with the grower's equipment. A fungicide application may be made to pruning wounds in February for control of Eutypa, but is not included as a cost in this study.

Weeds. In late January/early February of the first year, prior to planting, Glyphos (glyphosate) is applied to the vine row (24-inch band) with an ATV and sprayer. In April the cover crop (middles) is mowed and then disked in early May and August. In July or August, Glyphos is sprayed around the vines. In the second year and third year, Glyphos is applied as a strip spray in February prior to pruning: the middles (cover crop) are mowed in April, disked in May, August and October (for cover crop seedbed).

Cover Crop. After land preparation in the fall of the year prior to planting, an annual cover crop is planted in the vine middles, mowed in March/April of the following year, and then disked in May. In the fall of the first and second year, an annual cover crop (bell bean, oat, vetch) is planted in October and disked in May of the second year. In October of the third year a permanent cover crop is planted and allowed to reseed thereafter in the spring.

Fertilization. Beginning in the first year, an NPK fertilizer, 8-8-8, is applied in equal amounts through the drip line in June, July, and September. A total of five gallons or 51 pounds of material per acre is applied. In the third year, the fertilizer is applied in May and in September after harvest.

Harvesting. Harvesting starts in the third year. In this study the crop is hand harvested. Labor costs are estimated at \$250 per ton for young vineyards. See Harvest in production section for operation explanations.

Yield. Average yields in the third year are assumed to be one ton per acre.

Production Cultural Practices and Material Inputs

Refers to tables 2 - 8

Pruning. Prepruning is done during the winter months (January) and final pruned in early March. The prunings are placed in the vine centers and chopped during the first mowing. Winter tying, where cordons are tied to the cordon wire with twine at the trunk and at each end of the cordons, is done in March. Pruning costs in this study are based on an hourly rate, although much of the pruning in the region may be done by piecework.

Canopy Management. Canopy management begins with trunk and cordon suckering in April. A second suckering pass in May also includes shoot thinning and positioning. Passes in June and July are made for leaf removal, lateral removal, and wire lifting. Crop thinning is done in two passes, once in July for color thin and once in August for crop thin. Shoot removal is the operation whereby weak shoots, which lack vigor and do not originate from the fruiting spur buds, are removed. In early June/July after fruit set, some basal leaves are removed in and around the fruit zone to allow for exposure and better air movement. Positioning and thinning shoots allows vines space to develop good fruit clusters, and opens the canopy to allow greater air movement through the vines and around the clusters. Canopy management varies among growers.

Irrigation. In this study 5.74 acre-inches (155,866 gallons per acre) are applied and water is calculated to cost \$16.50 per acre-inch. Once per week over 20 weeks, water at five gallons per vine is applied from late May to September/early October. Irrigation labor is calculated at 0.33 hours per acre per irrigation. No assumption is made about effective rainfall.

Frost Protection. It is assumed that the wind machines will run 50 hours per season, 5 hours per night during March, April and May.

Fertilization. An NPK fertilizer, 8-8-8, at 51 pounds per acre is applied through the irrigation system equally in May and in September after harvest.

Pest Management. The pesticides and rates mentioned in this cost study are listed in *UC Integrated Pest Management Guidelines, Grapes*. **Pesticides mentioned in the study are not recommendations, but those commonly used in the region.** For information on other pesticides available, pest identification, monitoring, and management visit the UC IPM website at www.ipm.ucdavis.edu. For additional information and pesticide use permits, contact the local county Agricultural Commissioner's office.

Pest Control Adviser. Written recommendations are required for many pesticides commercially applied and are made by licensed pest control advisers (PCAs). In addition the PCA will monitor the field for pests and nutrition. Growers may hire private PCAs or receive the service as part of a service agreement with an agricultural chemical and fertilizer company. Management companies may have their own PCA. A PCA or PCAs are hired in this study to monitor the field for irrigation, nutrition and pests for \$100 per acre

Insects. Leafhoppers and mites are the most common insect pests in the North Coast. The PCA hangs one trap per 10 acres for mealybug monitoring. The Vine Mealybug and the Light Brown Apple Moth are both growing concerns in Napa Valley vineyards. In this study, we assume that no insecticides are needed.

Diseases. Powdery mildew treatments begin in mid-March with two wettable sulfur applications one during March and one in April. In addition, Stylet Oil (paraffinic oil) is applied in May, Rally (myclobutanil) in June, Flint (trifloxystrobin) in July and Pristine (pyraclostrobin/boscalid) in August. All applications are made with the grower's equipment. It is recommended that applicators use fungicides with different modes of action in order to avoid fungicide resistance in powdery mildew populations. Growers have the option of using contacts, sterol inhibitors (SI), quinolins, strobilurins, or sulfur, which are classes of fungicides with different modes of action. See the UC IPM website for further information.

Weeds. In this vineyard, vine row weeds are controlled with Glyphos (glyphosate) applied as a strip spray (28.6% of the acreage) in January and again in July. A permanent cover crop is planted in the row middles and is described under cover crop.

Permanent Cover Crop. In October of the third year a permanent cover crop is planted and allowed to reseed in the spring. The crop is mowed once in March and again in May after seed formation. The cover crop is dried down by late spring/early summer.

Harvest. The crop is hand picked by a labor contractor. In normal producing vineyards (4-5 tons), labor costs of \$150 per ton are assumed. Charges may be lower or higher due to yield, trellis system, and ground terrain. To determine number of pickers for harvest, an industry assumption is one-ton per day per picker, assuming an eight-hour day. Bin handling includes use of the grower owned tractor and three bin trailers with one-half ton bins, two tractors rented and a forklift rented each for two-weeks. The grapes are handpicked into the bins, loaded on the grower owned flatbed truck and delivered to the winery. The truck holds 16 bins and takes one hour per roundtrip delivery.

Yields. Yield maturity is reached in the fifth or sixth year. An assumed yield of 5 tons per acre is used to calculate returns in the production years. Typical yield range for Cabernet Sauvignon in Napa County is 3.5 to 6.5 tons per acre.

Returns. A price of \$4,082 per ton for Cabernet Sauvignon winegrapes is used to show a range of yields over a series of returns. The price is an average of the 2004 to 2008 weighted average grower returns as reported each year in Table 10 of the Final Grape Crush Report. Net returns at different yields and prices are shown in Table 5 in this study.

Assessments/Membership. The Napa Valley Grapegrowers, a voluntary organization, charges membership dues of \$12.50 per net acre planted, bearing and non-bearing, with a minimum annual fee of \$250 per member per year. The organization's mission is to "to promote and preserve Napa Valley's world-class vineyards". Membership in the organization is not included as a cost in this study. Other grower assessments not included are the Pierce's Disease/Glassy Winged Sharpshooter assessment in which growers are assessed \$1 per \$1,000 of crop returns; and the Napa County Pest and Disease Control District Board annual assessment which is \$5.59 per acre for 2009. Additionally, Napa growers are assessed \$10 per acre by the Napa County Housing Commission for operation of the Napa County farmworker housing facilities.

Pickup/ATV. The grower uses the pickup for business and personal use. The assumed business use for the pickup is 10,000 miles per year for the ranch. In addition to spot spraying for weed control, the All Terrain Vehicle (ATV) is used on the ranch for checking the vineyard and irrigating.

Labor, Equipment and Interest Costs

Labor. Labor rates of \$20.30 per hour for machine operators and \$17.69 for general labor includes payroll overhead of 45%. The basic hourly wages are \$14.00 for machine operators and \$12.20 for general labor. The overhead includes the employers' share of federal and California state payroll taxes, workers' compensation insurance for vineyards (code 0040), and a percentage for other possible benefits. Workers' compensation insurance costs will vary among growers, but for this study the cost is based upon the participating growers' recommendations. Labor for operations involving machinery are 20% higher than the operation time given in Table 2 to account for the extra labor involved in equipment set up, moving, maintenance, work breaks, and field repair.

Equipment Operating Costs. Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients formulated by American Society of Agricultural Engineers (ASAE). Fuel and lubrication costs are also determined by ASAE equations based on maximum power takeoff (PTO) horsepower, and fuel type. Prices for on-farm delivery of red dye diesel and gasoline are \$3.70 (excludes excise taxes) and \$3.36 per gallon, respectively. The cost includes a 2% local sales tax on diesel fuel, but does not include excise taxes. Gasoline costs include an 8% sales tax plus federal and state excise tax. Some federal excise tax can be refunded for on-farm use when filing your income tax. The costs are based on 2008 (July thru December) American Automobile Association (AAA) and Department of Energy (DOE) monthly data. The fuel, lube, and repair cost per acre for each operation in Table 2 is determined by multiplying the total hourly operating cost in Table 7 for each piece of equipment used for the selected operation by the hours per acre. Tractor time is 10% higher than implement time for a given operation to account for setup, travel and down time.

Interest on Operating Capital. Interest on operating capital is based on cash operating costs and is calculated monthly until harvest at a nominal rate of 5.75% per year. A nominal interest rate is the typical market cost of borrowed funds. The interest cost of post harvest operations is discounted back to the last harvest month using a negative interest charge. The interest rate is the basic rate provided by a farm lending agency as of January 2009.

Risk. The risks associated with crop production should not be minimized. While this study makes every effort to model a production system based on typical, real world practices, it cannot fully represent financial, agronomic and market risks, which affect profitability and economic viability. Growers may purchase Federal crop insurance to reduce the production risk associated with specific natural hazards. Insurance policies vary and range from a basic catastrophic loss policy to one that insures losses for up to 75% of a crop. Insurance costs will depend on the type and level of coverage.

Cash Overhead

Cash overhead consists of various cash expenses paid out during the year that are assigned to the whole farm and not to a particular operation. These costs include property taxes, interest on operating capital, office expense, liability and property insurance, sanitation services, equipment repairs, and management.

Property Taxes. Counties charge a base property tax rate of 1% on the assessed value of the property. In some counties special assessment districts exist and charge additional taxes on property including equipment, buildings, and improvements. For this study, county taxes are calculated as 1% of the average value of the property. Average value equals new cost plus salvage value divided by 2 on a per acre basis.

Insurance. Insurance for farm investments varies depending on the assets included and the amount of coverage. Property insurance provides coverage for property loss and is charged at 0.82% of the average value of the assets over their useful life. Liability insurance covers accidents on the farm and costs \$621 for the entire farm.

Sanitation Services. Sanitation services provide portable toilets for the vineyard and cost the farm \$3,150 annually. The cost includes one double toilet unit with washbasins, delivery and pickup, and five months of weekly servicing. Costs also include soap or other suitable cleansing agent, and single use towels. Separate potable water and single-use drinking cups are also supplied. Contract labor providers may include this service for their work force and therefore sanitation fees would not be a direct cost to the grower.

Management/Supervisor Wages. Salary is not included. Returns above costs are considered a return to management

Office Expense. Office and business expenses are estimated at \$300 per acre. These expenses include office supplies, telephones, bookkeeping, accounting, legal fees, shop and office utilities, and miscellaneous administrative charges.

Investment Repairs. Annual repairs on investments or capital recovery items that require maintenance are calculated as 2% of the purchase price. Repairs are not calculated for land and establishment costs.

Non-Cash Overhead

Non-Cash overhead is calculated as the capital recovery cost for equipment and other farm investments.

Capital Recovery Costs. Capital recovery cost is the annual depreciation and interest costs for a capital investment. It is the amount of money required each year to recover the difference between the purchase price and salvage value (unrecovered capital). It is equivalent to the annual payment on a loan for the investment with the down payment equal to the discounted salvage value. This is a more complex method of calculating ownership costs than straight-line depreciation and opportunity costs, but more accurately represents the annual costs of ownership because it takes the time value of money into account (Boehlje and Eidman). The formula for the calculation of the annual capital recovery costs is $((\text{Purchase Price} - \text{Salvage Value}) \times \text{Capital Recovery Factor}) + (\text{Salvage Value} \times \text{Interest Rate})$.

Salvage Value. Salvage value is an estimate of the remaining value of an investment at the end of its useful life. For farm machinery (tractors and implements) the remaining value is a percentage of the new cost of the investment (Boehlje and Eidman). The percent remaining value is calculated from equations developed by the American Society of Agricultural Engineers (ASAE) based on equipment type and years of life. The life in years is estimated by dividing the wear out life, as given by ASAE by the annual hours of use in this operation. For other investments including irrigation systems, buildings, and miscellaneous equipment, the value at the end of its useful life is zero. The salvage value for land is the purchase price because land does not depreciate. The purchase price and salvage value for equipment and investments are shown in Table 6.

Capital Recovery Factor. Capital recovery factor is the amortization factor or annual payment whose present value at compound interest is 1. The amortization factor is a table value that corresponds to the interest rate used and the life of the machine.

Interest Rate. The interest rate of 4.75% used to calculate capital recovery cost is the effective long term interest rate effective January 1, 2009. The interest rate is provided by a local farm lending agency and will vary according to risk and amount of loan.

Establishment Costs. Costs to establish the vineyard are used to determine capital recovery expenses, depreciation, and interest on investment for the production years. Establishment cost is the sum of the costs for land preparation, trellis system, drip system, planting, vines, cash overhead and production expenses for growing the vines through the first year that grapes are harvested minus any returns from production. The Total Accumulated Net Cash Cost on Table 1, in the third year represents the establishment cost. For this study the cost is \$39,104 per acre or \$1,173,131 for the 30-acre vineyard. The establishment cost is spread over the remaining 22 years of the 25 years the vineyard is in production.

Irrigation System. The previous vineyard is assumed to have a well, pump, and filtration/injector stations that are included in the land cost.

Land. Based on local realtor information, bare land available for vineyard establishment is valued at \$150,000 per acre or \$175,000 per net plantable (30) acre. Land planted with resistant rootstock vines is valued from \$85,000 to \$180,000.

Building. The building complex is 400 square foot metal building or buildings on a cement slab.

Tools. This includes shop tools, hand tools, and miscellaneous field tools such as pruning tools.

Equipment. Farm equipment is purchased new or used, but the study shows the current purchase price for new equipment. The new purchase price is adjusted to 60% to indicate a mix of new and used equipment. Annual ownership costs for equipment and other investments are in the Whole Farm Equipment, Investment and Business Overhead Tables. Equipment costs are composed of three parts: non-cash overhead, cash overhead, and operating costs. Both of the overhead factors have been discussed in previous sections. The operating costs consist of repairs, fuel, and lubrication and are discussed under operating costs.

Table Values. Due to rounding, the totals may be slightly different from the sum of the components.

The University of California does not discriminate in any of its policies, procedures or practices. The university is an affirmative action/equal opportunity employer.

University of California and the United States Department of Agriculture cooperating

REFERENCES

- American Society of Agricultural Engineers. 1994. *American Society of Agricultural Engineers Standards Yearbook*. Russell H. Hahn and Evelyn E. Rosentreter (ed.) St. Joseph, MO. 41st edition.
- Boehlje, Michael D., and Vernon R. Eidman. 1984. *Farm Management*. John Wiley and Sons. New York, NY.
- California Chapter of the American Society of Farm Managers and Rural Appraisers. 2008. *Trends in Agricultural Land and Lease Values*. California Chapter of the American Society of Farm Managers and Rural Appraisers, Inc. Woodbridge, CA.
- California State Department of Food and Agriculture. 2004-2008. Table 10 of Final Grape Crush Report. California Department of Food and Agriculture. Sacramento, CA. Internet accessed March 30, 2009 <http://www.nass.usda.gov/ca/bul/crush/>
- California State Automobile Association. 2009. *Gas Price Averages July – December 2008*. AAA Press Room, San Francisco, CA. Internet accessed January 2009. <http://www.csaa.com/portal/site/CSAA>
- California State Board of Equalization. *Fuel Tax Division Tax Rates*. Internet accessed January 2009. <http://www.boe.ca.gov/sptaxprog/spftdrates.htm>
- Energy Information Administration. 2008. *Weekly Retail on Highway Diesel Prices July 2008 – December 2008*. Internet accessed January 2009. <http://tonto.eia.doe.gov/oog/info/wohdp>
- University of California Statewide IPM Project. 2008. *UC Pest Management Guidelines, Grapes*. University of California, Davis, CA. <http://www.ipm.ucdavis.edu>
- Weber, Edward A., Karen M. Klonsky and Richard L. De Moura, *Sample Costs to Establish a Vineyard and Produce Wine Grapes. North Coast Region - Napa*. 2003. University of California Cooperative Extension. Davis, CA.
- Weaver, Robert J. 1976. *Grape Growing*. John Wiley and Sons. New York, NY.

For information concerning the above or other University of California publications, contact UC DANR Communications Services at 1-800-994-8849, online at www.ucop.edu, or your local county UC Cooperative Extension office.

UC COOPERATIVE EXTENSION
Table 1. COSTS PER ACRE TO ESTABLISH A VINEYARD
 NORTH COAST - Napa County 2009

	Cost Per Acre			1
	Year:	1st	2nd	
	Tons Per Acre:			
Land Preparation Costs:				
Site Prep: Vineyard Removal		600		
Site Prep: Clean Field by Hand 2X (separate wood & metal, pickup debris)		848		
Site Prep: Rip 3X		525		
Site Prep: Disk 2X/Landplane 1X		375		
Site Prep: Apply Soil Amendments Gypsum or Lime and Compost		620		
Site Prep: Mark , Layout, Stake Vineyard		778		
Trellis: Install Trellis (includes labor & materials)		11,000		
Cover Crop: Plant		75		
TOTAL PRIOR YEAR LAND PREP COSTS		14,820		
Planting Costs:				
Weed: Spray Strip (Glyphos)		29		
Weed: Mow Middles		43		
Vines: 1,555 Per Acre (2% Replant In 2nd Year)		5,443	88	
Plant: Dig, Plant, Place Carton around vine		3,343	67	
Irrigate: Install Irrigation System (Drip)		3,200		
TOTAL PLANTING COSTS		12,058	155	
Cultural Costs:				
Weed: Disk Middles		61	91	122
Irrigate: (water & labor)		328	328	328
Miscellaneous Labor: (various hand operations)		283		
Fertilize: Through drip (8-8-8)		18	18	18
Weed: Spray Around Vines (Glyphos)		29		
Cover Crop: Plant		75	63	109
Weed: Spray Vine Row (Glyphos)			40	59
Train: Prune to 2 buds			230	
Weed: Mow Middles			43	43
Disease: Mildew (Oil)			63	83
Disease: Mildew (Rally)			54	63
Train: Sucker/Train/Tie			920	389
Disease: Mildew (Pristine)			70	
Train: Sucker/Train/Wrap on wire 2X			1,061	
Disease: Mildew (Sulfur)				87
Disease: Mildew (Flint)				74
Prune: Winter Prune				566
Train: Shoot Position				142
Prune: Thin Crop				142
Pickup Truck Use		269	269	269
ATV Use		26	26	26
TOTAL CULTURAL COSTS		1,091	3,278	2,520
Harvest Costs:				
Pick Fruit				250
Bin Handling				240
Haul To Crusher				4
TOTAL HARVEST COSTS				494
Interest On Operating Capital @ 5.75%		1,647	109	57
TOTAL OPERATING COSTS/ACRE		29,616	3,542	3,070

UC COOPERATIVE EXTENSION

Table 1. continued

	Cost Per Acre			
	Year:	1st	2nd	3rd
	Tons Per Acre:			1
Cash Overhead Costs:				
Office Expense		300	300	300
Liability Insurance		21	21	21
Sanitation Fees		140	140	140
Property Taxes		1,768	1,781	1,788
Property Insurance		14	26	31
Investment Repairs		23	73	73
TOTAL CASH OVERHEAD COSTS		2,266	2,341	2,353
TOTAL CASH COSTS/ACRE		31,881	5,882	5,423
INCOME/ACRE FROM PRODUCTION				4,082
NET CASH COSTS/ACRE FOR THE YEAR		31,881	5,882	1,341
PROFIT/ACRE ABOVE CASH COSTS				
ACCUMULATED NET CASH COSTS/ACRE		31,881	37,764	39,104
Non-Cash Overhead (Capital Recovery):				
Land		8,313	8,313	8,313
Buildings		37	37	37
Shop/Field Tools		21	21	21
Fuel Tanks		7	7	7
Wind Machines			181	181
Equipment		222	243	349
TOTAL INTEREST ON INVESTMENT		8,600	8,802	8,908
TOTAL COST/ACRE FOR THE YEAR		40,482	14,684	14,331
INCOME/ACRE FROM PRODUCTION				4,082
TOTAL NET COST/ACRE FOR THE YEAR		40,482	14,684	10,249
NET PROFIT/ACRE ABOVE TOTAL COST				
TOTAL ACCUMULATED NET COST/ACRE		40,482	55,166	65,415

UC COOPERATIVE EXTENSION
Table 2. COSTS PER ACRE to PRODUCE WINEGRAPES
 NORTH COAST - Napa County 2009

Operation	Cash and Labor Cost per acre						Total Cost	Your Cost
	Operation Time (Hrs/A)	Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/Rent	Total Cost		
Cultural:								
Prune: Preprune	13.00	230	0	0	0	230		
Weed: Spray Vine Row (Glyphos)	2.00	49	4	6	0	59		
Prune: (Cordon spur pruned)	27.00	478	0	0	0	478		
Prune: Tie Canes	12.00	212	0	0	0	212		
Weed: Mow Middles	2.00	49	38	0	0	86		
Disease: Mildew (Sulfur)	2.00	49	33	5	0	87		
Frost Protection: Windmills	5.01	89	0	216	0	305		
CM: Trunk/Cordon Sucker	15.00	265	0	0	0	265		
Irrigate: (water & labor)	3.30	58	0	95	0	153		
Fertilize: through drip (8-8-8)	0.00	0	0	18	0	18		
Disease: Mildew (Oil)	1.00	24	17	42	0	83		
CM: Sucker/Shoot Thin/Shoot Position	10.00	177	0	0	0	177		
Disease: Mildew (Rally)	1.00	24	17	22	0	63		
CM: Leaf/Lateral Removal & Wire Lift	40.00	708	0	0	0	708		
Thin: Thin Crop (color thin)	10.00	177	0	0	0	177		
Disease: Mildew (Flint)	1.00	24	17	33	0	74		
Thin: Thin Crop (set thin)	18.00	318	0	0	0	318		
Disease: Mildew (Pristine)	1.00	24	17	38	0	79		
Pest Control/Water Management Adviser	0.00	0	0	0	100	100		
Pickup Use	6.06	148	122	0	0	269		
ATV	1.00	24	2	0	0	26		
TOTAL CULTURAL COSTS	170.37	3,128	265	474	100	3,967		
Harvest:								
Harvest-Hand Labor	0.00	0	0	0	750	750		
Harvest-Bin Handling	4.00	91	16	0	133	240		
Haul	0.31	8	3	0	0	10		
TOTAL HARVEST COSTS	4.31	98	18	0	883	1,000		
Interest on operating capital @ 5.75%						97		
TOTAL OPERATING COSTS/ACRE		3,226	283	474	983	5,063		
CASH OVERHEAD:								
Office Expense						300		
Liability Insurance						21		
Sanitation						140		
Property Taxes						1,981		
Property Insurance						190		
Investment Repairs						266		
TOTAL CASH OVERHEAD COSTS						2,898		
TOTAL CASH COSTS/ACRE						7,961		
NON-CASH OVERHEAD:								
		Per producing Acre		Annual Cost				
				Capital Recovery				
Land		175,000		8,313		8,313		
Building		533		37		37		
Tools		167		21		21		
Wind Machines		2,500		181		181		
Vineyard Establishment		39,104		2,903		2,903		
Equipment		3,130		322		322		
TOTAL NON-CASH OVERHEAD COSTS		220,434		11,778		11,778		
TOTAL COSTS/ACRE						19,738		

CM=Canopy Management. X=number of times as 2X= 2 times or 2 passes.

For Assessment/Membership costs, see page 7.

UC COOPERATIVE EXTENSION
Table 3. COSTS AND RETURNS PER ACRE to PRODUCE WINEGRAPES
 NORTH COAST - Napa County 2009

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Cabernet Sauvignon Winegrapes	5.00	ton	4,082.00	20,410	
OPERATING COSTS					
Herbicide:					
Glyphos	1.00	pint	6.17	6	
Fungicide:					
Wettable Sulfur 97	6.00	lb	0.75	5	
JMS Stylet Oil	2.00	gal	20.77	42	
Rally 40 WSP	4.00	oz	5.50	22	
Flint	2.00	oz	16.50	33	
Pristine	10.00	oz	3.77	38	
Frost Protection:					
Wind Machine (Propane @ \$3.60 per gallon)	50.00	hr/ac	4.32	216	
Water:					
Water pumped (155,866 gallons)	5.74	acin	16.50	95	
Fertilizer:					
8-8-8 (10.2 lbs per gallon)	51.00	lb	0.36	18	
Custom/Contract:					
PCA (pest, nutrition, water monitoring)	1.00	acre	100.00	100	
Harvest Labor	5.00	ton	150.00	750	
Rent:					
Tractors (2)	4.00	acwk	24.66	99	
Forklift (1)	2.00	acwk	17.33	35	
Labor (machine)	24.45	hrs	20.30	496	
Labor (non-machine)	154.31	hrs	17.69	2,730	
Fuel - Gas	28.77	gal	3.36	97	
Fuel - Diesel	29.48	gal	3.70	109	
Lube				31	
Machinery repair				47	
Interest on operating capital @ 5.75%				97	
TOTAL OPERATING COSTS/ACRE				5,063	
NET RETURNS ABOVE OPERATING COSTS				15,347	
CASH OVERHEAD COSTS:					
Office Expense				300	
Liability Insurance				21	
Sanitation				140	
Property Taxes				1,981	
Property Insurance				190	
Investment Repairs				266	
TOTAL CASH OVERHEAD COSTS/ACRE				2,898	
TOTAL CASH COSTS/ACRE				7,961	
NON-CASH OVERHEAD COSTS (Capital Recovery):					
Land				8,313	
Building				37	
Tools				21	
Wind Machine				181	
Vineyard Establishment				2,903	
Equipment				322	
TOTAL NON-CASH OVERHEAD COSTS/ACRE				11,778	
TOTAL COSTS/ACRE				19,738	
NET RETURNS ABOVE TOTAL COSTS				672	

UC COOPERATIVE EXTENSION
Table 4. MONTHLY PER ACRE CASH COSTS to PRODUCE WINEGRAPES
 NORTH COAST - Napa County 2009

Beginning JAN 09	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Ending DEC 09	09	09	09	09	09	09	09	09	09	09	09	09	
Cultural:													
Prune: Preprune	230												230
Weed: Spray Vine Row (Glyphos)	29						29						59
Prune: (Cordon spur pruned)			478										478
Prune: Tie Canes			212										212
Weed: Mow Middles			43		43								86
Disease: Mildew (Sulfur)			43	43									87
Frost Protection: Windmills			94	116	94								305
CM: Trunk/Cordon Sucker				265									265
Irrigate: (water & labor)					15	31	31	31	31	15			153
Fertilize: through drip (8-8-8)					9				9				18
Disease: Mildew (Oil)					83								83
CM: Sucker/Shoot Thin/Shoot Position					177								177
Disease: Mildew (Rally)						63							63
CM: Leaf/Lateral Removal & Wire Lift						354	354						708
Thin: Thin Crop (color thin)							177						177
Disease: Mildew (Flint)							74						74
Thin: Thin Crop (set thin)									318				318
Disease: Mildew (Pristine)									79				79
Pest Control/Water Management Adviser	10	10	10	10	10	10	10	10	10	10			100
Pickup Truck Use	22	22	22	22	22	22	22	22	22	22	22	22	269
ATV	2	2	2	2	2	2	2	2	2	2	2	2	26
TOTAL CULTURAL COSTS	294	35	905	459	456	482	699	462	74	50	25	25	3,967
Harvest:													
Harvest-Hand Labor									750				750
Harvest-Bin Handling									240				240
Haul									10				10
TOTAL HARVEST COSTS									1,000				1,000
Interest on operating capital @ 5.75%	1	2	6	8	10	13	16	18	23	0	0	0	97
TOTAL OPERATING COSTS/ACRE	295	36	911	467	466	495	715	481	1,098	50	24	24	5,063
Cash Overhead:													
Office Expense	25	25	25	25	25	25	25	25	25	25	25	25	300
Liability Insurance		21											21
Sanitation	14	14	14	14	14	14	14	14	14	14			140
Property Taxes	991						991						1,981
Property Insurance	95						95						190
Investment Repairs	22	22	22	22	22	22	22	22	22	22	22	22	266
TOTAL CASH OVERHEAD COSTS	1,147	82	61	61	61	61	1,147	61	61	61	47	47	2,898
TOTAL CASH COSTS/ACRE	1,442	118	972	529	528	556	1,862	542	1,159	111	72	71	7,961

CM=Canopy Management. X=number of times as 2X= 2 times or 2 passes.

UC COOPERATIVE EXTENSION
Table 5. RANGING ANALYSIS
 NORTH COAST - Napa County 2009

COSTS PER ACRE AT VARYING YIELD TO PRODUCE WINEGRAPES

	YIELD in Tons/Acre						
	3.50	4.00	4.50	5.00	5.50	6.00	6.50
OPERATING COSTS:							
Cultural Cost	3,967	3,967	3,967	3,967	3,967	3,967	3,967
Harvest Cost	741	827	914	1,000	1,086	1,173	1,259
Interest on operating capital @ 5.75%	95	96	96	97	97	97	98
TOTAL OPERATING COSTS/ACRE	4,803	4,890	4,977	5,064	5,150	5,237	5,324
Total Operating Costs/ton	1,372	1,222	1,106	1,013	936	873	819
CASH OVERHEAD COSTS/ACRE	2,898	2,898	2,898	2,898	2,898	2,898	2,898
TOTAL CASH COSTS/ACRE	7,701	7,788	7,875	7,962	8,048	8,135	8,222
Total Cash Costs/ton	2,200	1,947	1,750	1,592	1,463	1,356	1,265
NON-CASH OVERHEAD COSTS/ACRE	11,778	11,778	11,778	11,778	11,778	11,778	11,778
TOTAL COSTS/ACRE	19,479	19,566	19,653	19,740	19,826	19,913	20,000
Total Costs/ton	5,565	4,891	4,367	3,948	3,605	3,319	3,077

For Assessment/Membership costs, see page 7

NET RETURNS PER ACRE ABOVE OPERATING COSTS

PRICE \$/ton	YIELD (ton/acre)						
	3.50	4.00	4.50	5.00	5.50	6.00	6.50
2,882	5,284	6,638	7,992	9,346	10,701	12,055	13,409
3,282	6,684	8,238	9,792	11,346	12,901	14,455	16,009
3,682	8,084	9,838	11,592	13,346	15,101	16,855	18,609
4,082	9,484	11,438	13,392	15,346	17,301	19,255	21,209
4,482	10,884	13,038	15,192	17,346	19,501	21,655	23,809
4,882	12,284	14,638	16,992	19,346	21,701	24,055	26,409
5,282	13,684	16,238	18,792	21,346	23,901	26,455	29,009

NET RETURNS PER ACRE ABOVE CASH COSTS

PRICE \$/ton	YIELD (ton/acre)						
	3.50	4.00	4.50	5.00	5.50	6.00	6.50
2,882	2,386	3,740	5,094	6,448	7,803	9,157	10,511
3,282	3,786	5,340	6,894	8,448	10,003	11,557	13,111
3,682	5,186	6,940	8,694	10,448	12,203	13,957	15,711
4,082	6,586	8,540	10,494	12,448	14,403	16,357	18,311
4,482	7,986	10,140	12,294	14,448	16,603	18,757	20,911
4,882	9,386	11,740	14,094	16,448	18,803	21,157	23,511
5,282	10,786	13,340	15,894	18,448	21,003	23,557	26,111

NET RETURNS PER ACRE ABOVE TOTAL COSTS

PRICE \$/ton	YIELD (ton/acre)						
	3.50	4.00	4.50	5.00	5.50	6.00	6.50
2,882	-9,392	-8,038	-6,684	-5,330	-3,975	-2,621	-1,267
3,282	-7,992	-6,438	-4,884	-3,330	-1,775	-221	1,333
3,682	-6,592	-4,838	-3,084	-1,330	425	2,179	3,933
4,082	-5,192	-3,238	-1,284	670	2,625	4,579	6,533
4,482	-3,792	-1,638	516	2,670	4,825	6,979	9,133
4,882	-2,392	-38	2,316	4,670	7,025	9,379	11,733
5,282	-992	1,562	4,116	6,670	9,225	11,779	14,333

UC COOPERATIVE EXTENSION
Table 6. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS
 NORTH COAST - Napa County 2009

ANNUAL EQUIPMENT COSTS

Yr	Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead		Total
						Insur- ance	Taxes	
09	60 HP 4WD Narrow Tract	45,000	15	8,761	3,849	220	269	4,338
09	Air Blast Gil 3Pt 200 gal	10,000	15	960	902	45	55	1,002
09	ATV 4WD	6,700	5	3,003	991	40	49	1,079
09	Bin 1/2 Ton 2Bins #1	500	10	88	57	2	3	62
09	Bin 1/2 Ton 2Bins #2	500	10	88	57	2	3	62
09	Bin 1/2 Ton 2Bins #3	500	10	88	57	2	3	62
09	Bin Trailer 2Bns #1	1,050	15	101	95	5	6	105
09	Bin Trailer 2Bns #2	1,050	15	101	95	5	6	105
09	Bin Trailer 2Bns #3	1,050	15	101	95	5	6	105
09	Mower-Flail 5'	8,000	15	768	722	36	44	801
09	Pickup Truck 1/2 Ton	32,000	7	12,139	3,978	181	221	4,380
09	Sprayer ATV 20gal	350	10	62	40	2	2	44
09	Truck Flatbed 20 ft 2 Ton	49,803	10	14,711	5,188	265	323	5,775
TOTAL		156,503		40,971	16,124	810	987	17,921
60% of New Cost *		93,902		24,583	9,674	486	592	10,752

*Used to reflect a mix of new and used equipment

ANNUAL INVESTMENT COSTS

Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead			Total
					Insur- ance	Taxes	Repairs	
Building 400 sq ft	16,000	25		1,107	66	80	512	1,765
Vineyard Establishment	1,173,131	22		87,103	4,810	5,866	5,866	103,645
Land 35 Acres	5,250,000	25	5,250,000	249,375	0	52,500	0	301,875
Tools-Shop/Field/Fuel Tanks	5,000	10		640	21	25	100	785
Wind Machine	75,000	23		5,430	308	375	1,500	7,612
TOTAL INVESTMENT	6,519,131		5,250,000	343,655	5,203	58,846	7,978	415,682

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/ Farm		Price/ Unit	Total Cost
	Unit	Unit		
Liability Insurance	30	acre	20.70	621
Office Expense	30	acre	300.00	9,000
Sanitation	30	acre	140.00	4,200

UC COOPERATIVE EXTENSION
Table 7. HOURLY EQUIPMENT COSTS
 NORTH COAST - Napa County 2009

Yr	Description	COSTS PER HOUR							Total Costs/Hr.	
		Actual Hours Used	Capital Recovery	Cash Overhead			Operating			Total Oper.
				Insur- ance	Taxes	Repairs	Fuel & Lube			
09	60 HP 4WD Narrow Tract	297	7.78	0.45	0.54	1.15	12.54	13.69	22.46	
09	Air Blast Gil 3Pt 200 gal	180	3.01	0.15	0.18	1.67	0.00	1.67	5.01	
09	ATV 4WD	90	6.60	0.27	0.32	0.50	1.29	1.79	8.98	
09	Bin 1/2 Ton 2Bins #1	30	1.14	0.05	0.06	0.00	0.00	0.00	1.25	
09	Bin 1/2 Ton 2Bins #2	30	1.14	0.05	0.06	0.00	0.00	0.00	1.25	
09	Bin 1/2 Ton 2Bins #3	30	1.14	0.05	0.06	0.00	0.00	0.00	1.25	
09	Bin Trailer 2Bns #1	30	1.89	0.09	0.12	0.16	0.00	0.16	2.26	
09	Bin Trailer 2Bns #2	30	1.89	0.09	0.12	0.16	0.00	0.16	2.26	
09	Bin Trailer 2Bns #3	30	1.89	0.09	0.12	0.16	0.00	0.16	2.26	
09	Mower-Flail 5'	30	7.22	0.36	0.44	3.73	0.00	3.73	11.75	
09	Pickup Truck 1/2 Ton	182	13.13	0.60	0.73	2.36	17.71	20.07	34.53	
09	Sprayer ATV 20gal	60	0.40	0.02	0.02	0.10	0.00	0.10	0.54	
09	Truck Flatbed 20 ft 2 Ton	9	331.52	16.90	20.61	4.81	4.25	9.06	378.09	

UC COOPERATIVE EXTENSION
Table 8. OPERATIONS WITH EQUIPMENT
 NORTH COAST - Napa County 2009

Operation	Operation Month	Tractor	Implement	Labor Hrs	Material	Broadcast Rate/acre	Unit
Cultural:							
Prune: Preprune	Jan			13.00			
Prune: (Cordon-Spur pruned)	Mar			27.00			
Prune: Tie Canes	Mar			12.00			
CM: Trunk/Cordon Suckering	Apr			15.00			
CM: Sucker/Shoot Thin/Shoot Position	May			10.00			
CM: Leaf/Lateral Removal/ Wire Lift	June			20.00			
CM: Leaf/Lateral Removal/ Wire Lift	July			20.00			
CM: Thin Crop (color thin)	July			10.00			
CM: Thin Crop (set thin)	Aug			18.00			
Weed: Spray Vine Row	Jan	ATV	ATV Sprayer		Glyfos	0.50	pt
	July	ATV	ATV Sprayer		Glyfos	0.50	pt
Weed: Mow Middles	Mar	60HP	Mower 5'				
	May	60HP	Mower 5'				
Disease: Mildew	Mar	60HP	Air Blast Sprayer		Wettable Sulfur	3.00	lb
	Apr	60HP	Air Blast Sprayer		Wettable Sulfur	3.00	lb
	May	60HP	Air Blast Sprayer		Stylect Oil	2.00	gal
	June	60HP	Air Blast Sprayer		Rally	4.00	oz
	July	60HP	Air Blast Sprayer		Flint	2.00	oz
	Aug	60HP	Air Blast Sprayer		Pristine	10.00	oz
Frost Protection	Mar	Wind Machine		1.70	Propane	1.20	gal
	Apr	Wind Machine		1.70	Propane	1.20	gal
	May	Wind Machine		1.70	Propane	1.20	gal
Irrigate	May			0.30	Water	*0.57	acin
	June			0.70	Water	*1.15	acin
	July			0.70	Water	*1.15	acin
	Aug			0.70	Water	*1.15	acin
	Sept			0.70	Water	*1.15	acin
	Oct			0.30	Water	*0.57	acin
Fertilize: Through Drip	May				8-8-8	25.50	lb
Harvest:							
Harvest-Hand Labor	September						
Harvest-Bin Handling	September	60HP 4WD	Bin Trailer/Bins		Rented Tractor		
			Bin Trailer/Bins		Rented Tractor		
			Bin Trailer/Bins		Rented Forklift		
Haul	September	Truck Flatbed					

*0.57 acin = 15.478 gal per acre, 1.15 acin = 31,227 gal per acre.