
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2015

SAMPLE COSTS TO ESTABLISH AN
ORCHARD AND PRODUCE

LEMONS



SAN JOAQUIN VALLEY - South

Low Volume Irrigation

Neil V. O'Connell

Craig E. Kallsen

Karen M. Klonsky

Kabir P. Tumber

UC Cooperative Extension Farm Advisor, Tulare County

UC Cooperative Extension Farm Advisor, Kern County

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

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

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

SAMPLE COSTS TO ESTABLISH AN ORCHARD and PRODUCE LEMONS San Joaquin Valley South - 2015

CONTENTS

INTRODUCTION	2
ASSUMPTIONS.....	3
Establishment Cultural Practices and Material Inputs	3
Production Cultural Practices and Material Inputs	6
Cash Overhead.....	10
Non-Cash Overhead.....	10
REFERENCES	13
Table 1. COSTS PER ACRE TO ESTABLISH A LEMON ORCHARD	14
Table 2. MATERIALS & CUSTOM WORK COSTS PER ACRE – ESTABLISHMENT YEARS	16
Table 3. COSTS PER ACRE TO PRODUCE LEMONS	18
Table 4. COSTS AND RETURNS PER ACRE TO PRODUCE LEMONS.....	19
Table 5. MONTHLY PER ACRE CASH COSTS – LEMONS.....	21
Table 6. RANGING ANALYSIS	22
Table 7. WHOLE FARM EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS	23
Table 8. HOURLY EQUIPMENT COSTS	23
Table 9. OPERATIONS WITH EQUIPMENT & MATERIALS	24

INTRODUCTION

Sample costs to establish a lemon orchard and produce lemons under low volume irrigation in the southern San Joaquin Valley are presented in this study. This study is intended as a guide only, and can be used to make production decisions, determine potential returns, prepare budgets and evaluate production loans. Practices described are based on production practices considered typical for the crop and area, but will not apply to every situation. Sample costs for labor, materials, equipment and custom services are based on current figures. A blank column titled “Your Costs”, in Tables 3 and 4 is provided to enter your costs.

The hypothetical farm operation, production practices, overhead, and calculations are described under the assumptions. For additional information or an explanation of the calculations used in the study call the Department of Agricultural and Resource Economics, University of California, Davis, (530) 752-5489, or your local UC Cooperative Extension office.

Sample Cost of Production Studies for all current and many archived commodities are available at <http://coststudies.ucdavis.edu>, or can be requested from the Department of Agricultural and Resource Economics, UC Davis, (530) 752-1515, or obtained from selected county UC Cooperative Extension offices.

ASSUMPTIONS

The assumptions refer to Tables 1 to 9 and pertain to sample costs to establish a lemon orchard and produce lemons in the southern San Joaquin Valley. The cultural practices shown represent production operations and materials considered typical of a well-managed orchard in the region. Costs, materials, and cultural practices in this study will not apply to all farms. Timing of and types of cultural practices will vary among growers within the region and from season to season due to variables such as variety, weather, soil, and insect and disease pressure. For more details on citrus production practices, see the 2014 University of California Cooperative Extension (UCCE) Citrus Production Manual. **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 65 contiguous acres. Establishment and production costs are based on ten acres being planted to lemons. Mature lemon trees are grown on 50 acres and the remaining five acres are roads, equipment and shop area, and homestead. The grower owns and farms the orchards. Lemons are highly susceptible to frost damage and require higher growing temperatures in comparison with oranges.

Establishment Cultural Practices and Material Inputs

Tables 1 & 2

Land Preparation. The orchard is established on ground previously planted to another tree crop. Land preparation begins by removing the old orchard. Orchard removal costs include pushing, stacking, and burning or shredding the trees, and a hand cleanup of the area. After removal, deep ripping of the soil profile, 4 to 6 feet deep, is done to break up stratified layers that affect root and water penetration. The ground is disced two times to break up large clods and then leveled (triplaned). All land preparation operations are contracted and done in the year prior to planting. Contracted or custom operation costs will vary depending upon acreage size. Small acres (10 in this case) may have a minimum fee or additional equipment delivery charges. Some of these costs are included in this study.

Planting. Planting the orchard starts by marking tree sites (layout orchard). Holes are then dug and the trees planted in February. The trunks are wrapped with a foam wrap to shield them from sunburn and to reduce sucker development.

Trees. The major lemon variety grown in the San Joaquin Valley is Lisbon. Tree costs are for the standard varieties. The trees are planted on 20 X 20-foot spacing, 109 trees per acre. Two percent of the trees, 2 trees per acre, are assumed to be replaced in the second year. Tree spacing and densities in orchards vary. Lemon trees have a long production life if they are well maintained. The life of the orchard is assumed to be 40 years.

Table A. Sucker/Prune

<u>Operation Time</u>		
<u>Year</u>	<u>Operation</u>	<u>Hours</u>
1	Sucker	3.00
2	Sucker	3.00
3	Sucker/Prune	5.00
4	Prune	7.00
5	Prune	12.00

Pruning. Suckering is done twice a year, April and July, during the first and second year. Light pruning is done in April after harvest from the third year until the trees are mature. Also in the third year some suckering may be done during the pruning. See Table A for estimated pruning/suckering times for the establishment years.

Irrigation. District water is delivered via canal to the farm at a cost of \$114 per acre-foot or \$9.50 per acre-inch. Water costs are highly variable among districts, and in drought years water costs may increase to as high as \$1,000 to \$1,800 per acre-foot. This study assumes a year with normal water costs. Irrigation costs include the water and the labor for system operation and monitoring. No assumption is made about effective rainfall, runoff, evaporation, winter water requirements or rainfall stored in the soil profile, tree size or tree health. In the first year, water is applied in March shortly after planting. Irrigation water is generally applied from April through October. The amount of water applied to different aged trees is shown in Table B. Values are based on an irrigation system delivering water with a distribution uniformity of 85%.

Year	Acre-Inches
1	3.0
2	7.0
3	13.0
4	22.0
5	27.0
6+	33.0

Frost Protection. Lemons are highly susceptible to temperatures that are two to three degrees below freezing. Damage begins at a higher temperature than oranges; therefore, the wind machines are started in some instances at Fahrenheit higher than when started for oranges. This study assumes that weed/cover crop management and 2.2 acre-inches of water are used for frost protection during November, December and January except for the first year. Wind machines are installed in the first year and begin operation in the winter (November & December) of the first year to which the costs are allocated, while the January costs are allocated to the second year. The costs are based on a calendar year. Except for the first year, water and wind machine use remains constant for frost protection. Table C illustrates this study’s frost protection methods.

In this region three methods are used to protect fruit and trees from frost or freeze during late winter and early spring. (1) Orchard floors are kept free of vegetation (or if a cover crop is used it is maintained as low as

Year	water	acin	floor management	wind machine
1	Yes	1.5	Discing & contact herbicide	66 hours
2	Yes	2.2	Residual & contact herbicide	100 hours
3	Yes	2.2	Residual & contact herbicide	100 hours
4	Yes	2.2	Residual & contact herbicide	100 hours
5+	Yes	2.2	Residual & contact herbicide	100 hours

possible during freezing weather by planting late in the fall). The low vegetation allows the soil to act as a reservoir for heat from solar radiation during the day. This heat is released at night which raises the air temperature (vegetation tends to reflect solar radiation during the day and consequently less heat is stored in the soil to be released at night). (2) Water is applied to the orchard floor. This also provides heat that is released to the trees as air temperature falls. (3) Wind machines are used to pull the warm air above the trees into the orchard and mix it with colder resident air resulting in a temperature increase. A single machine will effectively cover 10 acres.

Protection from yield losses due to freeze damage will help maintain an orchard’s economic viability. Several protection strategies have been outlined above, but other options are available (e.g. crop insurance). Methods for determining the best frost protection strategy for individual orchards are discussed in the publication *Reducing Citrus Revenue Losses for Frost Damage: Wind Machines and Crop Insurance*.

Fertilization. Nitrogen (N) is the major nutrient required for proper tree growth and optimum yields. Beginning in the first year, UN32 is applied through the low volume or drip system and low biuret urea plus micronutrients - zinc sulfate and manganese (Tecmangam) - are applied in March as a foliage spray. Beginning in the third year, low biuret urea (46-0-0) is applied twice as a foliar spray, once with the micronutrients in March and applied alone in May. Nitrogen

Year	per tree	per acre	Lbs of N	
			dripline	foliar
1	0.09	10.00	8.5	1.15
2	0.20	22.00	19.7	2.30
3	0.31	34.00	30.50	3.45
4	0.48	52.00	37.00	15.00
5	0.69	75.00	52.50	22.50
6	0.92	100.00	70.00	30.00
7+	1.20	130.00	100.00	30.00

fertilizer rates from orchard establishment through maturity are shown in Table D. If groundwater is used for irrigation, water should be tested for nitrogen and the content taken into consideration in the fertilization program.

Soil Amendments. Based on annual soil and water analysis, soluble gypsum applications begin in the third year. A total of one-ton per acre per year is applied each season, with application at each irrigation applied through the drip system. Gypsum, calcium, or lime is applied for improving water infiltration and soil pH, and use should be based on soil and water tests. Although not included in this study, compost may be added to enhance soil organic matter.

Pest Management. The pesticides and rates mentioned in this cost study as well as other materials available are listed in *UC Integrated Pest Management Guidelines, Citrus*. Pesticides mentioned in the study are commonly used, but are not presented as a recommendation.

Weeds. Chemical weed control begins the first year with three spot sprays in the tree row during the spring and summer using Roundup herbicide. In the first year a custom operator discs the floor middles three times. In the second and subsequent years, residual/pre-emergent herbicides, Karmex and Princep, are applied to the orchard floor in the fall and in the spring using half of the maximum rate for each application. These materials are regulated under the Groundwater Protection Regulations and under some conditions may require a pesticide permit from the agricultural commissioner's office.

Insects. Insects treated in this study are katydids, ants, and scale. Beginning in the fourth year, katydids (*Scudderia furcata*) are treated with Success insecticide plus oil in May at petal fall. A spray may be needed every other year for katydid or scale; katydid is treated every year in this study. Thrips and worms normally do not damage lemon fruit and are not treated in this study. Pesticides are sprayed at full rates in the fourth and fifth years, but are applied at a lower volume per acre to account for the small tree size. In the fourth year 50% and in the fifth, 75% of the recommended spray volume is applied. California red scale (*Aonidiella aurantii*) is not treated on young trees as it is only an economic problem when found on the fruit. Therefore treatment begins in the fourth year in July alternating each year with Esteem and Lorsban.

Fire ant (*Solenopsis xyloni*) control is needed through the third year, especially if nests are still present. Clinch or Esteem ant bait is applied in late spring to early summer (June in this study) with the grower owned ATV and a bait applicator furnished by the chemical company. After careful monitoring, spot treatments with Lorsban granules may be needed, but are not included in this study.

Diseases. Beginning in the third year, brown rot (*Phytophthora spp.*) and septoria spot (*Septoria spp.*), which can be a problem are regulated with a Kocide (copper) and hydrated lime application. A custom applicator applies the insect and disease materials by ground with an air blast sprayer.

Vertebrates. Voles and gophers can damage and kill young trees and should be monitored and controlled. No costs are included.

Nematodes and Phytophthora. Nematodes (*Tylenchulus semipenetrans*), phytophthora root rot (*Phytophthora citrophthora* and *P. parasitica*) and phytophthora gummosis (*Phytophthora ssp*) can be severe problems. If the field was previously planted to citrus, phytophthora and nematode samples should be taken to detect the presence and population levels of the organisms prior to planting. Management strategies include resistant rootstocks, irrigation management, and chemical applications. All pest management strategies need to be tailored to meet specific orchard requirements and should be discussed with a certified pest control adviser or local farm advisor.

Harvest, Yields and Returns. Commercial yields normally begin in the third or fourth establishment year. A contracted operator harvests the field. Annual yields are shown in Table E. See Returns in Production section.

Table E. Annual Lemon Yields Per Acre

Year	Field Bins (900 lbs)	Field Boxes (56 lbs)	Total Ctns/bin (37.5 lbs)	Packed Cartons (37.5 lbs)	Juice Cartons (37.5 lbs)
3	10.2	164	244	134	110
4	17	273	407	224	183
5	27	436	651	358	293
6	37.3	600	895	492	403
7	42.4	681	1,017	559	458
8+	47.5	763	1,139	626	513

Production Cultural Practices and Material Inputs

Table 3 to 9

Pruning. Pruning methods and frequencies vary widely on mature trees. Pruning is generally started in April after harvest. In this study, pruning includes topping, hedging, hand pruning, and shredding. Pruning operations are done every year: (1) top all trees, hand prune, stack, shred, and (2) hedge every row, stack, shred. Topping maintains tree height to augment adequate spray coverage and facilitate harvest operations. Hedging tree rows reduces fruit damage from orchard traffic and minimizes disruption of sprays applied to the orchard. Hand pruning of dead wood and suckering enhances spray deposition which is particularly important in the case of red scale. Hand pruning can also increase the amount of fruit inside the tree.

Fertilization. Nitrogen as UN-32 is applied through the irrigation system (not necessarily with a scheduled irrigation) in several applications during February, March, and April. A foliar application of N as low biuret urea plus minor nutrients, zinc sulfate and manganese (Tecmangam), are applied in March. A second low biuret urea application is made in May with the katydid spray. The nutritional program should be based on leaf analysis. Leaf samples are taken in the fall from spring flush, non-fruiting, 5-7 month old leaves. In this study, one sample is taken per 10 acres or 0.10 samples per acre.

Soil Amendments. Each year beginning with the first irrigation, gypsum is injected through the irrigation system with each irrigation; this results in a total application of one-ton per acre for the season. The cost includes the gypsum and the labor to operate and fill the gypsum machine. The machine is listed under the Non-Cash Overhead section of the tables.

Irrigation. Typically, water is applied each year from April through October. Thirty-three acre-inches of district water, delivered via canal, is applied to the orchard at a cost of \$114 per acre-foot or \$9.50 per acre-inch. Water costs are highly variable among districts. From grower and district information, costs may be as low as \$90 per acre-foot or as high as \$250 per acre-foot in non-drought years. In drought years growers may pay between \$1,000 and \$1,800 per acre-foot. This study assumes a year with normal water costs. The irrigation operation costs include the water and labor. Irrigation labor includes operating and monitoring the system. No assumption is made about effective rainfall, runoff, and evaporation.

Frost Protection. Protection is required from late winter to early spring (November through January in this study). In this study, chemical vegetation control on the orchard floor and 2.2 acre-inches of water are used for frost protection. Also, wind machines are operated on nights with frost threatening temperatures. Table C summarizes frost protection methods. Each wind machine protects approximately 10 acres and uses 15 gallons of propane per hour. The frost protection cost includes the fuel use and labor to operate the machines and to apply the water.

Pest Management. The pesticides and rates mentioned in this cost study are listed in *UC Integrated Pest Management Guidelines, Citrus and Reducing Insecticide Use and Energy Costs in Citrus Pest Management*. For more information on other pesticides available, pest identification, monitoring, and management visit the UC IPM website at www.ipm.ucdavis.edu. For information and pesticide use permits, contact the local county agricultural commissioner's office. Check with your farm advisor, PCA and/or the UC IPM website for current recommendations. Pesticide costs may vary by location, brand, and grower volume. Pesticide costs in this study are taken from local dealers.

Pest Control Adviser (PCA). Written recommendations are required for many pesticides and are made by licensed pest control advisers. In addition the PCA can monitor the field for agronomic problems including pests and nutrition. Growers may hire private PCAs or receive the service as part of a service agreement with an agricultural chemical and fertilizer company. In this study, a private PCA monitors the crops for pest, disease, and nutrition.

Weeds. Pre-emergent herbicides (Karmex, Princep) are applied to the orchard floor (tree row and middles) in split applications, one in the fall and one in the spring, using one-half the maximum rate per application. Surviving weeds are controlled with three spot sprays in April, June, and August with Roundup. Karmex and Princep are regulated under the Groundwater Protection Regulations. Check with your farm advisor or PCA prior to applying.

Insects. On the average, katydids or scales are concerns every other year. In this study katydids are treated each year in May with Success insecticide and oil. Low biuret urea is mixed with the katydid spray. A spray is applied in July for California red scale alternating each year with Esteem (insect growth regulator) and Lorsban. All insect and disease treatments are applied by a commercial applicator. The custom application costs vary by pest, material applied, volume of water used, and sprayer speed.

Disease. Brown rot is the primary preharvest disease of fruit that occurs in this study and is controlled by spraying Kocide (copper) and hydrated lime mixture during October or November. The same fungicide mixture also controls Septoria spot. Brown rot develops in the fall initially on fruit that is close to the ground. The pathogen is normally found in the soil and is splashed onto the low hanging fruit by rain. Symptoms usually appear during cool, wet periods on mature or nearly mature fruit.

Snails. Brown garden snails (*Helix aspera*) cause fruit damage. Control options for brown garden snails include predaceous snails, skirt pruning, trunk banding, and chemical baits. However, in this study snails are assumed not to be a problem.

Vertebrate(s). Roof rats may affect mature trees. They can girdle trees and cause fruit damage. Contact your local agricultural commissioner or farm advisor for controls available.

Insect and Disease Management Options. There are two fundamental approaches to using synthetic pesticides in citrus production. (1) Several applications of broad-spectrum pesticides are made to prevent pest damage. While these pesticides control a wide range of insect and mite pests, the pesticides persist to provide control for long periods of time; these attributes can also create additional pest problems. Long-term use has increased pest resistance to many of these pesticides, resulting in increased pesticide applications. Since broad-spectrum pesticides affect many species of insects and mites, those sprays decrease the levels of beneficial populations, that can assist in controlling many pests. Pest resurgence and secondary outbreaks can be the result of parasite and predator suppression by these pesticide applications. For example, treatment for orangeworms or citrus thrips can cause an increase of citrus red mite. (2) Use of selective pesticides and natural enemies (beneficial

predators) as control measures. Selective pesticides are toxic to a narrow range of pests and are usually less harmful to the natural enemies. Their use requires careful monitoring of pests and more precise timing and application to be effective. Many selective pesticides do not persist for long-term control. Preserving beneficial predatory and parasitic populations can reduce the potential resurgence and secondary outbreaks of pests. However, some minor pests such as citricola scale may become economic pests once broad spectrum pesticides are not used. Pest management practices used in this study follow the first strategy described (currently this is the more typical pest management program used in this region).

Growth Regulators. Gibberellic acid (Gib Gro) and 2,4-D (Citrus Fix) treatments are made on mid-to-late harvested lemons. Gibberellic acid is not applied to early ripening lemons, those picked in October and November. Gibberellic acid maintains a juvenile rind and 2,4-D applied in October/November minimizes pre-harvest fruit drop. In this study gibberellic acid is sprayed in October and 2,4-D in November to affect fruit harvested in January and later.

Harvest. Lemon trees typically reach full production by the eighth year. In this cost study, the crop is hand picked and hauled by a contracted harvesting company.

Typically one-third of the orchard is picked in each of three harvests over the growing season. Lemons are picked and graded by size and normally harvested from mid October through March. Lemons are hand picked and put into field bins that hold 900 pounds (24 carton equivalent) of fruit. The lemons are hauled from the field to a packinghouse where they are washed, graded, sized, and packed. Picking, hauling, packing, and marketing costs from the field to the packinghouse are paid by the grower. Current rates for these services vary; picking and hauling costs are \$2.37 per carton and the packinghouse cost are \$5.50 per carton. Delivering outside the local area will increase hauling costs. The packing house costs includes costs for the carton, packing, marketing and miscellaneous fees charged by the packer. The costs are based on typical costs as received from packinghouses and growers in the region.

Yields. Typical annual yields for lemons are measured in 900-pound field bins per acre, but are typically sold by packed cartons weighing 37.5 pounds, although the industry often refers to them as 40-pound cartons. A 900-pound bin is calculated as either 23 or 24 cartons. Packed cartons represent 55% of the fruit picked. The remaining 45% is assumed to go to juice. Yields from the third year to full production for field bins, boxes, and cartons are shown in Table E.

Table E. Annual Lemon Yields Per Acre

Year	Field	Field	Packed	Juice
	Bins (900 lbs)	Boxes (56 lbs)	Cartons (37.5 lbs)	Cartons (37.5 lbs)
3	10.2	164	134	110
4	17	273	224	183
5	27	436	358	293
6	37.3	600	492	403
7	42.4	681	559	458
8+	47.5	763	626	513

Returns. An estimated price based on industry feedback of \$20.00 per carton fresh market, fob packinghouse, and \$135 per ton, or \$2.70 per carton juice, is used in this study. Returns over a range of yields are shown in Table 6.

Assessments. Commercial lemon producers pay three assessments.

Citrus Pest and Disease Prevention Program (CPDPP). The CPDPP was created to advise the Agricultural Secretary of California and the agricultural industry about efforts to combat serious pests and diseases that threaten California’s citrus crop. Growers must pay a mandatory fee of \$0.08 per 40-pound carton, to support the disease prevention program.

State Marketing Order. Under a state marketing order, mandatory assessment fees are collected and administered by the grower-directed Citrus Research Board. This assessment, currently \$0.04 per 55-pound field box, is used to fund industry research programs.

Central California Tristeza Eradication Agency. Tristeza disease can result in damage ranging from lower fruit quality to the death of the tree. The Central California Tristeza Eradication Agency (CCTEA) manages an eradication program to keep the Central Valley tristeza-free. The assessment varies by pest control district and not all districts participate. Although not all growers participate in this program and pay assessments, an average of \$10.03 per acre is charged in this study. The charges are paid in the property assessment bill, but are shown as a line item cost in this study.

Pickup/ATV. The grower uses the pickup for business and personal use. It is assumed that 5,000 miles are for business use. The all terrain vehicle (ATV) cost is for checking and monitoring the field, irrigating, and checking the irrigation system. The cost is estimated and not based on any specific data. The grower also uses the ATV for weed control and the operation cost is included in that cost.

Labor, Equipment and Interest

Labor. Labor rates of \$16.92 per hour for machine operators and \$13.75 for general labor includes payroll overhead of 41%. The basic hourly wages are \$12.00 for machine operators and \$9.75 for general labor. The overhead includes the employers' share of federal and California state payroll taxes, workers' compensation insurance for orchard/fruit crops (code 0016), and a percentage for other possible benefits. Workers' compensation costs will vary among growers, but for this study the cost is based upon the average industry final rate as of March 1, 2014 (personal email from California Department of Insurance, March 2015, unreferenced). Labor for operations involving machinery are 20% higher than the operation time given in Table 3 to account for the extra labor involved in equipment set up, moving, maintenance, work breaks, and field repair.

Wages for management are not included as a cash cost. Any return above total costs is considered a return to management and risk. However, growers wanting to account for management may wish to add a fee. The manager makes all production decisions including cultural practices, action to be taken on pest management recommendations, and labor.

Equipment Operating Costs. Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients formulated by American Society of Agricultural Engineers (ASAE). Fuel and lubrication costs are also determined by ASAE equations based on maximum Power Take Off (PTO) horsepower, and fuel type. Prices for on-farm delivery of red dye diesel and gasoline are \$3.88 (excludes excise tax) and \$3.79 per gallon, respectively. Fuel costs are derived from the Energy Information Administration, averaging January to December 2014 fuel prices. The cost includes a 2% local sales tax on diesel fuel and 8% sales tax on gasoline. Gasoline also includes federal and state excise tax, which are refundable for on-farm use when filing your income tax. The fuel, lube, and repair cost per acre for each operation in Table 3 is determined by multiplying the total hourly operating cost in Table 7 for each piece of equipment used for the selected operation by the hours per acre. Tractor time is 10% higher than implement time for a given operation to account for setup, travel and down time.

Interest On Operating Capital. Interest on operating capital is based on cash operating costs and is calculated monthly until harvest at a nominal rate of 5.75% per year. A nominal interest rate is the typical market cost of borrowed funds. The interest cost of post harvest operations is discounted back to the last harvest month using a negative interest charge. The interest rate will vary depending upon various factors. The rate in this study is considered a typical lending rate by a farm lending agency as of January, 2015.

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. Crop insurance is a risk management tool available to growers.

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

Insurance. Insurance for farm investments varies depending on the assets included and the amount of coverage. Property insurance provides coverage for property loss and is charged at 0.843% of the average value of the assets over their useful life. Liability insurance covers accidents on the farm and costs \$621 for the entire farm.

Crop Insurance. Crop insurance is available to growers, but is not included as a cost in this study.

Office Expense. Office and business expenses are estimated at \$75 per acre. These expenses include office supplies, telephones, bookkeeping, accounting, legal fees, shop and office utilities, and miscellaneous administrative charges.

Management/Supervisor Salaries. The grower farms the orchard, so no cash cost is allocated to management. Returns above costs are considered a return to management.

Compliance Costs. Compliance costs are estimated by a study conducted for California Citrus Mutual examining compliance costs for citrus production across California. The study estimates total compliance cost per acre at \$356.20, which includes education and training, air quality compliance, water quality compliance, pesticide regulation, labor regulation, and capital expenditures.

Investment Repairs. Annual maintenance is calculated as 2% of the purchase price, except orchard establishment is calculated at 0.50% to account for tree replacement and orchard repairs.

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

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

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. An interest rate of 4.75% is used to calculate capital recovery. The rate will vary depending upon loan amount and other lending agency conditions, but is the basic suggested rate by a farm lending agency as of January, 2015.

Establishment Cost. Costs to establish the orchard are used to determine capital recovery expenses, depreciation, and interest on investment for the production years. Establishment cost is the sum of the costs for land preparation, planting, trees, cash overhead and production expenses for growing the trees through the first year that lemons are harvested minus any returns from production. The “Total Accumulated Net Cash Costs” on Table 1, in the fourth year represents the establishment cost. For this study the cost is \$6,453 per acre or \$64,530 for the 10-acre orchard. The establishment cost is spread over the remaining 37 years of the 40 years the orchard is in production. Establishment costs in this study are based on typical basic operations, but can vary considerably, depending upon terrain, soil type, local regulations, and other factors. For example, development on marginal soils will require additional land preparation and soil amendments.

Irrigation System. Water is delivered under pressure to the orchard through a low-volume irrigation system. Low-volume emitters discharge 10 gallons per hour and are spaced at one per tree. The cost for the low-volume irrigation system includes the cost of a pump, filtration system, hoses, emitters, and installation. The life of the irrigation system is estimated at 40 years. The above ground portion of the irrigation system will probably have to be replaced once per ten years, but is not separated out in this study.

Land. 2014 land values for bare or row crop land in Kern and Tulare Counties range between \$8,000 to \$18,000 per acre (Trends & Leases), depending on available water. Land with citrus orchards ranges from \$14,000 to \$24,000 per acre. Current real estate listings for bare land values range from \$15,000 to \$20,000 per acre. The land on which the orchard is planted in this study is valued at \$15,000 per acre.

Building. The shop building is a 1,800 square foot metal building or buildings on a cement slab.

Tools. This includes shop tools, hand tools, and miscellaneous field tools such as pruning tools. The value is estimated and not taken from any specific data.

Fuel Tanks. Two 250-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.

Wind Machines. Each wind machine will cover approximately 10-acres. The cost includes six machines on the farm with one being in the new planting and five on the remaining acres. Cost includes installation of the propane-powered machines. The machines are assumed to use 15 gallons of propane per hour over 10 acres.

Gypsum Machine. The machine is used to inject the soluble gypsum into the irrigation system. The machine costs are allocated to the 10-acres of newly established lemons.

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

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

REFERENCES

- American Society of Agricultural Engineers. 1992. *American Society of Agricultural Engineers Standards Yearbook*. St. Joseph, MI.
- Boehlje, Michael D., and Vernon R. Eidman. 1984. *Farm Management*. John Wiley and Sons. New York, NY
- California State Board of Equalization. 2015. *Fuel Tax Division Tax Rates*. Internet accessed January 2015. <http://www.boe.ca.gov/sptaxprog/spfdrates.htm>.
- California Chapter of the American Society of Farm Managers and Rural Appraisers. 2014. *Trends in Agricultural Land & Lease Values*. California Chapter of The American Society of Farm Managers and Rural Appraisers. Woodbridge, CA.
- Dreistadt, Steve. 2012. *Integrated Pest Management for Citrus, Third Edition*. University of California Statewide Integrated Pest Management Program, ANR.
- Energy Information Administration. 2015. *Gasoline and Diesel Fuel Update*. Internet accessed January 2015. <http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp>.
- Ferguson, L., E. Grafton-Cardwell. 2014. *Citrus Production Manual*. University of California Agriculture and Natural Resources.
- Hamilton, Lynn. 2006. *Comparing California's Cost of Regulation to Other States: A Case Study Approach for Agriculture*. California Institute for the Study of Specialty Crops.
- Haney, Philip B., Joseph G. Morse, Robert F. Luck, Harry Griffiths, Elizabeth E. Grafton-Cardwell, and Neil V. O'Connell. 1992. *Reducing Insecticide Use and Energy Costs in Citrus Pest Management*. UC IPM Pub. 15. Univ. of Calif. Statewide IPM Project. Division of Agriculture and Natural Resources. Oakland, CA.
- O'Connell, Neil V., Craig E. Kallsen, Karen M. Klonsky, and Richard L. De Moura. 2010. *Sample Costs to Establish an Orchard and Produce Lemons, Low-Volume Irrigation, San Joaquin Valley*. University of California, Cooperative Extension. Department of Agricultural and Resource Economics. Davis, CA.
- University of California Statewide Integrated Pest Management Program. *UC Integrated Pest Management Guidelines Citrus*. 2014 University of California, Davis, CA. <http://www.ipm.ucdavis.edu/PMG/selectnewpest.citrus.html>.
- Venner, Raymond and Steven C. Blank. 1995. *Reducing Citrus Revenue Losses From Frost Damage: Wind Machines and Crop Insurance*. Giannini Foundation Information Series No. 95-1. University of Calif. Oakland, CA.

UC COOPERATIVE EXTENSION
Table 1. COSTS PER ACRE TO ESTABLISH A LEMON ORCHARD
 SAN JOAQUIN VALLEY – SOUTH 2015

	Costs per Acre					
	YEAR:	1st	2nd	3rd	4th	5th
PACKOUT YIELD (37.5 lb Cartons/Acre) – Fresh Market & Juice:				244	407	651
Planting Costs						
Land Preparation: Remove Old Orchard (Push, Stack & Shred)		375				
Land Preparation: Ripping		300				
Land Preparation: Disc 2X		100				
Land Preparation: Level (Triplane)		175				
Trees @ 109 per acre (Replant 2% of Trees in 2nd Year)		1,254	23			
Plant: Layout, Plant, Stake & Wrap Trees (Includes Wrap Costs)		228	4			
TOTAL PLANTING COSTS		2,431	27	0	0	0
Cultural Costs:						
Sucker (Yr 1-2) Prune (Yr 3+)		41	41	69	96	165
Irrigate (Water & Labor)*		84	115	172	277	325
Frost Protection (Water & Wind Machines)		241	365	365	365	365
Fertilize: Foliar Spray (N, Mn, Zn)		37	37	38	41	44
Fertilizer: N w/ Irrigation, (UN32)		13	21	37	42	53
Fertilize: Foliar (N) Yrs 1-5. Insect: Katydid (Success, oil) Yr 5					61	73
Insect: Scale (Esteem)					130	150
Insect: Ants (Clinch)		5	5	5		
Weed: Pre-emergent – Orchard Floor (Karmex, Princep)			56	56	56	56
Weed: Spot Spray (Roundup)		19	19	19	19	19
Weed: Disc 3X (Custom)		150				
Disease: Brown Rot (Lime, Kocide)				58	70	81
Soil Amendments: Soluble Gypsum				175	175	174
Pickup Truck Use		111	111	111	111	111
ATV Use		73	73	73	73	73
Leaf Analysis (1 Sample/10 Acres)					7	7
PCA/Consultant Services		36	36	36	36	36
TOTAL CULTURAL COSTS		809	879	1,214	1,559	1,732
Harvesting Costs:						
Pick and Haul				578	965	1,543
Sort & Pack				737	1,232	1,969
Assessments				26	37	53
TOTAL HARVEST COSTS		0	0	1,341	2,234	3,565
Interest on operating capital @ 5.75%		183	27	45	58	78
TOTAL OPERATING COSTS PER ACRE		3,424	933	2,600	3,851	5,375
Cash Overhead Costs:						
Compliance Cost		356	356	356	356	356
Office Expense		75	75	75	75	75
Liability Insurance		11	11	11	11	11
Property Taxes		194	194	194	194	194
Property Insurance		17	15	16	16	16
Investment Repairs		118	118	118	118	120
TOTAL CASH OVERHEAD COSTS		770	769	769	769	773
TOTAL CASH COSTS		4,194	1,702	3,369	4,620	6,148
INCOME FROM PRODUCTION		0	0	2,812	4,974	7,951
NET CASH COSTS FOR THE YEAR		4,194	1,702	557		
PROFIT ABOVE CASH COSTS					354	1,803
TOTAL ACCUMULATED NET CASH COSTS		4,194	5,895	6,453	6,099	4,296

UC COOPERATIVE EXTENSION
Table 1. continued
 SAN JOAQUIN VALLEY – SOUTH 2015

	Costs per Acre				
	YEAR:	1st	2nd	3rd	4th
Non-Cash Overhead Costs:					
Buildings	66	66	66	66	66
Drip Irrigation System	104	104	104	104	104
Shop Tools	24	24	24	24	24
Land	772	772	772	772	772
Fuel Tanks & Pumps	3	3	3	3	3
Gypsum Machine					31
Wind Machine	202	202	202	202	202
Equipment	42	39	39	39	39
TOTAL NON-CASH OVERHEAD COSTS	1,213	1,210	1,210	1,210	1,241
TOTAL COST FOR THE YEAR	5,406	2,912	4,579	5,830	7,389
INCOME FROM PRODUCTION			2,812	4,974	7,951
NET TOTAL COST FOR THE YEAR	5,406	2,912	1,767	856	
NET PROFIT FOR THE YEAR					562
ACCUMULATED NET TOTAL COST	5,406	8,318	10,086	10,942	10,380

* Assumes a year with normal water costs. In drought years, water costs can increase to between \$1,000 and \$1,800 per acre-foot.

UC COOPERATIVE EXTENSION

Table 2. MATERIALS AND CUSTOM WORK COSTS PER ACRE - ESTABLISHMENT YEARS

SAN JOAQUIN VALLEY – SOUTH 2015

	Unit	\$/Unit	Year 1		Year 2		Year 3		Year 4		Year 5			
			Total Per Acre											
			units	\$	units	\$	units	\$	units	\$	units	\$		
OPERATING COSTS														
Custom:														
Orchard Removal & Chip	acre	375.00	1.00	375										
Ripping	acre	300.00	1.00	300										
Disc	acre	50.00	5.00	250										
Level - Triplane	acre	175.00	1.00	175										
Layout, Plant, Wrap	tree	1.50	109.00	164	2.00	3								
Ground Spray – Copper / Fertilizer	acre	35.00	1.00	35	1.00	35	2.00	70	1.00	35	1.00	35		
Ground Spray – Katydid / Citrus Cutworm	acre	35.00							1.00	35	1.00	35		
Ground Spray – Thrips	acre	35.00							1.00	35	1.00	35		
Ground Spray - Scale	acre	90.00							1.00	90	1.00	90		
Harvest: Pick & Haul	ctn	2.37					244.00	578	407.00	965	651.00	1,543		
Harvest: Sort & Pack	ctn	5.50					134.00	737	224.00	1,232	358.00	1,969		
Leaf Analysis (1 per 10 Acres)	each	68.00							0.10	7	0.10	7		
PCA	acre	36.00	1.00	36	1.00	36	1.00	36	1.00	36	1.00	36		
Assessments:														
Citrus Pest & Disease (40 lb ctn)	ctn	0.08					134.00	11	224.00	18	358.00	29		
Citrus Research (40 lb box)	ctn	0.04					134.00	5	224.00	9	358.00	14		
Tristeza Eradication	acre	10.03					1.00	10	1.00	10	1.00	10		
Tree/Tree Aids:														
Lemon Tree	tree	11.50	109.00	1,254	2.00	23								
Tree Wraps (Foam Type)	each	0.59	109.00	64	2.00	1								
Irrigation/Frost Protection:														
Wind Machine Operation	hr/ac	3.15	66.00	208	100.00	315	100.00	315	100.00	315	100.00	315		
Water Frost Protection*	acin	9.50	1.50	14	2.20	21	2.20	21	2.20	21	2.20	21		
Water (Growing Season)*	acin	9.50	3.00	29	7.00	67	13.00	124	22.00	209	27.00	257		

UC COOPERATIVE EXTENSION
Table 2. continued
 SAN JOAQUIN VALLEY – SOUTH 2015

	Unit	\$/Unit	Year 1		Year 2		Year 3		Year 4		Year 5	
			Total Per Acre						units	\$	units	\$
			units	\$	units	\$	units	\$				
Fertilizer:												
UN32 (32-0-0)	lb N	0.72	8.50	6	19.70	14	30.50	22	37.00	27	52.50	38
Urea Low Biuret (46-0-0)	lb N	0.74	1.15	1	2.30	2	3.45	3	15.00	11	22.50	17
Zinc Sulfate 36%	lb	0.86	0.50	0	0.50	0	0.50	0	0.50	0	0.50	0
Tecmangam (31% Mn)	lb	0.73	0.50	0	0.50	0	0.50	0	0.50	0	0.50	0
Soluble Gypsum (Soil Amendment)	ton	160					1.00	160	1.00	160	1.00	160
Herbicide:												
Roundup Original Max	pint	3.57	0.60	2	0.60	2	0.60	2	0.60	2	0.60	2
Princep 90S	gal	23.56			1.00	24	1.00	24	1.00	24	1.00	24
Karmex DF	lb	5.29			4.00	21	4.00	21	4.00	21	4.00	21
Insecticide:												
Clinch Ant Bait	lb	12.93	0.33	4	0.33	4	0.33	4				
Esteem	floz	4.7							8.50	40	12.75	60
Success	oz	5.97							3.00	18	4.50	27
Spray Oil 415	gal	5.68							0.50	3	0.50	3
Fungicide:												
Hydrated Lime	lb	0.29					5.00	1	7.50	2	10.00	3
Kocide 20/20	lb	4.32					5.00	22	7.50	32	10.00	43
Labor (machine)	hrs	16.92	8.93	151	9.53	161	9.53	161	9.50	161	9.50	161
Labor (irrigation)	hrs	13.75	4.00	55	3.50	48	3.50	48	4.97	68	4.97	68
Labor (non-machine)	hrs	13.75	4.90	67	5.60	77	9.25	127	11.30	155	16.30	224
Fuel - Gas	gal	3.78	9.08	34	9.17	35	9.17	35	9.17	35	9.25	35
Fuel - Diesel	gal	3.88										
Lube			5.16		5.00		5.00		5.00		5.00	
Machinery Repair			10.12		11.00		11.00		11.00		11.00	
Operating Interest @ 5.75%			183.27		27.00		45.00		58.00		78.00	
Total Operating Costs/Acre				3,423		932		2,598		3,850		5,375

* Assumes a year with normal water costs. In drought years, water costs can increase to between \$1,000 and \$1,800 per acre-foot.

UC COOPERATIVE EXTENSION
Table 3. COSTS PER ACRE TO PRODUCE LEMONS
 SAN JOAQUIN VALLEY - SOUTH 2015

Operation	Equipment Operation	Cash and Labor Costs per acre						Total Cost	Your Cost
	Time (Hrs/A)	Labor Cost	Fuel	Lube & Repairs	Material Cost	Custom/ Rent			
Cultural:									
Frost Protection (Water & Wind Machine)*	0.00	26	0	0	336	0	362		
Fertilize: N (UN32 Through Drip Line)	0.00	15	0	0	72	0	87		
Weed: Pre-emergent (Princep, Karmex) 2X	0.50	10	0	1	45	0	56		
Insect/Fertilizer: Citrus Cutworm (Dipel)/N Mn Zn	0.00	0	0	0	14	35	49		
Prune: Top Trees, Hand Prune, Stack & Shred Prunings	0.00	0	0	0	0	423	423		
Prune: Hedge, Stack & Shred Prunings	0.00	0	0	0	0	65	65		
Irrigate: (Water & Labor)*	0.00	78	0	0	314	0	391		
Soil Amendment: (Soluble Gypsum) w/ Irrigation	0.00	24	0	0	160	0	184		
Weed: Spot Spray (Roundup) 3X	0.75	15	1	1	2	0	19		
Insect/Fertilizer: Thrips, Katydid (Success, Oil) /N	0.00	0	0	0	50	35	85		
Insect: Scale (Esteem)	0.00	0	0	0	80	90	170		
Leaf Analysis (1 Sample/10 Acres)	0.00	1	0	0	0	7	7		
Disease: Brown Rot (Lime, Kocide)	0.00	0	0	0	46	35	81		
Growth Regulator: (GibGro or GA)	0	0	0	0	15	53	68		
Growth Regulator: (Fruit Fix)	0.00	0	0	0	6	53	59		
Pickup Truck Use	3.33	68	32	12	0	0	111		
ATV Use	3.33	68	2	3	0	0	73		
PCA/Consultant Services	0.00	0	0	0	0	36	36		
TOTAL CULTURAL COSTS	7.92	304	35	16	1,140	831	2,326		
Harvest:									
Pick & Haul Fruit	0.00	0	0	0	0	2,699	2,699		
Pack Fruit	0.00	0	0	0	0	3,443	3,443		
Assessments	0.00	0	0	0	85	0	85		
TOTAL HARVEST COSTS	0.00	0	0	0	85	6,142	6,228		
Interest on operating capital @ 5.75%							212		
TOTAL OPERATING COSTS/ACRE	7.92	304	35	16	1,225	6,973	8,766		
Cash Overhead:									
Liability Insurance							10		
Office Expense							75		
Compliance Cost							356		
Property Taxes							227		
Property Insurance							19		
Investment Repairs							120		
TOTAL CASH OVERHEAD COSTS							807		
TOTAL CASH COSTS/ACRE							9,573		
Non-Cash Overhead:									
		Per producing Acre		Annual Cost Capital Recovery					
Buildings 1800 sqft		1,050		66			66		
Drip Irrigation		1,850		104			104		
Orchard Establishment		6,453		374			374		
Fuel Tanks 2-250g		58		3			3		
Gypsum Machine (1)		133		31			31		
Land		16,250		772			772		
Shop Tools		250		24			24		
Wind Machine (6)		2,680		202			202		
Equipment		385		41			41		
TOTAL NON-CASH OVERHEAD COSTS		29,110		1,617			1,617		
TOTAL COSTS/ACRE							11,190		

* Assumes a year with normal water costs. In drought years, water costs can increase to between \$1,000 and \$1,800 per acre-foot.

UC COOPERATIVE EXTENSION
Table 4. COSTS AND RETURNS PER ACRE TO PRODUCE LEMONS
 SAN JOAQUIN VALLEY - SOUTH 2015

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Lemons (37.5 lb carton)	626.00	ctn	20	12,520	
Lemons (juice)	513.00	ctn	2.7	1,385	
GROSS RETURNS	1,139.00	ctn	12	13,905	
OPERATING COSTS					
Herbicide:					47
Princep 90S	1.00	gal	23.56	24	
Karmex	4.00	lb	5.29	21	
Roundup Original Max	0.60	pint	3.57	2	
Insecticide:					119
Success	6.00	oz	5.97	36	
Spray Oil 415	0.50	gal	5.68	3	
Esteem	17.00	floz	4.70	80	
Fungicide:					46
Hydrated Lime	10.00	lb	0.29	3	
Kocide 20/20	10.00	lb	4.32	43	
Growth Regulator:					22
Gib Gro 4LS (Gibberalic Acid)	32.00	gram	0.48	15	
Fruit Fix (2, 4-D)	1.25	floz	4.97	6	
Fertilizer:					97
UN 32 (32-0-0)	100.00	lb N	0.72	72	
Urea Low Biuret (46-0-0)	30.00	lb N	0.74	22	
Zinc Sulfate 36%	2.00	lb	0.86	2	
Tecmangam (31% Mn)	2.00	lb	0.73	1	
Soil Amendment:					160
Gypsum Soluble	1.00	ton	160.00	160	
Contract/Custom:					795
Spray Ground - Worm	1.00	acre	35.00	35	
Prune - Top	1.00	acre	45.00	45	
Stack - Top	1.00	acre	26.00	26	
Shred - Top & Hand	1.00	acre	25.00	25	
Prune - Hand and Stack	109.00	tree	3.00	327	
Prune - Hedge	1.00	acre	45.00	45	
Stack - Hedge	1.00	acre	5.00	5	
Shred - Hedge	1.00	acre	15.00	15	
Spray Ground - Thrips	1.00	acre	35	35	
Spray Ground - Scale	1.00	acre	90	90	
Leaf Analysis (1 per 10 acres)	0.10	each	68	7	
Spray Ground - Copper or Fertilizer	1.00	acre	35.00	35	
Spray Ground - Growth Regulator	2.00	acre	52.50	105	
Harvest - Pick & Haul	1,139.00	ctn	2.37	2,699	
Harvest - Sort & Pack	626.00	ctn	5.50	3,443	
PCA Fees	1.00	acre	36.00	36	
Irrigation:					314
Water*	33.00	acin	9.50	314	
Frost Protection:					336
Water*	2.20	acin	9.50	21	
Wind Machine Operation (Propane @ \$2.10/gal)	100.00	hour	3.15	315	
Assessment:					85
Citrus Research/55lb box	626.00	carton	0.04	25	
Tristeza Eradication	1.01	acre	10.03	10	
CPDPP	626.00	carton	0.08	50	

UC COOPERATIVE EXTENSION
Table 4. continued
 SAN JOAQUIN VALLEY - SOUTH 2015

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Labor (machine)	9.50	hrs	16.92	161	
Labor (non-machine)	5.00	hrs	13.75	66	
Labor (irrigation)	5.65	hrs	13.75	78	
Fuel - Gas	9.17	gal	3.79	35	
Lube				5	
Machinery Repair				11	
Interest on operating capital @ 5.75%				212	
TOTAL OPERATING COSTS/ACRE				8,766	
NET RETURNS ABOVE OPERATING COSTS				5,139	
CASH OVERHEAD COSTS:					
Liability Insurance				10	
Office Expense				75	
Compliance Cost				356	
Property Taxes				227	
Property Insurance				19	
Investment Repairs				120	
TOTAL CASH OVERHEAD COSTS/ACRE				807	
TOTAL CASH COSTS/ACRE				9,573	
NON-CASH OVERHEAD COSTS					
Buildings 1800 sqft				66	
Drip Irrigation				104	
Orchard Establishment				374	
Fuel Tanks 2-250g				3	
Gypsum Machine (1)				31	
Land				772	
Shop Tools				24	
Wind Machine (6)				202	
Equipment				41	
TOTAL NON-CASH OVERHEAD COSTS/ACRE				1,617	
TOTAL COSTS/ACRE				11,190	
NET RETURNS ABOVE TOTAL COSTS				2,715	

* Assumes a year with normal water costs. In drought years, water costs can increase to between \$1,000 and \$1,800 per acre-foot.

UC COOPERATIVE EXTENSION
Table 5. MONTHLY PER ACRE CASH COSTS - LEMONS
 SAN JOAQUIN VALLEY - SOUTH 2015

Beginning JAN 2015	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Ending DEC 2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
Cultural:													
Frost Protection (Water & Wind Machine)*	121										124	118	362
Fertilize: N (UN32 Through Drip Line)		31	31	25									87
Weed: Pre-emergent (Princep, Karmex) 2X			28						28				56
Insect/Fertilizer: Citrus Cutworm (Dipel)/N Mn Zn			49										49
Prune: Top Trees, Hand Prune, Stack & Shred Prunings				423									423
Prune: Hedge, Stack & Shred Prunings				65									65
Irrigate: (Water & Labor)*				38	52	67	78	78	52	27			391
Soil Amendment: (Soluble Gypsum) w/ Irrigation				21	26	31	37	31	26	13			184
Weed: Spot Spray (Roundup) 3X				6		6		6					19
Insect/Fertilizer: Thrips, Katydid (Success, Oil) /N					85								85
Insect: Scale (Esteem)							170						170
Leaf Analysis (1 Sample/10 Acres)									7				7
Disease: Brown Rot (Lime, Kocide)										81			81
Growth Regulator: (GibGro or GA)										68			68
Growth Regulator: (Fruit Fix)											59		59
Pickup Truck Use	9	9	9	9	9	9	9	9	9	9	9	9	111
ATV Use	6	6	6	6	6	6	6	6	6	6	6	6	73
PCA/Consultant Services	3	3	3	3	3	3	3	3	3	3	3	3	36
TOTAL CULTURAL COSTS	139	49	126	597	181	122	303	133	131	207	201	136	2,326
Harvest:													
Pick & Haul Fruit			898							901		901	2,699
Pack Fruit			1,144							1,150		1,150	3,443
Assessments			28							28		28	85
TOTAL HARVEST COSTS	0	0	2,071	0	0	0	0	0	0	2,079	0	2,079	6,228
Interest on operating capital @ 5.75%	1	1	11	14	15	16	17	18	18	29	30	41	212
TOTAL OPERATING COSTS/ACRE	139	50	2,208	612	196	138	320	151	150	2,315	231	2,256	8,766
Cash Overhead:													
Liability Insurance													10
Office Expense													75
Compliance Cost													356
Property Taxes													227
Property Insurance	9						9						19
Investment Repairs	10	10	10	10	10	10	10	10	10	10	10	10	120
TOTAL CASH OVERHEAD COSTS	19	10	10	10	10	10	19	10	10	10	10	10	807
TOTAL CASH COSTS/ACRE	159	60	2,218	622	206	148	340	161	160	2,325	241	2,266	9,573

* Assumes a year with normal water costs. In drought years, water costs can increase to between \$1,000 and \$1,800 per acre-foot.

UC COOPERATIVE EXTENSION
Table 6. RANGING ANALYSIS
 SAN JOAQUIN VALLEY - SOUTH 2015

COSTS PER ACRE AT VARYING YIELDS TO PRODUCE LEMONS

	*YIELD (cartons/acre)						
	866	957	1048	1139	1230	1321	1412
OPERATING COSTS/ACRE:							
Cultural Cost	2,326	2,326	2,326	2,326	2,326	2,326	2,326
Harvest Cost	4,735	5,233	5,730	6,228	6,725	7,223	7,720
Interest on Operating Capital	179	190	201	212	224	235	246
TOTAL OPERATING COSTS/ACRE	7,240	7,749	8,257	8,766	9,275	9,783	10,292
TOTAL OPERATING COSTS/CTN	8.36	8.1	7.88	7.7	7.54	7.41	7.29
CASH OVERHEAD COSTS/ACRE	807	807	807	807	807	807	807
TOTAL CASH COSTS/ACRE	8,047	8,556	9,065	9,573	10,082	10,591	11,099
TOTAL CASH COSTS/CTN	9.29	8.94	8.65	8.41	8.2	8.02	7.86
NON-CASH OVERHEAD COSTS/ACRE	1,617	1,617	1,617	1,617	1,617	1,617	1,617
TOTAL COSTS/ACRE	9,664	10,173	10,681	11,190	11,699	12,207	12,716
TOTAL COSTS/CTN	11.16	10.63	10.19	9.82	9.51	9.24	9.01

*cartons = 37.5 pounds

NET RETURNS PER ACRE ABOVE OPERATING COSTS

PRICE (\$/carton)		YIELD (cartons/acre)						
Fresh		476	526	576	626	676	726	776
Juice		390	431	472	513	554	595	636
14.00	2.70	477	779	1,081	1,383	1,685	1,987	2,289
16.00	2.70	1,429	1,831	2,233	2,635	3,037	3,439	3,841
18.00	2.70	2,381	2,883	3,385	3,887	4,389	4,891	5,393
20.00	2.70	3,333	3,935	4,537	5,139	5,741	6,343	6,945
22.00	2.70	4,285	4,987	5,689	6,391	7,093	7,795	8,497
24.00	2.70	5,237	6,039	6,841	7,643	8,445	9,247	10,049
26.00	2.70	6,189	7,091	7,993	8,895	9,797	10,699	11,601

NET RETURNS PER ACRE ABOVE CASH COSTS

PRICE (\$/carton)		YIELD (cartons/acre)						
Fresh		476	526	576	626	676	726	776
Juice		390	431	472	513	554	595	636
14.00	2.70	-330	-28	274	576	878	1,180	1,482
16.00	2.70	622	1,024	1,426	1,828	2,230	2,632	3,034
18.00	2.70	1,574	2,076	2,578	3,080	3,582	4,084	4,586
20.00	2.70	2,526	3,128	3,730	4,332	4,934	5,536	6,138
22.00	2.70	3,478	4,180	4,882	5,584	6,286	6,988	7,690
24.00	2.70	4,430	5,232	6,034	6,836	7,638	8,440	9,242
26.00	2.70	5,382	6,284	7,186	8,088	8,990	9,892	10,794

NET RETURNS PER ACRE ABOVE TOTAL COSTS

PRICE (\$/carton)		YIELD (cartons/acre)						
Fresh		476	526	576	626	676	726	776
Juice		390	431	472	513	554	595	636
14.00	2.70	-1,947	-1,645	-1,343	-1,041	-739	-437	-135
16.00	2.70	-995	-593	-191	211	613	1,015	1,417
18.00	2.70	-43	459	961	1,463	1,965	2,467	2,969
20.00	2.70	909	1,511	2,113	2,715	3,317	3,919	4,521
22.00	2.70	1,861	2,563	3,265	3,967	4,669	5,371	6,073
24.00	2.70	2,813	3,615	4,417	5,219	6,021	6,823	7,625
26.00	2.70	3,765	4,667	5,569	6,471	7,373	8,275	9,177

UC COOPERATIVE EXTENSION
Table 7. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS
 SAN JOAQUIN VALLEY - SOUTH 2015

ANNUAL EQUIPMENT COSTS

Yr	Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead		Total
						Insur- ance	Taxes	
15	ATV 4WD	7,100	15	1,382	607	4	42	653
15	Pickup Truck 1/2 Ton	28,000	7	10,621	3,481	16	193	3,690
15	Weed Sprayer-Pull, ATV 55 gal	2,750	20	143	212	1	14	227
TOTAL		37,850		12,147	4,300	21	250	4,570
60% of New Cost		22,710		7,288	2,580	12	150	2,742

*Used to reflect a mix of new and used equipment

Note: Additional equipment may be needed for farming other crops on the farm.

ANNUAL INVESTMENT COSTS

Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead			Total
					Insur- ance	Taxes	Repairs	
Buildings 1,800 sqft	63,000	30	0	3,982	26	315	1,260	5,583
Drip Irrigation (10 acres)	18,500	40	0	1041.49	8	93	370	1,512
Orchard Establishment (10 acres)	64,530	37	0	3,736	27	323	0	4,086
Fuel Tanks 2-500 gal	3,500	40	350	193.96	2	19	70	285
Gypsum Machine (1)	8,000	5	0	1,835	3	40	160	2,038
Land (65 acres)	975,000	40	975,000	46,313	808	9,750	0	56,871
Shop Tools	15,000	15	0	1,421	6	75	300	1,802
Wind Machine (6)	160,800	20	16,080	12,132	73	884	3,216	16,305
TOTAL INVESTMENT	1,308,330		991,430	70,654	953	11,499	5,376	88,482

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/ Farm	Unit	Price/ Unit	Total Cost
Liability Insurance	60	acre	10.35	621
Office Expense	60	acre	75.00	4,500
Compliance Cost	60	acre	356.20	21,372

UC COOPERATIVE EXTENSION
Table 8. HOURLY EQUIPMENT COSTS
 SAN JOAQUIN VALLEY - SOUTH 2015

Yr	Description	Lemons Hours Used	Total Hours Used	COSTS PER HOUR						Total Costs/Hr.
				Capital Recovery	Cash Overhead		Operating		Total Oper.	
					Insur- ance	Taxes	Lube & Repairs	Fuel		
15	ATV 4WD	46.00	133.00	2.74	0.02	0.19	0.77	0.69	1.46	4.41
15	Pickup Truck 1/2 Ton	33.00	265.00	7.87	0.04	0.44	3.64	9.48	13.12	21.46
15	Weed Sprayer-Pull, ATV 55 gal	13.00	75.00	1.69	0.01	0.12	0.72	0.00	0.72	2.53

UC COOPERATIVE EXTENSION
Table 9. OPERATIONS WITH EQUIPMENT & MATERIALS
 SAN JOAQUIN VALLEY - South 2015

Operation	Operation		Labor Type/ Material	Rate/	
	Month	Implement		Acre	Unit
Frost Protection (Water & Wind Machine)	Jan		Non-Machine Labor	0.7	hour
			Water-SJV Frost	0.73	acin
			Wind Machine Opera	33	hour
	Nov		Non-Machine Labor	0.7	hour
			Water-SJV Frost	0.73	acin
			Wind Machine Opera	34	hour
	Dec		Non-Machine Labor	0.7	hour
			Water-SJV Frost	0.74	acin
			Wind Machine Opera	33	hour
Fertilize: N (UN32 Through Drip Line)	Feb		Non-Machine Labor	0.5	hour
			UN 32	33.3	lb N
	Mar		Non-Machine Labor	0.5	hour
			UN 32	33.3	lb N
	Apr		Non-Machine Labor	0.1	hour
			UN 32	33.4	lb N
Weed: Pre-emergent (Princep, Karmex) 2X	Mar	ATV 4WD	Equipment Operator Labor	0.3	hour
			Princep	0.5	gal
	Oct	SprayerPull55GaATV	Karmex	2	lb
		ATV 4WD	Equipment Operator Labor	0.3	hour
			Princep	0.5	gal
			SprayerPull55GaATV	Karmex	2
Insect/Fertilizer: Citrus Cutworm (Dipel)/N Mn Zn	Mar		Spray Grnd Worm	1	acre
			Urea Low Biuret	15	lb N
			Zinc Sulfate 36%	2	lb
			Tecmangam (31%Mn)	2	lb
Prune: Top Trees, Hand, Stack & Shred Prunings	Apr		Non-Machine Labor		
			Prune:Top Lemon	1	acre
			StackToppingsLemon	1	acre
			Shred:ToppingLemon	1	acre
Prune: Hedge, Stack & Shred Prunings	Apr		Prune:Hand&StkLemo	109	tree
			Prune:Hedge Lemon	1	acre
			StackHedgingLemon	1	acre
Irrigate: (Water & Labor)	Apr		Shred:HedgingLemon	1	acre
			Irrigation Labor	0.5	hour
	May		Water-SJV	3.3	acin
			Irrigation Labor	0.8	hour
	June		Water-SJV	4.29	acin
			Irrigation Labor	1	hour
	July		Water-SJV	5.61	acin
			Irrigation Labor	1.1	hours
	Aug		Water-SJV	6.6	acin
			Irrigation Labor	1.1	hours
	Sept		Water-SJV	6.6	acin
			Irrigation Labor	0.8	hour
	Oct		Water-SJV	4.29	acin
			Irrigation Labor	0.35	hour
	Soil Amendment: (Soluble Gypsum)	Apr		Water-SJV	2.31
			Non-Machine Labor	0.25	hour
May			Gypsum Soluble SJV	0.11	ton
			Non-Machine Labor	0.25	hour
			Gypsum Soluble SJV	0.14	ton