
UNIVERSITY OF CALIFORNIA AGRICULTURE AND NATURAL RESOURCES
COOPERATIVE EXTENSION
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UC DAVIS DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS

**SAMPLE COSTS TO ESTABLISH AN ORCHARD AND PRODUCE
ALMONDS**



SAN JOAQUIN VALLEY SOUTH

DOUBLE LINE DRIP IRRIGATION - 2016

Mohammad Yaghmour	UC Cooperative Extension Area Orchard Systems Advisor, Kern County
David R. Haviland	UC Cooperative Extension Farm Advisor, Kern County
Elizabeth J. Fichtner	UC Cooperative Extension Farm Advisor, Tulare County
Blake L. Sanden	UC Cooperative Extension Farm Advisor, Kern County
Mario Viveros	UC Cooperative Extension Farm Advisor Emeritus, Kern County
Daniel A. Sumner	Director, UC Agricultural Issues Center, Professor, Department of Agricultural and Resource Economics, UC Davis
Donald E. Stewart	Staff Research Associate, UC Agricultural Issues Center and Department of Agricultural and Resource Economics, UC Davis
Christine A. Gutierrez	Staff Research Associate, UC Agricultural Issues Center and Graduate Student, Dept. of Agricultural and Resource Economics, UC Davis

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INTRODUCTION

Sample costs to establish an almond orchard and produce almonds under double-line drip irrigation in the southern San Joaquin Valley are presented in this study. This study is intended as a guide only. It can be used to guide production decisions, estimate potential returns, prepare budgets and evaluate production loans. Sample costs given for labor, materials, equipment and contract services are based on mid-2016 figures. Practices described are based on production practices considered typical for the crop and area, but will not apply to every situation. A blank column titled Your Costs is provided in Tables 1 and 2 to enter your estimated costs.

For an explanation of calculations used in the study refer to the section titled Assumptions. For more information contact Christine Gutierrez; University of California Agriculture and Natural Resources, Agricultural Issues Center, Department of Agricultural and Resource Economics, at 530-752-1520 or cagut@ucdavis.edu. The local extension office can be contacted at 661-868-6200 (Kern County) or 559-684-3300 (Tulare County).

Sample Cost of Production studies for many commodities are available and can be downloaded from the website, <http://coststudies.ucdavis.edu>. Archived studies are also available on the website.

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ASSUMPTIONS

The assumptions refer to Tables 1 to 8 and pertain to sample costs to establish an almond orchard and produce almonds under double-line drip irrigation in the southern San Joaquin Valley. Cultural practices and costs for almond production vary considerably among growers within the region; therefore, many of the costs, practices, and materials in this study will not be applicable to every farm. The practices and inputs used in this cost study serve as a guide only. **The use of trade names and cultural practices in this report does not constitute an endorsement or recommendation by the University of California nor is any criticism implied by omission of other similar products or cultural practices.**

Land. The hypothetical farm consists of 105 contiguous acres farmed by the owner. Almonds are being established on 100 acres. Roads, a water reservoir, shop buildings and equipment storage occupy an additional five acres. Smaller farms acres may be subject to minimum charges for custom farming services and non-contiguous parcels may have additional costs for travel time and equipment re-calibration.

Establishment Cultural Practices and Material Inputs

Site Preparation. This 100-acre orchard is established on land previously planted to an orchard. The land is assumed to be well drained and either a class I or II soil. The existing well, main lines and sub-main lines stay in place, while the lateral lines and emitters are removed and replaced as part of the new above-ground double line drip irrigation system.

Orchard Removal. Fifty percent of the cost to remove the old orchard is charged to this crop. A custom operator uses a dozer to push over the trees. A front-end loader with a clamp grabs the trees and hauls them to the horizontal grinder to mulch the wood. The chips are pushed to the edge of the orchard. The tree-row is ripped 3 to 4-feet deep to break up underlying hardpan and pull up any remaining old roots. The orchard site is disked and rolled twice to break up clods, fumigated in the fall and then left unattended over the winter. A custom operator fumigates the tree-row area with Chloropicrin and Telone[®] C35. Fall operations that prepare the orchard for planting are done the year prior to planting; however, the costs are reflected in the first establishment year.

Land Preparation. Prior to planting in January, a custom operator using GPS makes berms and marks the planting sites. Composite soil samples from the various depths, soil types and soil layers are taken at that time to determine major salinity (sodium, chloride, boron) concerns. In this study, the grower collects two soil samples at three different depths per 50 acres. An appropriate soil amendment and leaching requirements can then be determined. The irrigation system is installed and the row middles are floated/smoothed.

Trees. No specific almond variety is planted in this study, but cultural practices are based on mid-season varieties. Almond orchards will include a self-compatible cultivar or two or more varieties in which pollen shedding and bloom periods overlap to insure good pollination. Cultivars that may be planted in this region include mid-blooming Nonpareil and Monterey. Planting densities may range from 75 to 180 trees per acre. In the high-density or closer plantings, more intensive management may be needed to prevent excessive insect and disease problems. In this study, 124 trees per acre are planted on a 16' X 22' spacing (tree x row). The life of the orchard at the time of planting is estimated to be 23 years. Contact the local UCCE advisor or a commercial nursery for varieties and rootstocks that are available.

Planting. In this study, potted trees are planted and staked by hand, resulting in higher planting costs. A commercial planting crew plants and trims the trees, places a tree guard or carton around the trunk and applies 3-5 gallons of water to each tree. The tree guard protects against above ground rodents, herbicide sprays, and sunburn.

Train/Prune. Training, including suckering and light trimming for shape, is done in February or March during the first three years. Prunings in the first two years are placed in the row middles and shredded with the regular mowing. The young trees are pruned late to avoid bacterial canker. In the fourth and following years, pruning is done in November or December removing limbs for equipment access and safety. Starting in the third year, the prunings are stacked in the row middles and shredded by a custom operator. Tree tying is done late (November/December) in the second year and again early (January/February) in the fourth year. The tie (small rope) is made around the tree about one-third of the way from the top of the tree. In the fourth year there are two ties per tree.

Fertilizer. Fertilizer rates shown in Table A below reflect typical nutrient requirements, but do not take into account soil and water nutrients. In the first and second year, N is applied monthly from April to August through the irrigation system using CAN-17® for the first two applications (50 percent of the nitrogen budget) and UAN 32 thereafter. In year three and the following years, UAN 32 is applied monthly from March – July. Half of the potassium allotment (as K₂O equivalent) is banded along the tree row in December or January in all years using potassium sulfate (K₂SO₄). The remainder is fertigated with the nitrogen applications using potassium thiosulfate (KTS). Phosphorous (P₂O₅ equivalent) is fertigated as urea ammonium phosphate (10-34-0) in February, April and June.

Table A. Applied Fertilizer (lbs./acre)				Table B. Total Applied Water		Table C. Annual Yields/Acre	
Year	N	K ₂ O	P ₂ O ₅	Year	Acre Inches/Year (*)	Year	Kernel (meat) Lbs.
1	15	30	30	1	5	3	600
2	30	30	30	2	16	4	1200
3	60	30	30	3	26	5	2400
4	100	50	30	4	47	6	2600
5	180	100	30	P	52	7	2800
P	200+	200+	40	* Includes in-season rainfall. Add 3 to 10 ac. in/year, depending on irrigation water quality for leaching salts below 4 foot depth.		P	3000

Sampling. Beginning in the third year, leaf samples are taken 40 days after bloom (early April) and again in July for nutrient analysis and the fertilizers are applied according to analytical recommendations. Leaf samples in this study are calculated at five per 100 acres. The samples are collected by the PCA and the cost is for the lab analysis. Hull samples for boron analysis are taken immediately prior to harvest at a rate of two samples per 100 acres. Many orchards on the east side of the San Joaquin Valley are boron deficient and an application of boron may be required.

In addition, soil samples are taken every other year. Samples are taken at a rate of four samples per 100 acres to determine salinity, pH and nutrient levels. The samples are taken at three depths (0-1ft, 1-3ft and 3-5ft), to allow for a complete soil profile, from multiple areas in the orchard with specified depths pooled for analysis. The grower uses an ATV to collect the samples, which is assumed to take one hour.

Fall Defoliation. Beginning in the 3rd year, zinc chelate (10 percent) is applied at a rate of 1 quart per acre in mid-November to defoliate the trees to reduce the amount of rust and shot hole inoculum. This practice allows for early pruning and also serves as secondary control for some diseases.

Irrigation. Water is pumped from a well to a reservoir (common in Kern county) and then through a filtration system into the above ground double line sprinkler system. The double line irrigation system and micro-sprinkler system are the prevalent systems in the region. A double line irrigation system reduces evaporation losses compared to micro sprinklers and; therefore, provides some water savings. Fertilizer use efficiency may also benefit from this more targeted application to the tree roots. This economic study assumes 100 percent application

efficiency for all years. Water costs will vary considerably depending upon the irrigation district and, when pumped, upon the pumping level, energy costs and type of irrigation system. Water costs may also change depending on availability and ground water regulation. This study assumed 100 percent ground water usage and availability. An estimated cost of \$22 per acre inch (\$264 per acre foot) is used in this study. Irrigation labor is listed as a separate line item.

Water is applied to the orchard approximately once to twice a week from mid-March through mid-October. The amount of water applied each year in this study is shown in Table B. Effective rainfall has not been considered in this study, because it is too variable; therefore, it is assumed that the season begins with a full soil profile following a winter watering for salt leaching (see “Soil Salinity Management” below). This study does not include irrigation costs for frost protection, as protection may not be needed every year and the amount of water applied for protection will vary. An annual water analysis to determine nitrate availability and to maintain regulatory records is included in this study.

Soil Salinity Management. Almond trees are relatively sensitive to sodium, chloride, and boron. If the salt levels within the soil are high, they must be leached from the soil. This process is typically done with either an application of a leaching fraction in-season or applications of water during the dormant season, when evapotranspiration rates are low. In this study, 10 acre inches are added in early January each year to leach salt and to refill the soil profile.

Pollination. A commercial beekeeper sets out one-half hive per acre in the third year, one hive per acre in the fourth and two hives thereafter. The hives are placed in the orchard in early February, prior to bloom. Bee colony strength should be a standard 8 frames per hive and the cost ranges from \$150-\$225 per hive. For this study, a charge of \$200 per hive is assumed.

Pest Management. The pesticides and rates mentioned in this cost study are listed in *UC Integrated Pest Management Guidelines, Almonds*. For information on other pesticides available, pest identification, monitoring, and management visit the UC IPM website at www.ipm.ucdavis.edu. **Pesticides mentioned in this study are not recommendations, but those commonly used in the region.** For information regarding pesticide use permits, contact the local county agricultural commissioner's office. Pesticides with different active ingredients, mode of action, and sites of action should be rotated as needed to combat species shift and resistance. Adjuvants are recommended for use with many pesticides for effective control, but the adjuvants and their costs are not included in this study.

Pest Control Advisor (PCA). Written recommendations are required for many pesticides and are available from licensed pest control advisors. The PCA will monitor the field for agronomic problems including irrigation and nutrition. Growers may hire a private PCA or receive the service as part of a service agreement with an agricultural chemical and fertilizer company. For this study, the PCA charge is \$20 per acre during the establishment years and \$35 per acre during the production years.

Application Methods. Pesticide and fertilizer applications are made by either chemigation (pesticides and/or fertilizers applied through the irrigation water), by ATV mounted ground or spot sprayer or foliar-broadcast by tractor pulled air-blast sprayer. Check individual pesticide labels for compatibility, mixing and usage.

Bees: Bees are sensitive to pesticides and timing of applications must coordinate with bee pollinating activity. **See the individual pesticide labels, environmental hazards section, for these requirements in the following publication:** Oregon State University, “How to Reduce Bee Poisonings from Pesticides”: <https://catalog.extension.oregonstate.edu/pnw591>

Weeds. In the first year, Gramoxone® and Prowl® are applied to the tree row (strip spray) in February soon after planting. In the second year, a pre-emergent herbicide (Chateau®) is applied to the tree row during the dormant season (early January) and a delayed dormant spot spray of Gramoxone® is applied in late January. Beginning in the third year, a dormant strip spray of Matrix® and Gramoxone® is applied to the tree row in the fall (November). Each year, the row middles are mowed in March and August (before harvest) plus a chemical mow using Roundup® in April.

Insects. Each year in May, mites are controlled with an Agri-Mek® (20fl oz. /acre) and 415 oil application (1 gal/acre). Treatment for peach twig borer includes a dormant spray of Asana® in December of the first and second year. Starting in the 3rd year, a second miticide application is made at hull-split (July) using Zeal® (3oz/acre). Beginning in the third year, ant bait (Clinch®, 1lb/acre) is broadcast for ant control in July. Also starting in the third year, the trees are treated for navel orangeworm (NOW) with Intrepid® (1pt/acre) at hull split (late June), followed by a second spray in mid-July using Altacor® (4fl oz./acre). Additional insecticide sprays for leaf-footed bug, stink bug and San Jose scale may be necessary in some areas, but this cost is not included in this study.

Disease. Treatment for rust starts in the first year and continues thereafter. The trees are treated with an application of Quash® in March (3.5fl oz. /acre). Wettable sulfur may be added to increase fungicide efficacy, but is not included in this study. The following list of applications commences in the 3rd year: Scab is treated with a delayed dormant liquid copper spray (2fl oz./acre) in January followed by a second spray around five weeks after petal fall (late March to April) using Bravo WeatherStik® (4pt/acre). An application of Vanguard® WG (10oz/acre) is made at late bloom (late February) for brown rot. Around two weeks after petal fall (Mid-March), Pristine® (14.5fl oz. /acre) is applied to the trees for shot hole. As treatment for alternaria, this study uses an application of Luna® Sensation in May (7.6 fl. oz. /acre) and Ph-D® WDG in June (6.2 oz./acre). Finally, to prevent hull rot, an application of Quash® (3.5oz/acre) is made at hull-split (late June).

Vertebrate Pest. Poison bait is applied in the spring (March) by a mechanical applicator for gopher control. Ground squirrels are controlled by the use of anti-coagulant baits with above ground bait stations in the spring. Late winter fumigation for squirrels can be done when soil moisture is adequate; this cost is not included in this study.

Winter Sanitation. Winter sanitation destroys overwintering sites for navel orangeworm and should be done before bud swell. In January of the third year, the trees are hand poled by a custom operator. Starting in the fourth year and subsequent years, the mummy nuts are shaken from the trees and swept into the row middles by a custom operator. After the mechanical shaking, a crew hand poles the remaining mummy nuts off the trees. The mummy nuts are shredded by the grower using a flail mower.

Harvest. Mechanical harvesting and pickup by the grower begins in the third year. The nuts are removed from the trees by shaking, followed by a custom labor crew that hand poles the remaining nuts from the trees. Next, the nuts are swept into windrows by a sweeping machine. The grower provides hand labor to rake any missed nuts into the windrows. Next, a harvesting machine picks up the nuts and places them in a nut cart. Once filled, a tractor pulls the nut cart to the edge of the orchard. Using a conveyor, the nuts are loaded into trucks and hauled to the hulling and shelling facility. At the time of this study, the hulling and shelling facility charges for the processing, including the transport of nuts from the orchard to the processing facility. Some growers engage custom operators to conduct the entire harvesting process.

Yield/Returns. Almonds begin bearing an economic crop in the third year after planting. Typical annual yields for almonds are measured in meat (kernel) pounds per acre. Yields and returns are further discussed in the section below and estimated yields by year of production are shown in Table C.

Production Cultural Practices and Material Inputs

Pruning. Maintenance hand pruning for safety and equipment access is done in November in this study, but can be done anytime from harvest through the dormant period. Prunings are stacked in the row middles and shredded by a custom operator. Some growers elect to continue tying and roping up until year eight depending on previous training, variety and tree spacing, albeit this cost is not included in this study. Starting in the 8th year, the trees in every other row are trimmed via mechanical hedging (alternating rows each year). Some growers choose to top the trees starting the 18th year.

Fertilization. In the production years, UAN 32 is fertigated monthly from March – July. 10-34-0 is fertigated in February, April and June. K₂SO₄ is banded along the tree row in the winter in all years (50 percent of the potassium budget) and KTS is applied through the irrigation system with the nitrogen application. Fertilizer rates in this study are typical nutrient requirements, but do not take into account soil and water nutrients.

Zinc Nutrition/Fall Defoliation. Zinc chelate (10 percent) is applied at a rate of 1 quart per acre in mid-November to early December defoliate the tree to reduce the amount of inoculum for rust and shot hole and provide for foliar uptake to prevent zinc deficiency. This also allows for early pruning and provides secondary control for some diseases.

Sampling. Leaf samples are taken in April and July for nutrient analysis and the fertilizers are applied according to analysis recommendations. Leaf samples in this study are calculated at five per 100 acres. Hull samples for boron analysis are taken immediately prior to harvest at a rate of 2 samples per 100 acres. The samples are collected by the PCA and the cost is for the lab analysis.

In addition, soil samples are taken every other year, as such, 50 percent of the cost is reflected. Samples are taken a rate of four samples per 100 acres to determine salinity, pH and nutrient levels. The samples are taken at three depths (0-1ft, 1-3ft and 3-5ft), to allow for a complete soil profile, from multiple areas in the orchard with specified depths pooled for analysis. The grower uses an ATV to collect the samples, which is assumed to take one hour.

Irrigation. Irrigation costs include water pumping and labor costs, with irrigation labor provided as a separate line item. Water is pumped from a well to a reservoir and then through a filtration system into the double line drip system at a cost of \$22 per acre inch (\$264 per acre foot) for this study. A total of fifty-two acre-inches of water is applied to the orchard based on a 100 percent application efficiency from March to October. An application efficiency/uniformity assumption of 100 percent is often used as the scheduling criteria for most micro systems in the San Joaquin Valley. This assumption includes additional significant water allocations for salinity management. In this study, 10 acre inches are applied in early January to leach salt and refill the soil profile. No assumption is made about effective rainfall, evaporation, and runoff. Cost for frost protection is not included in this study.

Pollination. Two hives (8+ frames/hive) per acre are contracted for pollination and set in the orchard in February by the beekeeper prior to bloom. For this study, \$200 per hive is charged.

Pest Management. See Pest Management in the previous section.

Weeds. Beginning in the third year, a dormant strip spray of Matrix[®] and Gramoxone[®] is applied to the tree row in the fall (November). Each year, the row middles are mowed in March and August (before harvest) plus a chemical mow using Roundup[®] in April.

Insects. Each year in May, mites are controlled with an Agri-Mek[®] and 415 oil application with a second miticide application made at hull-split (July) using Zeal[®]. Ant bait (Clinch[®]) is broadcast for ant control in July. The trees are treated for navel orangeworm (NOW) with Intrepid[®] at hull split (late June), followed by a second spray in mid-July using Altacor[®].

Disease. The trees are treated for rust with an application of Quash[®] in March. Scab is treated with a delayed dormant copper spray in January followed by a second spray around five weeks after petal fall (late March to April) using Bravo WeatherStik[®]. An application of Vanguard[®]WG is made at late bloom (late February) for brown rot. Around two weeks after petal fall (Mid-March), Pristine[®] is applied to the trees for shot hole. As treatment for Alternaria, this study uses an application of Luna[®] Sensation in May and Ph-D[®] WDG in June. Finally, to prevent hull rot, an application of Quash[®] is made at hull-split (late June).

Vertebrate Pest. Poison bait is applied in the spring (March) by a mechanical applicator for gopher control. Ground squirrels are controlled by the use of anti-coagulant baits with above ground bait stations in the spring. Late winter fumigation for squirrels can be done when soil moisture is adequate; this cost is not included in this study.

Winter Sanitation. Winter sanitation destroys over wintering sites for navel orangeworm and should be done before bud swell. In this study, winter sanitation is completed in January. The mummy nuts are shaken from the trees and swept into the row middles. The remaining mummy nuts are hand poled off the trees at a cost of \$200 per acre. All mummy nuts are shredded with a flail mower. Winter sanitation operations except for the shredding are custom hired.

Harvest. In this study, the grower mechanically harvests the almond crop. The grower shakes the nuts from the trees. A custom labor crew hand poles the remaining nuts from the tree. The grower sweeps the nuts into a windrow and provides hand labor to rake any missed nuts into the windrow. A pick-up machine picks up the nuts and places them into a nut cart, which is then pulled to the edge of the orchard. The nuts are loaded and hauled to the huller/sheller for processing. Harvest begins in August for the early maturing varieties and continues into October for late maturing varieties.

Yields. Typical annual yields for almonds are measured in meat (kernel) pounds per acre and are shown in Table C. Yields will vary by location, grower, year, and age of orchard. For this study, it is assumed the orchard will average 3,000 pounds per acre over the production years of the orchard. A ranging analysis provided in Table 5 shows returns at yields ranging from 2,000lbs/acre to 3,900lbs/acre.

Returns. An estimated price of a \$2.25 per meat pound is assumed based on reported current returns. Prices will vary depending on market condition, almond variety and quality, among other factors. Table 5 has a range of prices used for calculating returns per acre at different yields, with prices ranging from \$1.00 to \$4.00.

Almond Hulls and By-Products. Almond by-products include hulls, shells, almond hash, huller dust, and press cakes, which all can be used as livestock feed. Wood from tree removal used for firewood or for composting could be another source of income. These potential sources of income are not included in this study.

Assessment. The Almond Board of California (ABC) assesses all almonds commercially grown in the state to pay for almond promotions and research. The mandatory assessment is paid by processors and is not reflected in grower costs.

Pickup/ATV. The study assumes business use mileage of 100 minutes per acre per year for the pickup. The ATV is charged at 50 minutes per acre per year. The ATV is used for spot spraying, pest management and monitoring the orchard/irrigation systems. Each vehicle is shown as a separate line item.

Labor, Equipment, and Interest

Labor. Hourly wages for workers are \$16.00 for machine operators and \$11.00 per hour non-machine labor. Adding 40 percent for the employer's share of federal and state payroll taxes, workers compensation insurance, for nut crops (0045) and other possible benefits gives the labor rates shown of \$22.40 and \$15.40 per hour for machine labor and non-machine labor, respectively. Workers' compensation costs will vary among growers, but for this study the cost is based upon the average industry final rate as of January 1, 2016. Labor for operations involving machinery are 20 percent higher than the operation time 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 and Biological Engineers (ASABE). Fuel and lubrication costs are also determined by ASABE equations based on maximum power takeoff (PTO) horsepower, and fuel type. Average prices for on-farm delivery of diesel and gasoline based on 2016 data from the Energy Information Administration are \$2.84 and \$2.76 per gallon, respectively. The cost includes a 9.25 percent sales tax, a \$0.13/gal excise tax on diesel fuel, an 8 percent sales tax, and a \$0.30/gal excise tax on gasoline. It is noted that federal and state excise taxes are refundable for on-farm use when filing the farm income tax return. The fuel, lube, and repair cost per acre for each operation is determined by multiplying the total hourly operating cost for each piece of equipment used for the selected operation by the hours per acre. Tractor time is 10 percent 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 4.75 percent per year. Interest charge is the cost of your money that is tied up in the production of a crop. It reflects the amount of money you pay on borrowed money (Line of Credit) or that amount you could have earned had you invested your own resources in alternative uses. The interest cost of post-harvest operations is discounted back to the last harvest month using a negative interest charge. The interest rate will vary depending upon various factors. The rate in this study is considered a typical lending rate by a farm lending agency as of August 2016.

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 of almond production. Because of so many potential risk factors, effective risk management must combine specific tactics in a detailed manner, in various combinations for a sustainable operation. Moreover, Table 5 of this study reflects a ranging analysis of returns based on various assumptions which is therefore hypothetical in nature. It is important to realize that actual results may differ from the returns contained in this study. Any returns above total costs are considered returns on risk and investment to management, (or owners).

Cash Overhead Costs

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.

Property Taxes. Counties charge a base property tax rate of 1 percent 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 percent of the average value of the property.

Insurance. Insurance for farm investments varies depending on the assets included and the amount of coverage.

Property Insurance. This provides coverage for property loss and is charged at 0.843 percent of the average value of the assets over their useful life.

Liability Insurance. A standard farm liability insurance policy will help cover the expenses for which you become legally obligated to pay for bodily injury claims on your property and damages to another person's property as a result of a covered accident. Common liability expenses covered under your policy include attorney fees and court costs, medical expenses for people injured on your property, injury or damage to another's property. In this study, \$792 is charged and covers the entire farm.

Crop Insurance. This is available to almond growers for any unavoidable loss of production, damage or poor quality resulting from adverse weather conditions such as cool wet weather, freeze, frost, hail, heat, rain, wind and damage from birds, drought, earthquakes and fire. Coverage levels are from 50-85 percent of the approved average yield as established by verifiable production records from the orchard. Actual insurance coverage is by unit, not by acre. A significant number of growers purchase crop insurance in this region. Due to variability in coverages no level is specified in this study.

Office Expense. Office and business expenses are estimated at \$60 per acre. These expenses include office supplies, telephones, bookkeeping, accounting, utilities, and miscellaneous administrative charges.

Environmental/Regulatory Costs. Various environmental fees are collected by the county and state. The fees will vary by county. For example, there are fees assessed by the Air Resources Board (state agency) regulating air pollution, a Water Coalition Fee (local coalition) for water discharges, and a hazardous material storage fee (local coalition). The grower must also provide safety training, safety equipment and maintain training records. For this study, a cost of \$10 per acre is assumed.

Sanitation Services. Sanitation services provide trailer mounted, double portable toilets and washbasins for the orchard and cost the farm \$200 per month for four months. The cost includes delivery and weekly service.

Management Salaries. The grower farms the orchard; therefore, no salaries are included for management. Returns above costs are considered a return to management.

Investment Repairs. Annual maintenance is calculated as two percent of the purchase price. The average tree replacement cost over the life of the orchard is assumed to be 0.50 percent of the establishment cost or \$4,036 (~\$40 per acre) per year.

Non-Cash Overhead Costs

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 prices and salvage values (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 the tables below.

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 3.75 percent is used to calculate capital recovery. The rate will vary depending upon size of loan and other lending agency conditions, but is a suggested rate by a farm lending agency in August 2016.

Irrigation System. The pump and well cost is based on one 125 horsepower pump lifting from a water level depth of 400 feet into a reservoir. The reservoir, the pump and a 1,000-foot deep well already existed on the site. The cost of the irrigation system includes a 40 horsepower pump to pump from the reservoir into the double line drip system, the cost of installation of the lateral lines and emitters.

The life of the irrigation system is estimated to be 25 years. The irrigation system is considered an improvement and is shown in the non-cash overhead sections and the investment portion of the tables. A bi-annual pump test is performed in December or January to monitor pumping level and efficiency (gallons/minute) at a cost of \$200 for the test. In this study, the cost of the pump test is applied at a 50 percent rate to the total acreage of the orchard during the production years.

Land. Cropland with irrigation availability previously planted to almonds is valued at \$25,000 per acre. Established almond orchards range in value from \$30,000 to \$40,000 per acre in this region, which varies by irrigation availability, age of trees, average yields, soil quality and various other factors. For this study, the cost of producing acreage of a three year old established orchard is estimated at \$33,000 per acre. It is the crop land value plus the Establishment Cost for a three years of an almond orchard in the southern San Joaquin Valley, $(\$25,000 + \sim 8,000 = \$33,000)$.

Establishment Cost. Establishment cost is the sum of the costs for land preparation, planting, trees, cash overhead and production expenses for growing the trees through the first three years minus any returns from production. Costs to establish the orchard are included in non-cash overhead expenses and capital recovery costs for the production years. For this study, the total accumulated net cash cost for through the third year represents the establishment cost and is estimated at \$8,072 per planted acre. The cost is amortized over the remaining 20 years of orchard production to estimate the annual capital recovery cost.

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 percent to indicate a mix of new and used equipment. Annual ownership costs for equipment and other investments are shown in the Whole Farm Annual Equipment, Investment, and Business Overhead Costs table. 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.

Tree Replacement. One or more trees per acre may die each year and are replaced in late winter. Costs in this study are basic costs that will vary with each orchard and type of tree loss. Tree replacement is included in investment repairs under Cash Overhead.

Pole Barn. A 1,500 sf shop and pole barn is used for equipment and tool storage. The building is located on the grower owned land.

Tools. This includes shop tools and equipment, hand tools, and miscellaneous field tools.

Fuel Tanks. Two 500-gallon fuel tanks using gravity feed are on metal stands. The tanks are setup in a cement containment pad that meets federal, state, and county regulations.

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

REFERENCES

- American Society of Agricultural and Biological Engineers (ASABE). *2013 ASABE Standards Book with 2015 Standards Supplement*. St. Joseph, MI: Curran Associates, Inc., 2015.
- Boehlje, Michael D., and Vernon R. Eidman. *Farm Management*. New York: John Wiley and Sons, 1984.
- California Chapter of the American Society of Farm Managers and Rural Appraisers. *Trends in Agricultural Land & Lease Values*. Woodbridge, CA: American Society of Farm Managers and Rural Appraisers, 2016. <http://www.calasfmra.com>
- "Cost and Return Studies." University of California Davis Agricultural and Resource Economics. <http://coststudies.ucdavis.edu/>.
- Duncan, Roger A. Brent A. Holtz., David A. Doll, Karen Klonsky, Daniel A. Sumner, Christine A. Gutierrez and Donald Stewart. 2016. *Sample Cost to Establish an Almond Orchard and Produce Almonds, Northern San Joaquin Valley*. University of California Cooperative Extension. Department of Agricultural and Resource Economics. Davis, CA.
- "Economic Research Service - Publications." United States Department of Agriculture. www.ers.usda.gov/data-products.aspx.
- Freeman, Mark A., Mario A Viveros, Karen M. Klonsky, and Richard L. De Moura. *Sample Costs to Establish an Almond Orchard and Produce Almonds, San Joaquin Valley South*. 2008. University of California Cooperative Extension. Department of Agricultural and resource Economics. Davis, CA.
- "How to Reduce Bee Poisonings from Pesticides." Oregon State University. <https://catalog.extension.oregonstate.edu/pnw591>.
- "National Agricultural Statistics Service." United States Department of Agriculture. www.nass.usda.gov/Quick_Stats/.
- "Tax Rates for Motor Vehicle and Diesel Fuels." California State Board of Equalization. Last modified May 2015. <http://www.boe.ca.gov/pdf/l413.pdf>.
- "UC IPM Pest Management Guidelines- Almond". University of California Agriculture and Natural Resources Publication 3431. <http://ipm.ucanr.edu/PMG/selectnewpest.almonds.html>.
- "University of California Integrated Pest Management for Almonds." Second edition. University of California Agriculture and Natural Resources 3308. <http://anrcatalog.ucanr.edu/>
- "U.S. Gasoline and Diesel Retail Prices." U.S. Energy Information Administration (EIA). https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_m.htm.
- "Workers' Compensation Rate Comparison." California Department of Insurance. <http://www.insurance.ca.gov/01-consumers/105-type/9-compare-prem/wc-rate/index.cfm>

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
Table 1. COSTS PER ACRE TO ESTABLISH AN ALMOND ORCHARD
 SAN JOAQUIN VALLEY- SOUTH - 2016

Year:	Cost per Acre				
	1st	2nd	3rd	4th	5th
Meat Pounds Per Acre @\$2.25/lbs.			600	1200	2400
Pre-Plant:					
Land Prep: Tree Removal (50%)	375				
Land Prep: Root Removal (50%)	100				
Land Prep: Disk & Roll (2x)	50				
Land Prep: Fumigate Tree Row	1,040				
Land Prep: Berms	30				
Land Prep: Smooth Middles	30				
Land Prep: Soil Analysis	2				
TOTAL PRE-PLANT COSTS	1,628				
Plant:					
Planting Costs including Trees, Layout, Trim/Stake/Wrap	1,370				
TOTAL PLANTING COSTS	1,370				
Cultural:					
Pruning: Train & Sucker	310	310	310		
Pruning: Shred Pruning			13	25	25
Pruning: Tree Tying		62		124	
Pruning: Maintenance (Hand)				120	120
Pollination			100	200	400
Irrigation: Profile Refill & Salt Leaching	240	240	240	240	240
Irrigate (Mar - Oct)	120	384	624	1,128	1,248
Irrigation: Pump Test (every other year) /Water Analysis (all years)	5	1	5	1	5
Fertilize- CAN17 & KTS (2x)	15	20			
Fertilize- UAN32 & KTS (3x in Yrs. 1 & 2, 5x in Yrs. 3+)	13	18	53	88	164
Fertilize- K2SO4	23	23	23	34	61
Fertilize- 10-34-0 (3x)	93	93	93	93	93
Fertilize- Soil Analysis			2		2
Fertilize- Leaf Analysis			1	1	1
Fertilize- Hull Analysis			1	1	1
Fertilize- Fall Defoliation (Zn)			12	12	12
Weeds- Strip Spray	37	21	17	17	17
Weeds- Spot Spray		9			
Weeds- Mow Middles (2x)	8	8	8	8	8
Weeds- Chemical Mow	8	8	8	8	8
Pests- Insects – Mites (2x)	31	31	92	92	92
Pests- Insects – PTB	36	34			
Pests- Insects – NOW (2x)			87	87	87
Pests- Insects - Ants			18	18	18
Pests- Disease- Scab/Rust (2x)	47	47	80	80	80
Pests- Disease- Brown Rot			63	63	63
Pests- Disease- Shot Hole			69	69	69
Pests- Disease- Alternaria (2x)			134	135	135
Pests- Disease- Hull Rot			53	53	53
Pests- Gophers	5	5	5	5	5
Pests- Squirrels	13	12	12	12	12
Winter Sanitation			58	142	192
PCA Fee	20	20	20	35	35
Pickup	62	62	62	62	62
ATV	24	24	24	24	24
TOTAL CULTURAL COSTS	1,109	1,431	2,287	2,976	3,332

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER

Table 1. CONTINUED
SAN JOAQUIN VALLEY – SOUTH -2016

Year	Cost per Acre				
	1st	2nd	3rd	4th	5th
Meat Pounds Per Acre @\$2.25/lbs.			600	1200	2400
Harvest:					
Pole Nuts			50	100	150
Shake Trees			11	11	11
Sweep & Rake Nuts			8	9	13
Pickup Nuts			22	22	31
Hull & Shell Nuts			30	60	120
TOTAL HARVEST COSTS			121	202	326
Interest On Operating Capital @ 4.75%	150	36	61	75	85
TOTAL OPERATING COSTS/ACRE	4,257	1,468	2,469	3,254	3,743
Cash Overhead					
Liability Insurance	8	8	8	8	8
Office Expense	60	60	60	60	60
Sanitation Fees	8	8	8	8	8
Environmental Fee	10	10	10	10	10
Property Taxes	262	262	264	304	304
Property Insurance	22	22	22	26	26
Investment Repairs	39	39	39	79	79
TOTAL CASH OVERHEAD COSTS	409	409	411	495	495
TOTAL CASH COSTS/ACRE	4,666	1,876	2,880	3,749	4,238
INCOME/ACRE FROM PRODUCTION			1,350	2,700	5,400
NET CASH COSTS/ACRE FOR THE YEAR	4,666	1,876	1,530	1,049	
PROFIT/ACRE ABOVE CASH COSTS					1,162
ACCUMULATED NET CASH COSTS/ACRE	4,666	6,542	8,072	9,121	7,959
NON-CASH OVERHEAD:					
Pole Barn 1,500 sq. ft.	12	12	12	12	12
Fuel Tanks 2- 500 Gal	4	4	4	4	4
Shop/Field Tools	7	7	7	7	7
Irrigation System- Double Line Drip	112	112	112	112	112
Land	938	938	938	938	938
Establishment Costs				581	581
Equipment	21	21	61	61	63
TOTAL NON-CASH OVERHEAD COST/ACRE	1,094	1,094	1,134	1,714	1,716
TOTAL COST/ACRE FOR THE YEAR	5,759	2,970	4,014	5,463	5,955
INCOME/ACRE FROM PRODUCTION			1,350	2,700	5,400
TOTAL NET COST/ACRE FOR THE YEAR	5,759	2,970	2,664	2,763	555
NET PROFIT/ACRE ABOVE TOTAL COSTS					
TOTAL ACCUMULATED NET COST/ACRE	5,759	8,729	11,393	14,156	14,711

UC COOPERATIVE EXTENSION-AGRICULTURAL ISSUES CENTER
Table 2. COSTS PER ACRE TO PRODUCE ALMONDS
 SAN JOAQUIN VALLEY – SOUTH - 2016

Operation	Equipment Time (Hrs./A)	Cash and Labor Costs per Acre					Total Cost	Your Cost
		Labor Cost	Fuel	Lube & Repairs	Material Cost	Custom/ Rent		
Cultural:								
Pruning: Hand Pruning	0.00	0	0	0	0	120	120	
Pruning: Shred Prunings	0.00	0	0	0	0	25	25	
Pollination	0.00	0	0	0	0	400	400	
Pests - Disease - Scab/Rust 2x	0.41	11	5	3	61	0	80	
Pests - Disease - Brown Rot	0.21	6	3	2	53	0	63	
Pests - Disease - Shot Hole	0.21	6	3	2	59	0	69	
Pests - Disease - Alternaria 2x	0.41	11	5	3	115	0	135	
Pests - Disease - Hull Rot	0.21	6	3	2	43	0	53	
Pests - Insects - Mites 2x	0.41	11	5	3	72	0	92	
Pests - Insects - NOW 2x	0.41	11	5	3	67	0	87	
Pests - Insects - Ants	0.19	5	0	0	13	0	18	
Pests - Gophers	0.11	3	1	0	2	0	5	
Pests - Squirrels	0.08	2	0	0	9	0	12	
Irrigation: Profile Refill & Salt Leaching	0.00	20	0	0	220	0	240	
Irrigate	0.00	104	0	0	1,144	0	1,248	
Irrigation: Pump Test (50%)	0.00	0	0	0	1	0	1	
Irrigation: Water Analysis	0.00	0	0	0	1	0	1	
Weeds: Mow Middles (2x)	0.31	8	4	3	0	0	15	
Weeds: Strip Spray	0.13	4	0	0	13	0	17	
Weeds: Chemical Mow	0.13	4	0	0	4	0	8	
Fertilize: Soil Analysis (50%)	0.01	0	0	0	1	0	1	
Fertilize: Leaf Analysis (2x)	0.00	0	0	0	1	0	1	
Fertilize: Hull Analysis	0.00	0	0	0	0	0	0	
Fertilize: UAN32 & KTS (5x)	0.00	0	0	0	236	0	236	
Fertilize: K2SO4	0.15	4	1	1	110	0	116	
Fertilize: 10-34-0 (3x)	0.00	0	0	0	125	0	125	
Fertilize: Fall Defoliation (Zn)	0.21	6	3	2	2	0	12	
Winter Sanitation	0.15	4	2	2	0	230	238	
PCA Fee	0.00	0	0	0	0	35	35	
Pickup	1.67	45	12	5	0	0	62	
ATV	0.83	22	1	1	0	0	24	
TOTAL CULTURAL COSTS	6.24	292	53	34	2,352	810	3,540	
Harvest:								
Harvest: Shake Trees	0.25	7	3	1	0	0	11	
Harvest: Pole Nuts	0.00	0	0	0	0	200	200	
Harvest: Sweep & Rake Nuts	0.14	15	1	0	0	0	17	
Harvest: Pick-up Nuts	0.75	20	7	4	0	0	31	
Harvest: Hull & Shell Nuts	0.25	11	1	0	0	150	161	
TOTAL HARVEST COSTS	1.39	53	12	6	0	350	421	
Interest on Operating Capital at 4.75%							66	
TOTAL OPERATING COSTS/ACRE	7.63	345	65	40	2,352	1,160	4,027	

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
Table 2. CONTINUED
 SAN JOAQUIN VALLEY – SOUTH - 2016

Operation	Cash and Labor Costs per Acre					Total Cost	Your Cost
	Labor Cost	Fuel	Lube & Repairs	Material Cost	Custom/Rent		
CASH OVERHEAD:							
Environmental Fees						10	
Liability Insurance						8	
Office Expense						60	
Sanitation Fee						8	
Property Taxes						305	
Property Insurance						26	
Investment Repairs						80	
TOTAL CASH OVERHEAD COSTS/ACRE						496	
TOTAL CASH COSTS/ACRE						4,522	
NON-CASH OVERHEAD:							
	Per Producing Acre		Annual Cost				
			Capital Recovery				
Pole Barn 1500sf	171		12			12	
Fuel Tanks 2-500 Gal	52		4			4	
Tools	95		7			7	
Irrigation System Double Line Drip	1,800		112			112	
Land	25,000		938			938	
Establishment Costs	8,072		581			581	
Equipment	644		65			65	
TOTAL NON-CASH OVERHEAD COSTS	35,835		1,719			1,719	
TOTAL COSTS/ACRE						6,241	

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
TABLE 3. COSTS AND RETURNS PER ACRE TO PRODUCE ALMONDS
 SAN JOAQUIN VALLEY – SOUTH – 2016

	Quantity / Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Almonds- Production Years	3,000	Lb.	2.25	6,750	
TOTAL GROSS RETURNS	3,000	Lb.		6,750	
OPERATING COSTS					
Herbicide:					17
Matrix®	1.50	Oz	6.37	10	
Gramoxone®	3.00	Pint	1.15	3	
Roundup®	1.40	Pint	2.75	4	
Fungicide:					331
Liquid Copper Spray	2.00	FL Oz	0.87	2	
Bravo®	4.00	Pint	4.00	16	
Quash®	7.00	FL Oz	12.22	86	
Vanguard®	10.00	Oz	5.34	53	
Pristine®	14.50	FL Oz	4.08	59	
Luna Sensation®	14.00	FL Oz	4.80	67	
PH-D®	6.50	Oz	7.34	48	
Insecticide:					152
Agri-Mek®	20.00	FL Oz	0.70	14	
415 Oil Spray	1.00	Gal	7.00	7	
Zeal®	3.00	Oz	17.00	51	
Intrepid®	1.00	Pint	21.93	22	
Altacor®	4.00	FL Oz	11.25	45	
Clinch®	1.00	Lb.	12.74	13	
Rodenticide:					11
Gopher Poison Bait	0.20	Lb.	7.71	2	
Vertebrate Pest Bait	0.50	Lb.	1.92	1	
Bait Stations	1.00	Each	8.50	9	
Custom:					1,160
Pruning (Hand) and Stacking	1.00	Acre	120.00	120	
Shredding	1.00	Acre	25.00	25	
Pollination Fee	2.00	Hive	200.00	400	
Hand Poling	8.00	Acre	50.00	400	
Hull/Shell Nuts	3000.00	Lb.	0.05	150	
Winter Sanitation- Shake & Sweep	1.00	Acre	30.00	30	
PCA/CCA Fee (Prod Yrs.)	1.00	Acre	35.00	35	
Irrigation:					1,366
Water - Pumped	62.00	Ac In	22.00	1,364	
Irrigation Pump Test (50%)	0.01	Each	200.00	1	
Water Analysis	0.02	Each	50.00	1	
Fertilizer:					473
UAN32 (32-0-0)	200.00	Lb. N	0.58	116	
KTS (0-0-25) 25% w/17% Sulfur	400.00	Lb.	0.30	120	
Potassium Sulfate-K2SO4 50%	200.00	Lb.	0.55	110	
10-34-0 (Ammonium Phosphate)	117.66	Lb.	1.06	125	
Zinc Chelate 10%	1.00	Qt	2.24	2	
Analysis:					3
Soil Analysis incl. Salinity	0.01	Each	225.00	1	
Leaf Analysis	0.05	Each	20.00	1	
Hull Analysis	0.02	Each	20.00	0	
Labor					345
Equipment Operator Labor	9.16	Hrs.	22.40	205	
Irrigation Labor	8.07	Hrs.	15.40	124	
Non-Machine Labor	1.00	Hrs.	15.40	15	
Machinery					105
Fuel-Gas	0.77	gal	2.76	2	
Fuel-Diesel	22.07	gal	2.84	63	
Lube				10	
Machinery Repair				30	
Interest on Operating Capital @ 4.75%				66	
TOTAL OPERATING COSTS/ACRE				4,027	
TOTAL OPERATING COSTS/LB				1	
NET RETURNS ABOVE OPERATING COSTS				2,723	

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
Table 3. CONTINUED
SAN JOAQUIN VALLEY – SOUTH – 2016

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
CASH OVERHEAD COSTS					
Environmental/Safety Training				10	
Liability Insurance				8	
Office Expense				60	
Sanitation Fee				8	
Property Taxes				305	
Property Insurance				26	
Investment Repairs				80	
TOTAL CASH OVERHEAD COSTS/ACRE				496	
TOTAL CASH OVERHEAD COSTS/LB				0	
TOTAL CASH COSTS/ACRE				4,522	
TOTAL CASH COSTS/LB				2	
NET RETURNS ABOVE CASH COSTS				2,228	
NON-CASH OVERHEAD COSTS (Capital Recovery)					
Pole Barn 1500sf				12	
Fuel Tanks 2-500 Gal				4	
Tools				7	
Irrigation System Double Line Drip				112	
Land				938	
Establishment Costs				581	
Equipment				65	
TOTAL NON-CASH OVERHEAD COSTS/ACRE				1,719	
TOTAL NON-CASH OVERHEAD COSTS/LB				1	
TOTAL COST/ACRE				6,241	
TOTAL COST/LB				2	
NET RETURNS ABOVE TOTAL COST				509	

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
Table 4. MONTHLY CASH COSTS PER ACRE TO PRODUCE ALMONDS
 SAN JOAQUIN VALLEY - SOUTH 2016

Beginning JAN 16 Ending DEC 16	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Cultural:													
Pruning: Hand Pruning											120		120
Pruning: Shred Prunings											25		25
Pollination		400											400
Pests – Disease -Scab/Rust 2x	12		69										80
Pests – Disease - Brown Rot		63											63
Pests – Disease - Shot Hole			69										69
Pests – Disease - Alternaria 2x					77	58							135
Pests – Disease - Hull Rot							53						53
Pests – Insects - Mites 2x					31		61						92
Pests – Insects - NOW 2x						32	55						87
Pests – Insects Ants							18						18
Pests – Gophers			5										5
Pests – Squirrels			12										12
Irrigation: Refill Profile & Salt Leaching	240												240
Irrigate			54	108	156	204	246	216	162	102			1,248
Irrigation: Pump Test (50%)	1												1
Irrigation: Water Analysis	1												1
Weeds: Mow Middles (2x)			8					8					15
Weeds: Strip Spray										17			17
Weeds: Chemical Mow				8									8
Fertilize: Soil Analysis (50%)	1												1
Fertilize: Leaf Analysis (2x)				1			0						1
Fertilize: Hull Analysis								0					0
Fertilize: UAN32 & KTS (5x)			47	47	47	47	47						236
Fertilize: K2SO4												116	116
Fertilize: 10-34-0 (3x)		42		42		42							125
Fertilize: Fall Defoliation (Zn)											12		12
Winter Sanitation	238												238
PCA Fee											35		35
Pickup	5	5	5	5	5	5	5	5	5	5	5	5	62
ATV	2	2	2	2	2	2	2	2	2	2	2	2	24
TOTAL CULTURAL COSTS	500	512	271	213	318	442	435	231	169	109	216	123	3,540
Harvest:													
Harvest: Shake Trees													
Harvest: Pole Nuts									200				200
Harvest: Sweep & Rake Nuts									17				17
Harvest: Pick-up Nuts									31				31
Harvest: Hull & Shell Nuts									161				161
TOTAL HARVEST COSTS	0	0	0	0	0	0	0	0	421	0	0	0	421
Interest on Operating Capital @ 4.75%	2	4	5	6	7	9	11	12	14	-2	-1	0	66
TOTAL OPERATING COSTS/ACRE	502	516	276	218	326	451	445	243	604	107	215	123	4,027
Environmental/Safety Training									10				10
Liability Insurance			8										8
Office Expense	5	5	5	5	5	5	5	5	5	5	5	5	60
Sanitation Fee									8				8
Property Taxes		152							152				305
Property Insurance		13							13				26
Investment Repairs	7	7	7	7	7	7	7	7	7	7	7	7	80
TOTAL CASH OVERHEAD COSTS	12	177	19	12	12	12	12	12	195	12	12	12	496
TOTAL CASH COSTS/ACRE	513	693	295	230	337	463	457	254	799	119	227	134	4,522

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
TABLE 5. RANGING ANALYSIS
 SAN JOAQUIN VALLEY – SOUTH – 2016

COSTS PER ACRE AND PER LB AT VARYING YIELDS TO PRODUCE ALMOND

	YIELD (lbs. /acre)						
	2,000	2,300	2,600	3,000	3,300	3,600	3,900
OPERATING COSTS/ACRE:							
Cultural	3,540	3,540	3,540	3,540	3,540	3,540	3,540
Harvest	366	382	399	421	438	454	471
Interest on Operating Capital @ 4.75%	65	65	66	66	66	66	66
TOTAL OPERATING COSTS/ACRE	3,971	3,988	4,005	4,027	4,043	4,060	4,077
TOTAL OPERATING COSTS/LB	1.99	1.73	1.54	1.34	1.23	1.13	1.05
CASH OVERHEAD COSTS/ACRE	496	496	496	496	496	496	496
TOTAL CASH COSTS/ACRE	4,467	4,483	4,500	4,522	4,539	4,555	4,572
TOTAL CASH COSTS/LB	2.23	1.95	1.73	1.51	1.38	1.27	1.17
NON-CASH OVERHEAD COSTS/ACRE	1,719	1,719	1,719	1,719	1,719	1,719	1,719
TOTAL COSTS/ACRE	6,185	6,202	6,219	6,241	6,257	6,274	6,291
TOTAL COSTS/LB	3.09	2.70	2.39	2.08	1.90	1.74	1.61

Net Return per Acre above Operating Costs for Almond

PRICE (\$/lb.)	YIELD (lb./acre)						
	2,000	2,300	2,600	3,000	3,300	3,600	3,900
Almonds							
1.00	-1,971	-1,688	-1,405	-1,027	-743	-460	-177
1.50	-971	-538	-105	473	907	1,340	1,773
2.00	29	612	1,195	1,973	2,557	3,140	3,723
2.50	1,029	1,762	2,495	3,473	4,207	4,940	5,673
3.00	2,029	2,912	3,795	4,973	5,857	6,740	7,623
3.50	3,029	4,062	5,095	6,473	7,507	8,540	9,573
4.00	4,029	5,212	6,395	7,973	9,157	10,340	11,523

Net Return per Acre above Cash Costs for Almond

PRICE (\$/lb.)	YIELD (lb./acre)						
	2,000	2,300	2,600	3,000	3,300	3,600	3,900
Almonds							
1.00	-2,467	-2,183	-1,900	-1,522	-1,239	-955	-672
1.50	-1,467	-1,033	-600	-22	411	845	1,278
2.00	-467	117	700	1,478	2,061	2,645	3,228
2.50	533	1,267	2,000	2,978	3,711	4,445	5,178
3.00	1,533	2,417	3,300	4,478	5,361	6,245	7,128
3.50	2,533	3,567	4,600	5,978	7,011	8,045	9,078
4.00	3,533	4,717	5,900	7,478	8,661	9,845	11,028

Net Return per Acre above Total Costs for Almond

PRICE (\$/lb.)	YIELD (lb./acre)						
	2,000	2,300	2,600	3,000	3,300	3,600	3,900
Almonds							
1.00	<u>-4,185</u>	<u>-3,902</u>	<u>-3,619</u>	<u>-3,241</u>	<u>-2,957</u>	<u>-2,674</u>	<u>-2,391</u>
1.50	<u>-3,185</u>	<u>-2,752</u>	<u>-2,319</u>	<u>-1,741</u>	<u>-1,307</u>	<u>-874</u>	<u>-441</u>
2.00	<u>-2,185</u>	<u>-1,602</u>	<u>-1,019</u>	<u>-241</u>	343	926	1,509
2.50	<u>-1,185</u>	<u>-452</u>	281	1,259	1,993	2,726	3,459
3.00	<u>-185</u>	698	1,581	2,759	3,643	4,526	5,409
3.50	815	1,848	2,881	4,259	5,293	6,326	7,359
4.00	1,815	2,998	4,181	5,759	6,943	8,126	9,309

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**TABLE 6. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS
SAN JOAQUIN VALLEY – SOUTH - 2016**

ANNUAL EQUIPMENT COSTS								
Yr.	Description	Price	Yrs. Life	Salvage Value	Capital Recovery	Cash Overhead		Total
						Insurance	Taxes	
16	Air-Blast PTO 500Gal	25,000	5	8,143	4,065	14	166	4,245
16	ATV-4WD	8,500	10	2,511	823	5	55	883
16	Fertilizer Applicator PTO	15,000	10	2,653	1,603	7	88	1,699
16	Pickup Truck 1/2 Ton	28,000	5	12,549	3,917	17	203	4,137
16	85HP4WD Low-Profile Tractor	68,100	15	13,258	5,344	34	407	5,785
16	34HP4WD Tractor	29,452	12	7,363	2,596	16	184	2,795
16	ATV Sprayer System 100 Gal	5,646	10	998	603	3	33	639
16	ATV Mounted Spot Sprayer	200	5	69	32	0	1	33
16	Bait Applicator	2,473	10	437	264	1	15	280
16	Flail Mower 11'	12,803	10	2,264	1,368	6	75	1,450
16	Tree Shaker-Side Bullet	125,000	15	12,001	10,436	58	685	11,179
16	Nut Sweeper/Blower	78,000	15	7,489	6,512	36	427	6,976
16	Nut Pickup Machine	150,000	15	14,401	12,524	69	822	13,415
16	Nut Elevator	25,000	20	1,303	1,754	11	132	1,897
16	Nut Kart #1	20,000	20	1,042	1,403	9	105	1,517
16	Nut Kart #2	20,000	20	1,042	1,403	9	105	1,517
TOTAL		613,174	-	87,525	54,649	295	3,503	58,448
60% of New Cost*		367,904	-	52,515	32,789	177	2,102	35,069

*Used to reflect a mix of new and used equipment

ANNUAL INVESTMENT COSTS								
Description	Price	Yrs. Life	Salvage Value	Capital Recovery	Cash Overhead			Total
					Insurance	Taxes	Repairs	
INVESTMENT								
Pole Barn 1500sf	18,000	20	0	1,295	8	90	36	1,429
Fuel Tanks 2-500 Gal	5,489	20	0	395	2	27	110	535
Tools	10,000	20	0	720	4	50	200	974
Irrigation System	180,000	25	0	11,220	76	900	3,600	15,796
Land	2,500,000	25	2,500,000	93,750	2,108	25,000	0	120,858
Establishment Costs	807,200	20	0	58,088	340	4,036	4,036	66,500
TOTAL INVESTMENT	3,520,689	--	2,500,000	165,467	2,538	30,103	7,982	206,091

ANNUAL BUSINESS OVERHEAD COSTS				
Description	Units/	Unit	Price/	Total
	Farm		Unit	Cost
Environmental/Safety Training	100	Acre	10.00	1,000
Liability Insurance	105	Acre	7.54	792
Office Expense	105	Acre	60.00	6,300
Sanitation Fee	100	Acre	8.00	800

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TABLE 7. HOURLY EQUIPMENT COSTS
 SAN JOAQUIN VALLEY – SOUTH - 2016

COSTS PER HOUR										
Yr.	Description	Almond Hours Used	Total Hours Used	Cash Overhead			Operating			Total Costs/Hr.
				Capital Recovery	Insurance	Taxes	Lube & Repairs	Fuel	Total Operating	
16	Air-Blast PTO 500Gal	246	400	6.10	0.02	0.25	4.45	0.00	4.45	10.82
16	ATV-4WD	138	200	2.47	0.01	0.17	0.78	1.03	1.82	4.47
16	Fertilizer Applicator PTO	15	120	8.01	0.04	0.44	5.85	0.00	5.85	14.34
16	Pickup Truck 1/2 Ton	167	400	5.88	0.03	0.30	3.16	7.10	10.26	16.47
16	85HP4WD Low-Profile Tractor	349	1066	3.01	0.02	0.23	3.56	11.85	15.41	18.67
16	34HP4WD Tractor	56	1000	1.56	0.01	0.11	2.09	4.74	6.83	8.51
16	ATV Sprayer System 100 Gal	27	150	2.41	0.01	0.13	1.53	0.00	1.53	4.09
16	ATV Mounted Spot Sprayer	19	100	0.19	0.00	0.01	0.00	0.00	0.00	0.20
16	Bait Applicator	11	120	1.32	0.01	0.07	0.96	0.00	0.96	2.36
16	Flail Mower 11'	46	200	4.10	0.02	0.23	6.35	0.00	6.35	10.70
16	Tree Shaker-Side Bullet	28	250	25.05	0.14	1.64	4.13	11.36	15.49	42.32
16	Nut Sweeper/Blower	16	250	15.63	0.09	1.03	2.79	8.52	11.31	28.05
16	Nut Pickup Machine	28	250	30.06	0.17	1.97	4.19	8.52	12.71	44.91
16	Nut Elevator	25	250	4.21	0.03	0.32	0.95	2.76	3.71	8.26
16	Nut Kart #1	25	150	5.61	0.04	0.42	3.02	0.00	3.02	9.09
16	Nut Kart #2	25	150	5.61	0.04	0.42	3.02	0.00	3.02	9.09

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
TABLE 8. OPERATIONS WITH EQUIPMENT & MATERIALS
 SAN JOAQUIN VALLEY – SOUTH - 2016

Operation	Month	Tractor & Implement	Labor Type/ Materials	Rate/ acre	Unit
Pruning: Hand Pruning	Nov		Pruning (Hand) and Stacking	1.00	Acre
Pruning: Shred Pruning	Nov		Shredding	1.00	Acre
Pollination	Feb		Pollination Fee	2.00	Hive
Pests – Disease - Scab/Rust	Jan	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Liquid Copper Spray	2.00	FL Oz
	Mar	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Bravo-Weatherstik	4.00	Pint
			Quash	3.50	FL Oz
Pests – Disease – Brown Rot	Feb	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Vanguard WG	10.00	Oz
Pests – Disease – Shot Hole	Mar	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Pristine	14.50	FL Oz
Pests – Disease - Alternaria	May	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Luna Sensation	14.00	FL Oz
	June	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	PH-D WDG	6.50	Oz
Pests – Disease – Hull Rot	June	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Quash	3.50	FL Oz
Pests - Insects - Mites	May	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air Blast PTO 500 Gal. Tractor	Agri-Mek 0.15EC	20.00	FL Oz
	July	85HP4WD Low-Profile Tractor	415 Oil Spray	1.00	Gal
		Air Blast PTO 500 Gal. Tractor	Equipment Operator Labor	0.25	hour
Pests – Insects -NOW (2x)	June	85HP4WD Low-Profile Tractor	Zeal	3.00	Oz
		Air Blast PTO 500 Gal. Tractor	Equipment Operator Labor	0.25	hour
	July	85HP4WD Low-Profile Tractor	Intrepid 2F	1.00	Pint
		Air Blast PTO 500 Gal. Tractor	Equipment Operator Labor	0.25	hour
Pests – Insects - Ants	July	ATV-4WD	Altacor	4.00	FL Oz
		ATV Mounted Spot Sprayer	Equipment Operator Labor	0.23	hour
Pests - Gophers	Mar	34HP4WD Tractor	Clinch	1.00	Lb.
		Bait Applicator	Equipment Operator Labor	0.13	hour
Pests - Squirrels	Mar	ATV-4WD	Gopher Poison Bait	0.20	Lb.
			Equipment Operator Labor	0.10	hour
Irrigation: Refill Profile & Salt Leaching Irrigate	Jan		Vertebrate Pest Bait	0.50	Lb.
			Bait Stations	1.00	Each
	Jan		Irrigation Labor	1.30	hours
			Water-Pumped	10.00	Ac In
	Mar		Irrigation Labor	0.29	hour
			Water-Pumped	2.25	Ac In
	Apr		Irrigation Labor	0.59	hour
			Water-Pumped	4.50	Ac In
	May		Irrigation Labor	0.85	hour
			Water-Pumped	6.50	Ac In
	June		Irrigation Labor	1.11	hours
			Water-Pumped	8.50	Ac In
	July		Irrigation Labor	1.33	hours
			Water-Pumped	10.25	Ac In
	Aug		Irrigation Labor	1.17	hours
		Water-Pumped	9.00	Ac In	
Sept		Irrigation Labor	0.88	hour	
		Water-Pumped	6.75	Ac In	
Oct		Irrigation Labor	0.55	hour	
		Water-Pumped	4.25	Ac In	
Irrigation: Pump Test	Jan		Irrigation Pump Test	0.01	Each
Irrigation: Water Analysis	Jan		Water Analysis	0.02	Each
Weeds: Mow Middles (2x)	Mar	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.18	hour
		Flail Mower 11'			
	Aug	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.18	hour
		Flail Mower 11'			
Weeds: Strip Spray	Nov	ATV-4WD	Equipment Operator Labor	0.16	hour
		ATV Sprayer System 100 Gal	Matrix SG	1.50	Oz
			Gramoxone	3.00	Pint
Weeds: Chemical Mow	Apr	ATV-4WD	Equipment Operator Labor	0.16	hour
		ATV Sprayer System 100 Gal	Roundup PowerMax	1.40	Pint
Fertilize: Soil Analysis	Jan	ATV-4WD	Equipment Operator Labor	0.01	hour
			Soil Analysis	0.01	Each
Fertilize: Leaf Analysis	Apr		Leaf Analysis	0.03	Each
	July		Leaf Analysis	0.02	Each
Fertilize: Hull Analysis	Aug		Hull Analysis	0.02	Each

UC COOPERATIVE EXTENSION - AGRICULTURAL ISSUES CENTER
TABLE 8. CONTINUED
 SAN JOAQUIN VALLEY – SOUTH - 2016

Operation	Month	Tractor & Implement	Labor Type/ Materials	Rate/ acre	Unit
Fertilize: UAN32 & KTS	Mar		UAN32 (32-0-0)	40.00	Lb. N
			KTS (0-0-25) 25% w/17% Sulfur	80.00	Lb.
	Apr		UAN32 (32-0-0)	40.00	Lb. N
			KTS (0-0-25) 25% w/17% Sulfur	80.00	Lb.
	May		UAN32 (32-0-0)	40.00	Lb. N
			KTS (0-0-25) 25% w/17% Sulfur	80.00	Lb.
	June		UAN32 (32-0-0)	40.00	Lb. N
KTS (0-0-25) 25% w/17% Sulfur			80.00	Lb.	
July		UAN32 (32-0-0)	40.00	Lb. N	
		KTS (0-0-25) 25% w/17% Sulfur	80.00	Lb.	
Fertilize: K2SO4	Dec	34HP4WD Tractor	Equipment Operator Labor	0.18	hour
		Fertilizer Applicator PTO	Potassium Sulfate-K2SO4 50%	200.00	Lb.
Fertilize: 10-34-0 (3x)	Feb		10-34-0 (Ammonium Phosphate)	39.22	Lb.
	Apr		10-34-0 (Ammonium Phosphate)	39.22	Lb.
	June		10-34-0 (Ammonium Phosphate)	39.22	Lb.
Fertilize: Fall Defoliation	Nov	85HP4WD Low-Profile Tractor	Equipment Operator Labor	0.25	hour
		Air-Blast PTO 500 Gal.	Zinc Chelate 10%	1.00	Qt.
Winter Sanitation	Jan	85HP4WD Low-Profile Tractor Flail Mower 11'	Equipment Operator Labor	0.19	hour
			Non-Machine Labor	0.25	hour
			Winter Sanitation- Shake & Sweep	1.00	Acre
			Hand Poling	4.00	Acre
PCA Fee	Nov		PCA/CCA Fee (Prod Yrs.)	1.00	Acre
Pickup	Nov	Pickup Truck 1/2 Ton	Equipment Operator Labor	2.00	hours
ATV	Nov	ATV-4WD	Equipment Operator Labor	1.00	hour
Harvest: Shake Trees	Sept	Tree Shaker-Side Bullet	Equipment Operator Labor	0.30	hour
Harvest: Pole Nuts	Sept		Hand Poling	4.00	Acre
Harvest: Sweep & Rake	Sept	Nut Sweeper/Blower	Equipment Operator Labor	0.17	hour
			Non-Machine Labor	0.75	hour
Harvest: Pick-up Nuts	Sept	Nut Pickup Machine	Equipment Operator Labor	0.30	hour
	Sept	85HP4WD Low-Profile Tractor Nut Cart #1	Equipment Operator Labor	0.30	hour
	Sept	34HP4WD Tractor Nut Kart #2	Equipment Operator Labor	0.30	hour
Harvest: Hull & Shell	Sept	Nut Elevator	Equipment Operator Labor	0.30	hour
			Non-Machine Labor	0.25	hour
			Hull/Shell Nuts	3,000.00	Lb.