UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

RAISIN BEST MANAGEMENT PRACTICES†
with
ESTIMATED COSTS AND RETURNS
FOR A 120 ACRE RAISIN VINEYARD

1998

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RAISIN BEST MANAGEMENT PRACTICES[†] - 1998

Introduction

The California grape industry ranks first in grape production in the nation with roughly 676,000 bearing acres. This produces about 90% of the total United States grape crop. Grapes have consistently been the second largest contributor to farm income in California during the 1990's, with gross values ranging from $1.7 to $2.8 billion for juice, raisin, table and wine grapes combined. Raisin varieties account for approximately 40% of the state's bearing acres and 25% of the gross value for all grapes. Raisin production is concentrated in the Southern San Joaquin Valley, with the largest acreages located in Fresno and Madera counties.

Production for many of California's major crops decreased in 1998, due in large part to erratic weather patterns and challenging field conditions. The California Department of Food and Agriculture (CDFA) estimates that weather related crop damage exceeded half a billion dollars (CDFA, 1998). Total grape tonnage reportedly decreased by 24%, with raisin production reduced by 32% (California Agricultural Statistics Service, 1999).

The following report is meant to familiarize readers with different production strategies and practices currently being used by growers enrolled in the Raisin Best Management Practices Program (BMP) of Sun-Maid Growers of California. BMP is an approach to crop production that considers all aspects of farming including soil, water and pest management, economics, and human and environmental health and safety. Specifically, the program has four major objectives: 1) improve yields per acre, 2) improve worker safety, 3) improve chemical selectivity and decrease usage, and 4) improve grower margins.

The first section of this study discusses three broad areas of raisin BMP: soil fertility and vineyard floor management, pest management, and other considerations such as labor management. Estimated costs and returns for a 120 acre raisin vineyard, including the set of assumptions used to generate costs, are then presented. The study is intended as a guide for growers who would like to evaluate potential costs and returns associated with raisin BMP in relationship to their own situations. It is not meant to be a cost comparison of different production systems because, in addition to economics, each grower's approach to farming is determined by multiple complex issues.

[†] The Raisin Best Management Practices Program is an innovative partnership with Sun-Maid Growers, The Pew Charitable Trusts, and Fresno Pacific University and is available for all California raisin growers. This report is for the first year of a two-year study.

Raisin Best Management Practices

BMP farming methods are in many ways similar to raisin production as has been practiced for numerous years. Similar practices include pruning, vine tying, vineyard maintenance and harvest operations. Because a general goal of BMP is to reduce fertilizer and pesticide use, growers are encouraged to use certain practices such as cover cropping and vineyard monitoring, and are discouraged from using some material inputs by Sun-Maid's "Do Not Use" list. Therefore, differences in practices often occur in the areas of soil fertility, vineyard floor, and pest management. It is important to note that BMP supports a flexible problem-solving approach to decision-making and farm management. Because of this, there is no "model" set of practices or strategies for any individual vineyard using BMP. Various BMP production strategies and practices are presented in the following discussion.

Raisin BMP Soil Fertility & Vineyard Floor Management Strategies

- Petiole, soil and water analyses
- Cover crops
- Manure or compost
- Drip irrigation
- Mechanical mowing and cultivation; chemical mowing
- Low volume sprayers

In the area of soil fertility, growers rely on petiole, soil, and water analyses to monitor vineyard nutrient levels and help with fertilizer application decisions. Petiole analyses are usually performed on a yearly basis; soil and/or water analyses are performed every third or fourth year. The type, number and frequency of the different analyses typically depends on grower experience and vineyard needs.

An increasing number of BMP growers plant and maintain cover crops in their raisin vineyards on a year-to-year basis. Growers report five potentially beneficial reasons for their use: 1) the addition of nitrogen and other nutrients to vineyard soils, 2) the addition of organic matter to vineyard soils, 3) improvement of water penetration and infiltration, 4) management of habitat to attract and sustain beneficial insects, and 5) the reduction of dust in vineyards, which in turn may lead to a reduction in spider mite pest populations.

The type of cover crop that is planted, and associated vineyard floor management practices, depend on a grower's specific objectives. Some growers plant cereal grasses such as barley, oats or rye on an annual basis to add organic matter to the soil and improve water infiltration. Others plant annual legumes such as vetch or peas for their nitrogen benefit. Still others plant a mixture of the two cover crop types to take advantage of the potential benefits of both. A smaller number of growers plant self-reseeding annual cover crops such as blando brome or bur clover to avoid yearly seeding costs. Cover crops are most often seeded in the fall in every or every other row middle, leaving the vine rows free of vegetative growth. Annually planted cover crops are usually mowed and incorporated into the soil during the spring or summer months. However, growers may perform these operations earlier in the year to minimize frost hazard.

Some raisin BMP growers also indicate that cover crop use has potential drawbacks. Drawbacks include increased costs for seed and planting, and in addition, increased labor costs to manage vegetative growth on vineyard floors. Also, tillage operations may increase in vineyards with planted cover crops. This, in turn, may

increase dust problems, and therefore spider mite problems in vineyards. As an alternative to planted cover crops, some growers allow resident vegetation (weeds) to re-seed and re-grow in their vineyards. This practice eliminates seed and planting costs, and may also help reduce tillage operations, dust, and spider mite populations. Growers have also found that the use of leguminous cover crops may lead to over fertilization of vineyards by fixing excessive nitrogen.

Manures and composts are being used in some BMP vineyards to add organic matter to the soil and help meet the crop's nutrient needs. Manures and composts may be used alone, or in conjunction with a cover crop program.

BMP growers also manage crop growth and health through the efficient use of water and fertilizers. Drip irrigation is a suggested strategy for BMP vineyards because it may lead to improved distribution, thus use, of both inputs. However, water costs are generally higher with drip irrigation because of increased energy use. Tensiometer and gypsum block use is another suggested means of monitoring water use and moisture levels in vineyards.

Management of vegetative growth on vineyard floors is another important aspect of raisin BMP. Weeds are controlled using a combination of various techniques throughout the year including mechanical mowing and cultivation, or chemical mowing. To help reduce total herbicide use, some growers are using or experimenting with new types of application equipment such as low volume sprayers. Other growers have decreased herbicide use by eliminating pre-emergent herbicides and now "spot spray" only those areas in or surrounding vineyards with high weed densities.

Raisin BMP Pest Management Strategies

- Use an integrated approach for pest management
- Monitor insect, mite and disease populations and incidence
- Use weather station information, degree days, pest cast models

BMP growers use an integrated approach for pest management. This may include genetic, chemical, cultural, behavioral and natural controls. Examples of genetic controls include resistant rootstock for the management of various nematode species and grape phylloxera (*Daktulosphaira vitifoliae*). Chemical controls can include the use of synthetically formulated pesticide materials such as Provado for variegated grape leafhopper (*Erythroneura variabilis*) and western grape leafhopper (*E. elegantula*) populations, and Abound for powdery mildew (*Uncinula necator*) control, or organically acceptable materials such a sulfur dust for powdery mildew or cryolite for OLR, omnivorous leafroller (*Platynota stultana*). Growers are also managing pests culturally using such methods as vineyard sanitation for OLR, behaviorally using pheromones for mating disruption of OLR, and naturally using releases of beneficial insects and predaceous mites with the goal of reducing populations of leafhoppers and spider mite pests. There is some debate, however, as to the effectiveness of beneficial insect and mite releases for this purpose.

One of the cornerstones of raisin BMP is monitoring vineyards for the presence or absence of pest and beneficial insects, mites, and diseases. Monitoring familiarizes growers with existing insect, mite, and disease levels and helps with yearly pest management decisions. For BMP, raisin vineyards are typically monitored at

least once every week, but may be visited more or less often depending on the site's history and current pest populations.

Growers sometimes monitor their own vineyards, but frequently enlist the services of an input supplier, in-house or independent pest control advisor (PCA) to help with this activity. There are usually no fees associated with the services of an input supplier or in-house PCA so long as a grower's material inputs are purchased from the same PCA. By contrast, independent PCA's do not act as material suppliers and therefore charge for their services. Costs vary depending on the level of service agreed to by the grower and the PCA, and are generally charged on a per acre basis.

BMP growers make pesticide application decisions by evaluating information from a variety of sources including PCA and grower monitoring data, weather station reports, Sun-Maid's vineyard information phone line, degree day calculations, and pest cast models. For example, insect monitoring data may show that the population of a particular pest is high in a vineyard, thereby indicating the need for a material application, while powdery mildew sprays may be timed by using information gathered from both weather station reports and pest cast models.

BMP growers also strive to reduce pesticide use through various other strategies, including a decrease in the number of pesticide applications per year, applying materials at below label rate, or treating only those areas of the vineyard in which pest outbreaks occur or pest populations are high.

Other Raisin BMP Considerations

- Labor management
- Pesticide regulation

While BMP emphasizes a flexible problem-solving approach to crop production and farm management on a yearly basis, the overarching goal is to consider long-term effects on the entire farming system. This includes human, and environmental health and safety considerations. It follows that raisin BMP growers are concerned about various aspects of labor management and pesticide regulations.

Farm labor is viewed as part of a well-balanced, complete BMP program in that, as much as is possible, raisin growers want to provide farm workers with year-round employment, opportunities for advancement, education, and work incentives. Whereas education may take the form of participation in training programs, incentives can include added worker benefits or bonuses. However, labor availability and scarcity may preclude some growers from meeting the above objectives.

BMP growers generally have one of two different perspectives with respect to pesticide regulation in agricultural production. On the one hand, many growers view current laws and regulations as an integral part operating a farm business, and therefore incorporate related activities such as pesticide use reporting into daily management activities. Other growers see pesticide regulation as burdensome, particularly as it relates to the areas of training and reporting procedures. The added training and paperwork demands may be difficult and costly to implement especially in the case of growers with small acreages and/or few employees. Ultimately, however, both groups understand that compliance with pesticide laws and regulations is essential to maintaining a farm business.

ESTIMATED COSTS AND RETURNS
FOR A 120 ACRE RAISIN VINEYARD - 1998

General Information

The practices described for the hypothetical vineyard used in this report are considered common for raisin production within the five districts of the Raisin Best Management Practices Program (BMP)[†] of Sun-Maid Growers of California. The costs and returns associated with BMP vineyards may not vary substantially from vineyards managed using conventional or organic production methods. In this report, sample costs given for labor, materials, equipment and contract services are based on 1998 prices. **The use of trade names does not constitute an endorsement or a recommendation by the University of California or the BMP Program nor is criticism implied by omission of other similar products**. A blank Your Cost column is provided to enter your actual costs on Table 1 Costs Per Acre by Operation and Table 2 Detail of Costs Per Acre by Input. Costs and practices detailed in this study may not be applicable to all situations. This study is only intended as an estimate or guide and can be helpful in making production decisions, determining potential returns, preparing budgets and evaluating production loans.

This report consists of the set of assumptions used for a 120 acre vineyard in raisin production and the following seven tables.

Table 1. Costs Per Acre by Operation
Table 2. Detail of Costs Per Acre by Input
Table 3. Monthly Cash Costs Per Acre
Table 4. Annual Equipment, Investment and Business Overhead Costs
Table 5. Hourly Equipment Costs
Table 6. Ranging Analysis
Table 7. Costs and Returns/Breakeven Analysis

For an explanation of calculations used for this study refer to the attached assumptions. For questions, call the Department of Agricultural and Resource Economics, Cooperative Extension, University of California, Davis, California, (530) 752-3563 or a representative of the Raisin Best Management Practices Program at (559) 897-6356.

Copies of this study can be requested through the Department of Agricultural and Resource Economics, U.C. Davis, or from the Raisin Best Management Practices Program of Sun-Maid Growers of California.

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Cost of Production Assumptions for a 120 Acre Raisin Vineyard

This study reflects the practices and costs associated with production of raisins in the Best Management Practices Program (BMP) of Sun-Maid Growers of California. While every effort is made to model a production system based on real world practices, this report cannot fully represent the costs and practices that are specific to each vineyard or production district within the program. This study should therefore be interpreted as a representative operation only and not as a statistical average. Costs are presented on an annual per acre basis.

The following is a description of general assumptions pertaining to sample costs for raisins.

Land. The total farm size is 300 acres, 120 of which are in raisin production. The remaining acreage is dedicated to other agricultural enterprises and land for the farmstead, roads and wells. For this study, land for an established vineyard is assumed to be owned by the grower and is valued at $8,250 per acre. This figure is within the range of low and high values for established raisin producing land in Fresno and Madera Counties. The price includes cost of the land, mature vines and furrow irrigation system, and is shown as an investment in Table 4 Annual Equipment, Investment and Business Overhead Costs. Land values per acre vary within each county and will affect grower returns. The vineyard and irrigation system are considered improvements to the property and are depreciated as part of capital recovery costs under total land costs. Land is assumed to be level, with well-drained soils of moderate depth and fertility.

Vines/Trellis System. The grape variety is assumed to be Thompson Seedless. Vines are planted on a 7' x 12' spacing with 519 vines per acre. The trellis system is a single wire design.

Production Practices. Production practices for raisins are listed in Table 1 Costs Per Acre by Operation. This table shows the order in which the operations are performed, as well as the hours per acre required for each operation. Labor, contract and rental rates, materials, and fuel and repair costs are also included in this table. Input costs can be found in Table 2 Detail of Costs Per Acre by Input. In addition, the sequence of operations and monthly cash costs per acre for the crop are located in Table 3 Monthly Cash Costs Per Acre.

Floor Management. In this study, a winter annual cover crop is assumed to be drill-seeded in the fall after harvest. Prior to seeding the cover crop, vineyard middles are re-leveled (terraced back) as well as irrigated. Planting into moisture serves to improve stand establishment and early cover crop growth. After this time, cover crop growth is dependent on fall and winter rains.

A barley cover crop is used, which is planted into alternate middles in six-foot strips at a rate of 25 pounds per planted vineyard acre. This represents 25% of the seeding rate per acre to account for space taken up by the vine rows. It may be necessary to increase seeding rates for late season plantings to insure a good stand.

The cover crop is mowed in late February, and then incorporated into the soil by discing once to keep the vineyard floor free of vegetative growth and minimize the risk of frost hazard. Alternate middles should also be disced once to eliminate weed growth and reduce the risk of frost hazard. This is best practiced by late February or early March to take advantage of some winter rainfall to settle and moisten the disced soil surface. Vineyard middles are disced three additional times during the remaining spring and summer months to control weeds. Therefore, no additional water is required for cover crop growth or for resident weeds during the summer.

Weeds in vine rows are controlled with one berm spray in February, which consists of a combination of pre and post-emergent herbicides. Two additional post-emergent spot sprays are used in the vineyard during the growing season to control weeds. No other means of weed control are used in this study.

Crop Irrigation. The amount of irrigation water applied to vineyards in this region ranges from 2.0 to 4.5 acre-feet per acre per year, averaging a total of 3.5 acre-feet per acre. However, this amount is dependent on soil type, rainfall and residual soil moisture, water availability, and irrigation system design. Raisin grapes are either furrow or drip irrigated with district (surface) or well (pumped) water, or a combination of the both district and well water.

This study assumes that furrow irrigation is used in the vineyard. Water costs are estimated at $25 per acre, with a total of 3.5 acre-feet per acre applied to grapes during the season. For most districts, the cost for water is based on a flat tax rate, and ranges from $17 to $38 per acre, averaging about $25 per acre. In the Madera area, delivery charges are incurred, and district water costs average about $54 per acre-foot. Labor costs include time to start each irrigation and monitor the system for proper function. No assumption is made with respect to effective rainfall. The vineyard is assumed to be irrigated once after harvest in October, and as needed during the growing season between May and early August.

Pest Management. Disease incidence and arthropod and vertebrate pest damage vary on a year-to-year basis depending on vineyard location, pest populations and management techniques. This study assumes that vineyards are monitored for disease, insect and mite pests throughout the growing season by the grower and by an input supplier who is also a licensed pest control advisor (PCA). Therefore, no specific cost is incurred for PCA and monitoring services. Costs for the pest management practices used in this report are located in Tables 1 through 3 and will vary from grower to grower.

Equipment Cash Costs. Equipment costs are composed of three parts: cash overhead, capital recovery and operating costs. The operating costs consist of fuel, lubrication and repairs.

Repair costs are based on the purchase price, annual hours of use, total hours of life and repair coefficients formulated by the American Society of Agricultural Engineers (ASAE). Fuel and lubrication costs are also determined by ASAE equations based on maximum power take-off (PTO) horsepower (hp) and the type of fuel used. The fuel and repair costs per acre for each operation in Table 1 are determined by multiplying the total hourly operating cost in Table 5 for each piece of equipment used for the cultural practice by the number of hours per acre for that operation. Tractor operation time is 10% higher than implement operation time to account for fueling, moving equipment, and setup time. Prices for on-farm delivery of diesel and gasoline are $0.78 and $1.22 per gallon, respectively.

Harvest. In this study, grapes are assumed to be hand harvested in September at a contract rate of $0.26 per tray. Contract services are also used for turning and rolling ($70 per thousand trays), and for transporting raisins to a packer ($10 per ton). Labor and taxes are included in all of the above contract rates. Boxing and shaking raisins is performed by the grower. Harvest costs are located in Tables 1 through 3.

Because contract services are assumed for most harvest operations, costs for harvest equipment (other than equipment to box and shake raisins) are not included in this study. If growers choose to perform all harvest operations, equipment for the appropriate operations should be inventoried and labor, fuel, repairs and capital recovery costs should be added as a cost of production. Contract harvest costs, then, would not be included.

Packers. After harvest the crop is transported to a packer where it is inspected by a representative of the United States Department of Agriculture (USDA) for maturity, quality and moisture. Industry standards are set by the Raisin Administrative Committee (RAC), the administrative arm of the federal marketing order for raisins. Fees are associated with both USDA inspections and RAC administrative responsibilities; these are paid for by the packer. Growers receive payment for their crop from the packer.

Yield and Return Ranges. This study assumes a raisin yield of 2.0 tons per acre in Tables 1 to 3. Yields for raisins typically range from 1.5 to 2.8 tons per acre. Yield is determined by a variety of factors, including growing location and conditions, soil type and fertility, irrigation practices and pest management.

In 1998, the base price for raisins was $1,184 per ton, which represented payment to growers on 100% of the crop at 50% maturity and 14% moisture. In most years, returns to growers are calculated by "constructing" a per ton price, which includes yield percentages of both free tonnage and a reserve pool as announced by the Raisin Administrative Committee (RAC), and field price per ton as calculated by the Raisin Bargaining Association (RBA) and packers. In the past, constructed prices have ranged from $800 to $1,200 per ton. The exact price each grower receives varies depending on crop maturity, quality and moisture.

Labor. Basic hourly wages for workers are $5.75 and $6.75 per hour for field workers and machine operators, respectively. Adding 34% for workers compensation, social security, insurance and other benefits increases the labor rates shown to $7.71 per hour for field labor and $9.05 for machine labor. The percentage charged for benefits varies depending upon whether or not growers utilize labor contractors or hire their own laborers. For those growers handling their own labor, benefit percentages are often lower than 34%, and have been as low as 18% in the past.

The labor hours for operations involving machinery are 20% higher than the operation times listed on Table 1 to account for extra labor involved in equipment set-up, moving, maintenance, work breaks and repair. Wages for managers are not included as a cash cost. Any returns above total costs are considered returns to management and risk.

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, but are not limited to, property taxes, interest on operating capital, office expenses, property and liability insurance, sanitation services and equipment repairs. Cash overhead costs are found in Tables 1 through 4.

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 two, on a per acre basis.

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 10.46% per year. A nominal interest rate is the going market cost for borrowed funds.

Office and Business Expense. Office and business expenses are estimated at $28 per acre. These expenses include, but are not limited to, office supplies, telephones, bookkeeping, accounting, legal fees and road maintenance.

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 0.713% of the average value of the assets over their useful life. Liability insurance covers accidents on the farm and costs $684 per year.

Sanitation Services. Sanitation services (portable toilets) are provided by the contractor when contract labor is used. Because contract labor is assumed for many of the operations included in this study, the minimal cost of $200 for sanitation services is included here.

Crop Insurance. This study assumes that the grower pays a total of $31 per ton for crop insurance. This rate includes 65% crop loss coverage and reconditioning insurance under the federal crop insurance program.

Capital Recovery Costs. Although farm equipment for raisin vineyards in the region might be purchased new or used, this 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 shown in Tables 1, 2 and 4. They represent the capital recovery cost for each investment on an annual per acre basis.

Capital Recovery Costs. Capital recovery cost is the amount of money required each year to recover the difference between the purchase price and salvage value (unrecovered capital). Put another way, 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 by using 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, 1984). The calculation for annual capital recovery costs is as follows.

[(Purchase Price - Salvage Value) x (Capital Recovery Factor)] + [Salvage Value x Interest Rate]

Salvage Value. Salvage value is an estimate of the remaining value of an investment at the end of its life. For farm machinery (tractors and other implements), the remaining value is a percentage of the new cost of the investment (Boehlje and Eidman, 1984). The life in years is estimated by dividing the wear-out life, as given by the ASAE, by the annual use in hours. Salvage value is calculated as follows.

[New Price x % Remaining Value]

Salvage value for other investments including farm buildings, irrigation systems and miscellaneous tools and equipment is zero. The salvage value for land is equal to the purchase price because land does not depreciate from use. Purchase price and salvage value for the equipment and investments used in this study are shown on Table 4.

Capital Recovery Factor. The capital recovery factor is the amortization factor or annual payment whose present value at compound interest is equal to one. The capital recovery factor is a function of the interest rate and years of life of the investment.

Interest Rate. The interest rate of 7.81% used to calculate capital recovery costs is the United States Department of Agriculture Economic Research Service's (USDA-ERS's) ten year average of the agricultural sector long-run rate of return to production assets from current income. It is used to reflect the long-term realized rate of return to the specialized resources that can only be used effectively in the agricultural sector. In other words, the next best alternative use of these resources is in another agricultural enterprise.

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REFERENCES

American Society of Farm Managers and Rural Appraisers. 1999. *Trends in Agricultural Land & Lease Values.* American Society of Farm Managers and Rural Appraisers. California Chapter. Fresno, California.

Boehlje, M.D. and V.R. Eidman. 1984. *Farm Management.* John Wiley and Sons. New York, New York.

California Agricultural Statistics Service. 1999. *California Fruit & Nut Review*. 19(2):1-2

California Department of Food and Agriculture. 1998. *1998 California Agricultural Resource Directory.* California Department of Food and Agriculture. Sacramento, California.

Integrated Pest Management Education and Publications. 1992. *U.C. IPM Pest Management Guidelines.* University of California, Statewide Integrated Pest Management Project, Division of Agriculture and Natural Resources. Oakland, California. Publication 3339.

Ingels, C., R.L. Bugg, P. Christensen and G. McGourty. 1998. *Cover Cropping in Vineyards: A Grower's Handbook*. Division of Agriculture and Natural Resources. University of California. Oakland, California. Publication 3338.

Klonsky, K., P. Christensen, M. Costello, G. Leavitt, D. Luvisi, B. Peacock, L. Tourte and P. Livingston. 1997. *Sample Costs to Establish a Vineyard and Produce Raisins - Thompson Seedless - in the San Joaquin Valley*. University of California Cooperative Extension. Department of Agricultural and Resource Economics. Davis, California.

Klonsky, K., L. Tourte, P. Christensen, M. Costello, C. Ingels, G. Leavitt and P. Livingston. 1997. *Production Practices and Sample Costs for Organic Raisin Grapes in the Southern San Joaquin Valley*. University of California Cooperative Extension. Department of Agricultural and Resource Economics. Davis, California.

Parnes, R. 1990. *Fertile Soil: A Grower's Guide to Organic & Inorganic Fertilizers.* agAccess. Davis, California.

Raisin Best Management Practices Program. 1997. *California Raisins Best Management Practices Handbook*. Raisin Best Management Practices Program. Fresno, California.

University of California Publications. 1992. *Grape Pest Management*. Second Edition. Division of Agriculture and Natural Resources. Oakland, California. Publication 3343.

Table 1. U.C. COOPERATIVE EXTENSION

COSTS PER ACRE TO PRODUCE RAISINS - 1998 BEST MANAGEMENT PRACTICES PROGRAM[†‡]

VINEYARD SIZE: 120 ACRES

Labor Rate: $ 9.05/hr. machine labor
$ 7.71/hr. non-machine labor

Interest Rate: 10.46%
Yield per Acre: 2.00 ton

Operation	Operation Time (Hrs/A)	Cash and Labor Costs per Acre: Labor Cost	Fuel,Lube & Repairs	Material Cost	Contract/ Rent	Total Cost	Your Cost
Cultural:							
Prune Vineyard	0.00	0	0	0	171	171	
Shred/Chop Brush	0.25	3	1	0	0	4	
Vineyard Maintenance	1.00	11	4	0	0	15	
Tie Vines	0.00	0	0	0	31	31	
Berm Spray	0.20	2	2	67	0	71	
Mow Cover Crop - Alternate Middles	0.10	1	1	0	0	2	
Disc 1X - All Middles/Incorporate Cover Crop	0.30	3	2	0	0	5	
Furrow Out	0.40	4	2	0	0	6	
Phomopsis/Mildew Control	0.22	2	2	7	0	12	
Winter Weeds - Spot Spray	0.13	1	1	3	0	5	
Sulfur Application 10X	1.20	13	5	19	0	37	
Sucker Vineyard	1.25	10	0	0	0	10	
Spring Weeds - Spot Spray	0.13	1	1	3	0	5	
OLR/Mildew Control with Gibberellic Acid	0.22	2	1	42	0	45	
Fertilizer Application - 40lb Nitrogen	0.25	3	1	16	0	19	
Irrigation	2.00	15	0	20	0	35	
Disc 3X - Floor Management	0.60	7	3	0	0	10	
Petiole Analysis - Yearly	0.00	0	0	2	0	2	
Soil &/or Water Analysis – Every 3rd Year	0.00	0	0	1	0	1	
Mite Control - 1/3 of Acreage	0.08	1	0	9	0	10	
OLR/Mildew Control	0.22	2	1	33	0	37	
Leafhopper Control - 1/4 of Acreage	0.10	1	0	8	0	10	
Ethrel Application	0.20	2	1	2	0	5	
Terrace	0.25	3	1	0	0	4	
Pickup Use	1.90	21	7	0	0	28	
Terrace Back	0.25	3	1	0	0	4	
Disc - Prepare Cover Crop Seedbed	0.20	2	1	0	0	3	
Postharvest Irrigate & Fertilize	0.50	4	0	8	0	12	
Plant Cover Crop - Alternate Middles	0.25	3	1	5	0	9	
TOTAL CULTURAL COSTS	12.20	121	39	245	202	606	
Harvest:							
Harvest - Contract	0.00	0	0	37	231	269	
Turn & Roll - Contract	0.00	0	0	0	62	62	
Box & Shake	0.95	51	4	0	8	63	
Haul To Packer	0.00	0	0	0	20	20	
TOTAL HARVEST COSTS	0.95	51	4	37	322	414	
Interest on operating capital @ 10.46%						36	
TOTAL OPERATING COSTS/ACRE		171	43	282	524	1,057	
CASH OVERHEAD:							
Office Expense						28	
Liability Insurance						2	
Sanitation Services						2	
Crop Insurance						62	
Property Taxes						68	
Property Insurance						48	
Investment Repairs						2	
TOTAL CASH OVERHEAD COSTS						212	
TOTAL CASH COSTS/ACRE						1,269	

COSTS PER ACRE TO PRODUCE RAISINS - 1998 BEST MANAGEMENT PRACTICES PROGRAM[†‡]
VINEYARD SIZE: 120 ACRES
Table 1. continued

			Total Cost	Your Cost
CAPITAL RECOVERY (7.81% Interest Rate):				
Investment:	Per Producing Acre	--Annual Cost-- Capital Recovery		
Buildings	74	6	6	
Shop Tools	25	3	3	
Established Vineyard Land	8,250	644	644	
Fuel Tanks & Pump	20	2	2	
Equipment	339	45	45	
TOTAL CAPITAL RECOVERY COSTS	8,708	700	700	
TOTAL COSTS/ACRE			1,969	

[†] The Raisin Best Management Practices Program is an innovative partnership with Sun-Maid Growers, The Pew Charitable Trusts, and Fresno Pacific University and is available for all California raisin growers.

[‡] Calculation differences in categories due to rounding.

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Table 2. DETAIL OF COSTS PER ACRE TO PRODUCE RAISINS - 1998 BEST MANAGEMENT PRACTICES PROGRAM[†]

VINEYARD SIZE: 120 ACRES

Labor Rate: $ 9.05/hr. machine labor
$ 7.71/hr. non-machine labor

Interest Rate: 10.46%

	Quantity/Acree	Unit	Price or Cost/Unit	Value or Cost/Acre[‡]	Your Cost
OPERATING COSTS					
Contract:					
Prune	519.00	vine	0.33	171	
Tie Vines	519.00	vine	0.06	31	
Harvest	889.00	tray	0.26	231	
Turn & Roll	0.89	thou	70.00	62	
Haul to Packer	2.00	ton	10.00	20	
Weed Control:					
Roundup	2.00	pint	5.95	12	
Goal 1.6E	6.00	oz	0.61	4	
Princep	0.75	lb	4.22	3	
Solicam	2.50	lb	21.80	54	
Disease Control:					
Kocide	2.00	lb	2.89	6	
Wettable Sulfur	7.00	lb	0.56	4	
Dusting Sulfur	112.00	lb	0.17	19	
Rubigan EC	10.00	oz	3.22	32	
Insect Control:					
Cryolite	12.00	lb	2.68	32	
Provado	0.25	oz	32.71	8	
Mite Control:					
Misc. Materials	1.00	acre	8.50	9	
Water:					
District	1.00	acre	25.00	25	
Cover Crop Seed:					
Barley	25.00	lb	0.19	5	
Fertilizing Materials:					
UN32	50.00	lb	0.39	19	
Miscellaneous:					
Gibberellic Acid	5.00	oz	1.69	8	
Ethrel	1.00	pint	1.67	2	
Petiole Analysis[§]	1.00	acre	2.00	2	
Soil &/or Water Analysis	1.00	acre	1.00	1	
Paper Trays	0.89	thou	42.00	37	
Rent:					
Forklift	1.00	acre	8.25	8	
Labor (machine)	11.28	hrs	9.05	102	
Labor (non-machine)	9.00	hrs	7.71	69	
Fuel - Gas	3.57	gal	1.22	4	
Fuel - Diesel	23.86	gal	0.78	19	
Lube				3	
Machinery repair				16	
Interest on operating capital@10.46%				36	
TOTAL OPERATING COSTS/ACRE				1,057	
CASH OVERHEAD COSTS:					
Office Expense				28	
Liability Insurance				2	
Sanitation Services				2	
Crop Insurance				62	
Property Taxes				68	
Property Insurance				48	
Investment Repairs				2	
TOTAL CASH OVERHEAD COSTS/ACRE				212	
TOTAL CASH COSTS/ACRE				1,269	

U.C. COOPERATIVE EXTENSION
DETAIL OF COSTS PER ACRE TO PRODUCE RAISINS - 1998 BEST MANAGEMENT PRACTICES PROGRAM†
VINEYARD SIZE: 120 ACRES
Table 2. continued

	Value or Cost/Acre	Your Cost
CAPITAL RECOVERY (7.81% Interest Rate):		
Buildings	6	
Shop Tools	3	
Established Vineyard Land	644	
Fuel Tanks & Pump	2	
Equipment	45	
TOTAL CAPITAL RECOVERY COSTS/ACRE	700	
TOTAL COSTS/ACRE	1,969	

The Raisin Best Management Practices Program is an innovative partnership with Sun-Maid Growers, The Pew Charitable Trusts, and Fresno Pacific University and is available for all California raisin growers.

Calculation differences in categories due to rounding.
Cost for each petiole analysis is $29.

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Table 3. MONTHLY CASH COSTS PER ACRE TO PRODUCE RAISINS
1998 BEST MANAGEMENT PRACTICES PROGRAM[†‡] - VINEYARD SIZE: 120 ACRES

Beginning JAN 98 Ending DEC 98	JAN 98	FEB 98	MAR 98	APR 98	MAY 98	JUN 98	JUL 98	AUG 98	SEP 98	OCT 98	NOV 98	DEC 98	TOTAL
Cultural:													
Prune Vineyard	171												171
Shred/Chop Brush	4												4
Vineyard Maintenance	15												15
Tie Vines		31											31
Berm Spray		71											71
Mow Cover Crop - Alternate Middles		2											2
Disc 1X - All Middles/Incorporate Cov Crop		5											5
Furrow Out			1			2	2			2			6
Phomopsis/Mildew Control			12										12
Winter Weeds - Spot Spray			5										5
Sulfur Application 10X				14	8	15							37
Sucker Vineyard				10									10
Spring Weeds - Spot Spray				5									5
OLR/Mildew Control with Gibberellic Acid					45								45
Fertilizer Application - 40 lb Nitrogen					19								19
Irrigation					9	9	9	9					35
Disc 3X - Floor Management					3		3	3					10
Petiole Analysis - Yearly					2								2
Soil &/or Water Analysis - Every 3rd Year					1								1
Mite Control - 1/3 of Acreage							10						10
OLR/Mildew Control							37						37
Leafhopper Control - 1/4 of Acreage							10						10
Ethrel Application							5						5
Terrace								4					4
Terrace Back										4			4
Disc - Prepare Cover Crop Seedbed										3			3
Postharvest Irrigate & Fertilize										12			12
Plant Cover Crop - Alternate Middles										9			9
Pickup Use	3	3	3	3	3	3	3	3	3	3			28
TOTAL CULTURAL COSTS	193	112	21	31	90	28	78	19	3	32			606
Harvest:													
Harvest - Contract									269				269
Turn & Roll - Contract									62				62
Box & Shake									63				63
Haul To Packer									20				20
TOTAL HARVEST COSTS									414				414
Interest on oper. capital	2	3	3	3	4	4	5	5	9	0			36
TOTAL OPERATING COSTS/ACRE	194	114	24	34	94	33	83	24	425	32			1,057
CASH OVERHEAD:													
Office Expense	3	3	3	3	3	3	3	3	3	3			28
Liability Insurance									2				2
Sanitation Services	1					1							2
Crop Insurance									62				62
Property Taxes				34								34	68
Property Insurance	48												48
Investment Repairs						1						1	2
TOTAL CASH OVERHEAD COSTS	51	3	3	37	3	3	3	3	67	3	0	34	212
TOTAL CASH COSTS/ACRE	246	117	27	71	97	36	86	27	493	35	0	34	1,269

[†] The Raisin Best Management Practices Program is an innovative partnership with Sun-Maid Growers, The Pew Charitable Trusts, and Fresno Pacific University and is available for all California raisin growers.

[‡] Calculation differences in categories due to rounding.

Table 4. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS FOR RAISIN PRODUCTION - 1998 BEST MANAGEMENT PRACTICES PROGRAM[†]
VINEYARD SIZE: 120 ACRES

ANNUAL EQUIPMENT COSTS

Yr	Description	Price	Yrs Life	Salvage Value	Capital Recovery	--Cash Overhead-- Insur-ance	Taxes	Total[‡]
98	50 HP 2WD Tractor	22,630	12	5,658	2,672	101	141	2,914
98	60 HP 2WD Tractor	24,882	12	6,221	2,938	111	156	3,204
98	80 HP 2WD Tractor	35,500	12	8,875	4,191	158	222	4,572
98	Air/Fan Sprayer	11,130	10	1,968	1,507	47	65	1,620
98	Brush Shredder 6'	5,721	10	1,012	775	24	34	832
98	Disc - Offset 8'	4,219	10	746	571	18	25	614
98	Disc - Tandem 8'	3,997	10	707	541	17	24	582
98	Disc Furrower	1,493	10	264	202	6	9	217
98	Drill Seeder 6'	2,893	10	512	392	12	17	421
98	Duster	2,520	10	446	341	11	15	367
98	Flail Mower 6'	3,530	10	624	478	15	21	514
98	Pick up - 1/2 ton	16,409	7	6,225	2,430	81	113	2,623
98	Shaker & Bin Dumper	12,870	10	2,276	1,743	54	76	1,873
98	Spray Rig 500 gal	21,150	10	3,740	2,865	89	124	3,078
98	3 Pt Sprayer 100 gal	2,628	10	465	356	11	15	382
98	Terracer	2,465	10	436	334	10	15	359
98	Trailer #1	1,287	12	178	160	5	7	172
98	Trailer #2	1,287	12	178	160	5	7	172
TOTAL EQUIPMENT		176,611		40,531	22,656	774	1,086	24,515
60% of New Cost[§]		105,967		24,319	13,593	464	651	14,709

ANNUAL INVESTMENT COSTS

Description	Price	Yrs Life	Salvage Value	Capital Recovery	--------Cash Overhead------- Insur-ance	Taxes	Repairs	Total
Buildings	22,200	30		1,937	79	111	444	2,571
Fuel Tanks & Pump	5,985	25		552	21	30	60	663
Established Vineyard Land	990,000		570,000	77,319	5,561	7,800	0	90,680
Shop Tools	7,500	15		866	27	38	75	1,005
TOTAL INVESTMENT	1,025,685		570,000	80,673	5,689	7,978	579	94,919

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/ Farm	Unit	Price/ Unit	Total Cost
Crop Insurance	240	ton	31	7,440
Liability Insurance	1	year	684	684
Office Expense	120	acre	28	3,360
Sanitation Services	1	year	200	200

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[‡] Calculation differences in categories due to rounding.

[§] Used to reflect a mix of new and used equipment.

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Table 5. HOURLY EQUIPMENT COSTS FOR RAISIN PRODUCTION - 1998 BEST MANAGEMENT PRACTICES PROGRAM[†‡]
VINEYARD SIZE: 120 ACRES

			COSTS PER HOUR					
			--Cash Overhead--			Operating		
Yr	Description	Actual Hours Used[§]	Capital Recovery	Insurance	Taxes	Repairs	Fuel & Lube	Total Oper.	Total Costs/Hr.
98	50 HP 2WD Tractor	999.5	1.60	0.06	0.08	0.97	2.20	3.17	4.92
98	60 HP 2WD Tractor	999.3	1.76	0.07	0.09	1.07	2.64	3.71	5.63
98	80 HP 2WD Tractor	999.2	2.52	0.09	0.13	0.65	3.52	4.17	6.92
98	Air/Fan Sprayer	199.3	4.54	0.14	0.20	1.85	0.00	1.85	6.72
98	Brush Shredder 6'	250.0	1.86	0.06	0.08	1.21	0.00	1.21	3.20
98	Disc - Offset 8'	200.0	1.71	0.05	0.07	0.67	0.00	0.67	2.51
98	Disc - Tandem 8'	200.0	1.62	0.05	0.07	0.64	0.00	0.64	2.38
98	Disc Furrower	200.0	0.61	0.02	0.03	0.23	0.00	0.23	0.89
98	Drill Seeder 6'	120.0	1.96	0.06	0.09	0.59	0.00	0.59	2.69
98	Duster	200.0	1.02	0.03	0.04	0.42	0.00	0.42	1.52
98	Flail Mower 6'	200.0	1.43	0.04	0.06	1.63	0.00	1.63	3.17
98	Pick up - 1/2 ton	228.0	6.39	0.21	0.30	1.19	2.63	3.82	10.73
98	Shaker & Bin Dumper	200.0	5.23	0.16	0.23	0.00	0.00	0.00	5.62
98	Spray Rig 500 gal	149.7	11.48	0.36	0.50	5.59	0.00	5.59	17.92
98	3 Pt Sprayer 100 gal	150.0	1.42	0.04	0.06	0.70	0.00	0.70	2.23
98	Terracer	200.0	1.00	0.03	0.04	0.28	0.00	0.28	1.35
98	Trailer #1	250.0	0.38	0.01	0.02	0.19	0.00	0.19	0.61
98	Trailer #2	250.0	0.38	0.01	0.02	0.19	0.00	0.19	0.61

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‡ Calculation differences in categories due to rounding.

§ Actual hours used equals hours for raisins and other enterprises.

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Table 6. RANGING ANALYSIS FOR RAISIN PRODUCTION - BEST MANAGEMENT PRACTICES PROGRAM[†]
VINEYARD SIZE: 120 ACRES

COSTS PER ACRE AT VARYING YIELDS TO PRODUCE RAISINS[‡]

	YIELD (TONS/ACRE)						
	1.5	1.6	1.8	2.0	2.2	2.5	2.8
OPERATING COSTS/ACRE:							
Cultural Cost	606	606	606	606	606	606	606
Harvest Cost	310	331	373	414	455	517	579
Interest on operating capital	36	36	36	36	37	37	38
TOTAL OPERATING COSTS/ACRE	952	973	1,015	1,057	1,099	1,161	1,224
TOTAL OPERATING COSTS/TON	635	608	564	528	499	464	437
CASH OVERHEAD COSTS/ACRE	212	212	212	212	212	212	212
TOTAL CASH COSTS/ACRE	1,164	1,185	1,227	1,269	1,310	1,373	1,436
TOTAL CASH COSTS/TON	776	741	682	634	596	549	513
CAPITAL RECOVERY COSTS/ACRE	699	700	700	700	701	701	701
TOTAL COSTS/ACRE	1,864	1,885	1,927	1,969	2,011	2,074	2,137
TOTAL COSTS/TON	1,242	1,178	1,071	985	914	830	763

NET RETURNS PER ACRE ABOVE OPERATING COSTS FOR RAISINS

PRICE (DOLLARS/TON)	YIELD						
Raisins	1.5	1.6	1.8	2.0	2.2	2.5	2.8
800	248	307	425	543	661	839	1,016
900	398	467	605	743	881	1,089	1,296
1,000	548	627	785	943	1,101	1,339	1,576
1,184	824	921	1,116	1,311	1,506	1,799	2,091
1,200	848	947	1,145	1,343	1,541	1,839	2,136

NET RETURNS PER ACRE ABOVE CASH COSTS FOR RAISINS

PRICE (DOLLARS/TON)	YIELD						
Raisins	1.5	1.6	1.8	2.0	2.2	2.5	2.8
800	36	95	213	331	450	627	804
900	186	255	393	531	670	877	1,084
1,000	336	415	573	731	890	1,127	1,364
1,184	612	709	904	1,099	1,294	1,587	1,879
1,200	636	735	933	1,131	1,330	1,627	1,924

NET RETURNS PER ACRE ABOVE TOTAL COSTS FOR RAISINS

PRICE (DOLLARS/TON)	YIELD						
Raisins	1.5	1.6	1.8	2.0	2.2	2.5	2.8
800	-664	-605	-487	-369	-251	-74	103
900	-514	-445	-307	-169	-31	176	383
1,000	-364	-285	-127	31	189	426	663
1,184	-88	10	204	399	594	886	1,178
1,200	-64	35	233	431	629	926	1,223

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[‡] Calculation differences in categories due to rounding.

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Table 7. COSTS AND RETURNS / BREAKEVEN ANALYSIS FOR RAISIN PRODUCTION
1998 BEST MANAGEMENT PRACTICES PROGRAM† - VINEYARD SIZE: 120 ACRES

COSTS AND RETURNS - PER ACRE BASIS

Crop	1. Gross Returns	2. Operating Costs	3. Net Returns Above Oper. Costs (1-2)	4. Cash Costs	5. Net Returns Above Cash Costs (1-4)	6. Total Costs	7. Net Returns Above Total Costs (1-6)
Raisins	2,368	1,057	1,311	1,269	1,099	1,969	399

COSTS AND RETURNS - TOTAL ACREAGE

Crop	1. Gross Returns	2. Operating Costs	3. Net Returns Above Oper. Costs (1-2)	4. Cash Costs	5. Net Returns Above Cash Costs (1-4)	6. Total Costs	7. Net Returns Above Total Costs (1-6)
Raisins	284,160	126,821	157,339	152,246	131,914	236,286	47,874

BREAKEVEN PRICES PER YIELD UNIT

			----------Breakeven Price To Cover----------		
CROP	Base Yield (Units/Acre)	Yield Units	Operating Costs	Cash Costs	Total Costs
			----------$ per Yield Unit----------		
Raisins	2.0	ton	528	634	985

BREAKEVEN YIELDS PER ACRE

			----------Breakeven Yield To Cover----------		
CROP	Yield Units	Base Price ($/Unit)	Operating Costs	Cash Costs	Total Costs
			----------Yield Units/Acre----------		
Raisins	ton	1,184	0.9	1.1	1.7

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