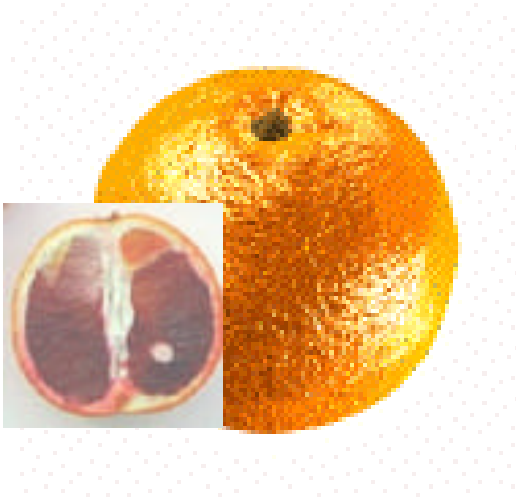
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2002

SAMPLE COSTS TO ESTABLISH A BLOOD ORANGE ORCHARD AND PRODUCE

BLOOD ORANGES

(PIGMENTED ORANGES)



SAN JOAQUIN VALLEY - South

Low Volume Irrigation

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UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH a BLOOD ORANGE ORCHARD and PRODUCE BLOOD ORANGES San Joaquin Valley South - 2002

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INTRODUCTION

Sample costs to establish a blood orange orchard and produce blood oranges 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, "Your Costs", in Tables 2 and 3 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) 752-3589 or your local UC Cooperative Extension office.

Sample Cost of Production Studies for many commodities are available and can be requested through the Department of Agricultural and Resource Economics, UC Davis, (530) 752-3589. Current studies can be obtained from selected county UC Cooperative Extension offices or downloaded from the department website at http://coststudies.ucdavis.edu.

ASSUMPTIONS

The assumptions refer to Tables 1 to 7 and pertain to sample costs to establish a blood orange orchard and produce blood oranges in the Southern San Joaquin Valley. The blood orange is also known as a pigmented orange. **Practices described are not University of California recommendations, but represent production practices and materials considered typical of a well-managed orchard in the region.** The costs, materials, and practices shown in this study will not apply to all situations. Establishment and production cultural practices vary by grower and the differences can be significant. **The use of trade names 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.**

Land. The hypothetical farm consists of 60 contiguous acres. Ten acres are being planted to blood oranges and the remaining acreage is in mature orange trees. The grower owns and farms the orchard.

Establishment Operating Costs

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 the trees, and a hand cleanup of the area. After removal, deep ripping (slip plowing) of the soil profile 4 to 6 feet is done to break up stratified layers that affect root and water penetration. The ground is disced three 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.

Planting. Planting the orchard starts by marking tree sites. Holes are then dug and the trees planted. The trunks are wrapped to shield from sunburn and reduce sucker development. Also, 2% of the trees or 2 trees per acre are assumed to be replaced in the second year.

Trees. Moro is the cultivar referred to in this study. The trees are planted on 18 X 22-foot spacing, 110 trees per acre. Tree spacing and densities in orchards vary. Many new orchards are planted closer for earlier production, but historical data shows that the trees begin to crowd at 8 to 9 years with tree removal consideration warranted. Blood orange trees have a long production life if they are well maintained. The life of the orchard is assumed to be 40 years.

Pruning. Suckering is done during the first through the third year. Light pruning is done from the fourth year until mature.

Table A. Water applied from March 15 through October 30 to a 110-tree orchard

Year	Acre-Inches
1	2.0
2	4.5
3	7.0
4	10.5
5	14.0
Maturity	30.0

Irrigation.. District water is delivered via canal to the farm at a cost of $80.00 per acre-foot or $6.67 per acre-inch. Water costs are highly variable among districts. 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.

Irrigation water applied from March 15 through October 30 for different aged trees is approximated in Table A. Values are based on an irrigation system delivering water with a distribution uniformity of 85%.

Frost Protection. This study assumes that only weed/cover crop management and 2.2 acre-inches of water are used for frost protection during the first two years. Wind machines are installed in the third year and begin operation in the fourth year. Water use remains constant for frost protection in all years. Table B illustrates this study's frost protection methods.

Table B. Frost Protection Procedures

Year	water	acin	floor management	wind machine
1	Yes	2.2	Discing & contact herbicide	No
2	Yes	2.2	Residual & contact herbicide	No
3	Yes	2.2	Residual & contact herbicide	No
4	Yes	2.2	Residual & contact herbicide	100 hours
5+	Yes	2.2	Residual & contact herbicide	100 hours

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 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. Wind machine installation is often delayed until significant fruit is produced, sometimes as late as the seventh or eighth establishment year. A single machine will cover about 10 acres, effectively. 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 is the major nutrient required for proper tree growth and optimum yields. In the first three years, ammonium nitrate (34-0-0) is spread by hand near the base of the trees, and low biuret urea plus zinc sulfate and manganese sulfate are applied at petal fall (March in this study) as a foliage spray. Beginning in the fourth year UN-32 (32-0-0) is applied though the drip lines and low biuret urea (46-0-0) and micronutrients are applied as a foliar fertilizer with the worm spray. Nitrogen fertilizer rates from orchard establishment through maturity are shown in Table C. If groundwater is used for irrigation, water should be tested for nitrogen and the content taken into consideration in the fertilization program.

Table C. Applied N for Blood Orange Orchards

Year	per tree	per acre	hand	dripline	foliar
	Lbs of N applied				
1	0.1	9.65	8.5		1.15
2	0.2	21.80	19.5		2.30
3	0.3	33.95	30.5		3.45
4	0.4	44.00		29.0	15.00
5	0.5	55.00		32.5	22.50
6	0.6	66.00		36.0	30.00
7+	0.8	110.00		80.0	30.00

Soil Amendments. In this study, beginning in the third year, compost at two-tons per acre is applied annually in October and soluble gypsum is applied through the drip lines at each irrigation at a rate proportional to one-ton per acre per year for mature trees. Manures or compost are added to enhance soil organic matter.

Calcium, lime, or gypsum is applied for improving water infiltration and soil pH, and use should be based on soil and water tests.

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 recommendations.

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. From the second year on 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.

Insects. Insects treated in this study are citrus thrips (*Scirtothrips citri*), katydids (*Scudderia furcata),* orangeworms [citrus cutworm (*Xylomyges curialis*) and fruittree leafroller (*Archips argyrosphilus*)]. Control for citrus thrips, orangeworms, and katydids begin in the fourth year. Orangeworms are controlled (control is generally required every other year) in March with one application of Dipel insecticide. Pesticides are sprayed at full rates for orangeworms 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. Thrips and katydids are treated with Success insecticide plus oil in May at petal fall. Although a common industry practice is to apply multiple sprays on non-bearing trees for thrips, protection in this study begins in the fourth year for fruit protection rather than foliage protection. California red scale (*Aonidiella aurantii*) can be a severe problem on blood oranges, but is not treated on young trees, as it is only an economic problem when found on the fruit.

Fire ant (*Solenopsis xyloni*) control may be 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 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*.) are regulated with a Kocide and hydrated lime application. These materials are sprayed by a commercial applicator.

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 and Yields. Commercial yields normally begin in the third or fourth establishment year. New plantings with close spacing may have commercial yields in the second or third year. A contracted operator harvests the field. Annual yields are shown in Table D.

Returns. See Returns in Production section.

Production Operating Costs

Pruning. In this study, pruning is done in April and includes topping, hedging, hand pruning, and shredding. Pruning operations are done on a three-year cycle: (1) hedge both sides of tree, (2) top the next year, (3) hand prune the third. One-third of the costs are allocated each year to the crop. Prunings are stacked into the middle, between rows, and shredded by a custom operator. Pruning is generally done after harvest and the methods and frequencies vary widely on mature trees. Pruning emphasis is on developing fruit size. 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 an irrigation) in several applications during February, March, and April. Foliar applications of N as low biuret urea plus minor nutrients, zinc sulfate and manganese sulfate, are mixed and sprayed with the March worm treatment. A second low biuret urea application is made with the May thrips and katydid spray.

Leaf Analysis. The nutritional program should be based on leaf analysis. Leaf samples are taken in the fall from the spring flush, non-fruiting, 5-7 month old leaves. In this study, one sample per 20 acres is taken.

Soil Amendments. Compost at two tons per acre is applied commercially each year in October and gypsum at one-ton per acre per year. The gypsum is distributed through the irrigation system with each irrigation.

Irrigation. In this study, water is applied mid-March through October. Thirty acre-inches of district water, delivered via canal, is applied to the orchard at a cost of $80.00 per acre-foot or $6.67 per acre-inch. Water costs are highly variable among districts. From grower and district information, costs range from $12 to $150 per acre-foot. The irrigation operation costs includes water and the labor for the system operation and monitoring. No assumption is made about effective rainfall, runoff, and evaporation.

Frost Protection. Protection is required from late winter to early spring. 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 threatening minimum temperatures. See Table B.

Pest Management. The pesticides and rates mentioned in this cost study are listed in *UC Integrated Pest Management Guidelines, Citrus.* 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.

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 PCA's 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. In addition, weeds are controlled with three spot sprays – April, June, August – with Roundup.

Insects. Worms are sprayed primarily in March with Dipel insecticide. Citrus thrips and katydids are treated in May and citrus thrips in June. Success insecticide and oil are used in both applications. Urea and micronutrients are mixed with the worm spray and urea, only, with the first thrip and 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.

Disease. Brown rot is the primary disease of fruit that occurs in this study and is controlled by spraying a Kocide and hydrated lime mix during October or November. The same fungicide mix 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.

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 and 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, beneficial populations, which can assist in controlling many pests, decrease. 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. Growth regulators are applied only to mature trees. In November, 2,4-D (Hivol 44) treatments are made to minimize pre-harvest fruit drop.

Harvest. Blood orange trees typically reach full production by the 12th or 13th 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 ranging from December to March. A December harvest is used in this study. Blood oranges are hand picked and put into field bins that hold 900

pounds of fruit. Picking costs are based on total field pick cartons. The blood oranges are hauled from the field to a packinghouse where they are washed, graded, sized, and packed. Picking, hauling, packing, and advertising costs from the field to the packinghouse are paid by the grower. Current rates for theses services will vary, but a cost of $5.01 per carton is used in this study.

Yields. Typical annual yields are measured in 56-pound field boxes per acre, but are typically sold by 37.5 pound packed cartons, although the industry refers to them as 40-pound cartons. Blood oranges are an alternate bearing crop (yields are lower or higher than the previous or following year). Packed cartons represent 70% of the fruit picked. The remaining 30% are culls and may be used as cattle feed. No juice market exists. Processors do not want the juice because it stains the processing equipment. The crop is relatively new in California and yield data in the industry is limited. For our study, yield information was furnished by a single grower, compared to orange production averages, and then adjusted to estimate the yields as shown in Table D. Production year yields used in the study are based on a rounded average of the two alternate bearing years ((437 + 538)/2) = 490 cartons per acre.

Table D. Estimated Yields Per Acre

Year	field bins (900 lbs)	field boxes (56 lbs)	cartons* (37.5 lbs)
4	7.0	113	118
5	23.0	370	386
6	9.0	145	151
7	24.0	386	403
8	19.0	305	319
9	31.0	498	520
10	26.0	418	437
11	32.0	514	538

*70% total yield. All numbers rounded

Returns. A price of $16.00 per carton is based on the average grower return over the past two seasons. Returns over a range of yields are shown in Table 7. A weighted average of returns paid to growers over the last five years as furnished by one packinghouse shows a return of $21.00 per carton, fob packinghouse. As trees mature and total production increases, the price has began to level out. Due to a limited market, the grower may not be able to sell or market his entire crop. No markets exist for the culls.

Assessments. Commercial blood orange producers pay two assessments.

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 $0.0235 cents 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 maintain the Central Valley tristeza-free. The assessment varies by pest control district and not all districts participate. Though not all growers participate in this program and pay assessments, in this study an average of $10 per acre is charged. The charges are paid in the property assessment bill. Charges for both the marketing order and CCTEA are shown in Tables 1, 2, and 4 and the assessment rates are detailed in Table 3.

Pickup/ATV. The grower uses the pickup for business and personal use. It is assumed that 5,000 miles are for business use. The grower uses the ATV for checking and monitoring the field. It is also used for irrigating and checking the system, but is not included as an irrigation cost.

Labor. Hourly wages for workers are $8.40 for skilled labor and $6.75 per hour for field workers. Adding 34% for the employers share of federal and state payroll taxes and other possible benefits gives the labor rates shown of $11.25 per hour for skilled labor, and $9.05 per hour for field labor. Labor for operations involving machinery are 20% higher than the operation time given in Table 2 to account for the extra labor involved in equipment set up, moving, maintenance, work breaks, and repair. Wages for management are not included as a cash cost. Any return above total costs is considered a return to management and risk.

Equipment Operating Costs. Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients formulated by ASAE. Fuel and lubrication costs are also determined by ASAE equations based on maximum PTO horsepower, and fuel type. Prices for on-farm delivery of diesel and gasoline are $1.26 and $1.51 per gallon, respectively. The fuel, lube, and repair cost per acre for each operation in Table 2 is determined by multiplying the total hourly operating cost in Table 6 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 7.40% 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.

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. **The blood orange market is limited and the grower should determine his market prior to investing in an orchard.**

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. These costs include property taxes, interest on operating capital, office expense, liability and property insurance, sanitation services, equipment repairs, and management.

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

Insurance. Insurance for farm investments varies depending on the assets included and the amount of coverage. Property insurance provides coverage for property loss and is charged at 0.660% of the average value of the assets over their useful life. Liability insurance covers accidents on the farm and costs $504 for the entire farm.

Office Expense. Office and business expenses are estimated at $110 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.

Investment Repairs. Annual maintenance is calculated as 2 % of the purchase price.

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 ((Purchase Price – Salvage Value) x Capital Recovery Factor) + (Salvage Value x Interest Rate).

Salvage Value. Salvage value is an estimate of the remaining value of an investment at the end of its 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. The interest rate of 6.41% used to calculate capital recovery cost is the USDA-ERS's ten-year average of California's agricultural sector long-run rate of return to production assets from current income. This represents the long-term interest rate typical of another agricultural enterprise.

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 blood oranges are harvested minus any returns from production. The Total Accumulated Net Cash Cost on Table 1, in the fourth year represents the establishment cost. For this study the cost is $3,895 per acre or $38,950 for the 10-acre orchard. The establishment cost is spread over the remaining 36 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. Management/Development companies will have additional labor costs.

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 replace once per ten years, but is not separated out in this study.

Land. Land values for bare or row crop land range from $1,000 to $5,500 per acre, depending on available water. Citrus orchards range from $4,000 to $9,000, whereas tree crops (almonds, walnuts) range from $4,500 to $9,000. Being that the orchard is being established on land previously planted to tree crops, the land in this study is valued at $6,000 per acre.

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Building. The building or buildings are 1,800 square feet of metal building on a cement slab.

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

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 machine will cover approximately 10-acres. The cost includes 6 machines – 1 in the new planting, 5 on the remaining acres. Cost includes installation of the propane-powered machines.

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.

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U.C. COOPERATIVE EXTENSION

Table 1. SAMPLE COSTS PER ACRE TO ESTABLISH A BLOOD ORANGE ORCHARD

SOUTHERN SAN JOAQUIN VALLEY - 2002

	Costs per Acre				
ESTABLISHMENT YEAR:	1st	2nd	3rd	4th	5th
YIELD (Cartons/Acre)				28	207
Planting Costs					
Land Preparation - Remove Old Orchard	200				
Land Preparation - Subsoil	375				
Land Preparation - Disc 3X	60				
Land Preparation - Level Ground	75				
Tree Cost (Replant 2% of Trees in 2nd Year)	935	17			
Layout, Plant & Wrap Trees	145	3			
TOTAL PLANTING COSTS	1,790	20			
Cultural Costs:					
Sucker (Yr 1-3) Prune (Yr 4+)	25	39	45	28	54
Irrigate	50	66	83	120	143
Frost Protection (Water & Wind Machines)	19	19	19	206	207
Fertilizer - Foliar Spray N, Mn, Zn	26	29	29		
Fertilizer - N by Hand Yr 1-3, by drip system 4+	9	14	14	8	8
Insect/Fertilizer -Thrips/Foliar N, Mn, Zn				53	55
Insect/Fertilizer - Worms/Foliar N				37	38
Insect - Ants	5	5	5		
Disease - Brown Rot			32	36	40
Weed - Pre-emergent		49	49	49	49
Weed - Spot Spray	30	30	30	30	30
Weed - Discing 3X	60				
Soil Amendments - Compost					80
Soil Amendments - Soluble Gypsum			30	57	105
Pickup Truck Use	64	64	64	64	64
ATV Use	48	48	48	49	49
Leaf Analysis				3	3
PCA/Consultant Services	35	35	35	35	35
TOTAL CULTURAL COSTS	371	398	483	776	960
Harvesting Costs:					
Pick and Haul				183	595
Pack, Pack Assessment				464	1,517
Assessments				13	19
TOTAL HARVEST COSTS				660	2,131
Interest on operating capital	115	7	15	40	55
Cash Overhead Costs:					
Office Expense	110	110	110	110	110
Liability Insurance	8	8	8	8	8
Property Taxes	73	73	85	85	85
Property Insurance	9	9	16	16	16
Investment Repairs	46	46	89	89	89
TOTAL CASH OVERHEAD COSTS	246	246	308	308	308
TOTAL CASH COSTS	2,522	671	806	1,784	3,454
INCOME FROM PRODUCTION				1,888	6,176
NET CASH COSTS FOR THE YEAR	2,522	671	806		
PROFIT ABOVE CASH COSTS					219
TOTAL ACCUMULATED NET CASH COSTS	2,522	3,193	3,999	**3,895**	1,173

U.C. COOPERATIVE EXTENSION
Table 1. continued

	Costs per Acre				
ESTABLISHMENT YEAR:	1st	2nd	3rd	4th	5th
Non-Cash Overhead Costs:					
Buildings	61	61	61	61	61
Drip Irrigation System	84	84	84	84	84
Shop Tools	22	22	22	22	22
Land	385	385	385	385	385
Fuel Tanks & Pumps	4	4	4	4	4
Gypsum Machine			116	116	116
Wind Machine			148	148	148
Equipment	36	33	33	32	32
TOTAL NON-CASH OVERHEAD COSTS	592	589	853	852	852
TOTAL COST FOR THE YEAR	3,114	1,260	1,659	2,636	4,306
INCOME FROM PRODUCTION				1,888	6,176
NET TOTAL COST FOR THE YEAR	3,114	1,260	1,659	748	
NET PROFIT FOR THE YEAR					1,870
ACCUMULATED NET TOTAL COST	3,114	4,374	6,033	6,781	4,911

UC COOPERATIVE EXTENSION

Table 2. COSTS PER ACRE TO PRODUCE BLOOD ORANGES

SAN JOAQUIN VALLEY - SOUTH 2002

Operation	Operation Time (Hrs/A)	Cash and Labor Costs per acre: Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/ Rent	Total Cost	Your Cost
Cultural:							
Frost Protection	2.19	20	0	200	0	220	
Irrigate	5.44	49	0	200	0	249	
Weed - Pre-emergent	0.50	7	1	41	0	49	
Weed - Spot Spray	0.75	24	2	4	0	30	
Top Trees 1X/3 Yr	0.00	0	0	0	14	14	
Hedge Trees Each Side 1X/3 Yr	0.00	0	0	0	7	7	
Prune - Hand 1X/3 Yr	0.00	0	0	0	116	116	
Shred Brush	0.00	0	0	0	30	30	
Fertilize - Nitrogen	0.30	3	0	21	0	24	
Pest/Fertilizer:Worm/N Mn Zn	0.00	0	0	19	22	41	
Pest/Fertilizer:Thrips Katydid/N	0.00	0	0	41	22	62	
Pest - Thrips Katydid	0.00	0	0	36	22	57	
Pest - Scale	0.00	0	0	84	60	144	
Pest - Brown Rot	0.00	0	0	15	25	40	
Leaf Analysis	0.05	0	0	0	3	3	
Soil Amendment:Soluble Gypsum w/irrigation	1.05	10	0	95	0	105	
Soil Ammendments: Compost	0.00	0	0	80	0	80	
Growth Regulators	0.00	0	0	9	45	54	
Pickup Truck Use	3.33	45	19	0	0	64	
ATV Use	3.33	45	4	0	0	49	
PCA/Consultant Services	0.00	0	0	0	35	35	
TOTAL CULTURAL COSTS	16.94	203	26	845	401	1,473	
Harvest:							
Pick & Haul Fruit	0.00	0	0	0	756	756	
Pack & Marketing	0.00	0	0	0	1,926	1,926	
Assessments	0.00	0	0	21	0	21	
TOTAL HARVEST COSTS	0.00	0	0	21	2,682	2,703	
Interest on operating capital @ 7.40%						75	
TOTAL OPERATING COSTS/ACRE		202	27	866	3,081	4,251	
CASH OVERHEAD:							
Office Expense						110	
Liability Insurance						8	
Property Taxes						100	
Property Insurance						27	
Investment Repairs						69	
TOTAL CASH OVERHEAD COSTS						314	
TOTAL CASH COSTS/ACRE						4,566	
Non-cash Overhead		Per producing Acre		Annual Cost Capital Recovery			
Buildings		800		61		61	
Fuel Tanks 2-250g		58		4		4	
Shop Tools		215		22		22	
Land		6,000		385		385	
Gypsum Machine		482		116		116	
Establishment		3,895		280		280	
Drip Irrigation		200		14		14	
Wind Machine (6)		1,695		148		148	
Equipment		422		57		57	
TOTAL NON-CASH OVERHEAD COSTS		13,767		1,087		1,087	
TOTAL COSTS/ACRE						5,651	

UC COOPERATIVE EXTENSION

Table 3. COSTS AND RETURNS PER ACRE TO PRODUCE BLOOD ORANGES

SAN JOAQUIN VALLEY - SOUTH 2002

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Blood Oranges	490.00	Crtn	16.00	7,840	
OPERATING COSTS					
Frost Protection:					
Water- Frost	2.20	acin	6.67	15	
Wind Machine Operation	100.00	hour	1.86	185	
Irrigation:					
Water	30.00	acin	6.67	200	
Fertilizer:					
UN 32	80.00	lb N	0.26	21	
Urea Low Biuret	30.00	lb N	0.46	14	
Zinc Sulfate 36%	2.00	lb	0.40	1	
Techmangan (MnSO4)	2.00	lb	0.40	1	
Soil Amendment:					
Gypsum Soluble	1.00	ton	95.00	95	
Compost, Haul, Spread	2.00	ton	40.00	80	
Assessment:					
Citrus Research/55lb box	477.00	box	0.02	11	
Tristeza Eradication	1.00	acre	10.00	10	
Herbicide:					
Princep 90S	4.00	lb	4.56	18	
Karmex	4.00	lb	5.59	22	
Roundup Ultra	0.60	pint	6.75	4	
Insecticide:					
Dipel ES	2.00	pint	5.39	11	
Success	12.40	oz	5.32	66	
Spray Oil 415	1.00	gal	3.50	4	
Esteem	17.00	floz	4.96	84	
Fungicide:					
Hydrated Lime	10.00	lb	0.19	2	
Kocide 20/20	10.00	lb	1.28	13	
Growth Regulator:					
Hivol 44	2.50	floz	3.72	9	
Custom:					
Spray Ground -Worm	1.00	acre	22.00	22	
Prune-Top	0.33	acre	43.00	14	
Prune-Hedge	0.33	acre	22.00	7	
Shred Brush	1.00	acre	30.00	30	
Spray Ground -Thrips	2.00	acre	21.50	43	
Spray Ground - Scale	1.00	acre	60.00	60	
Leaf Analysis	1.00	acre	2.50	3	
Spray Ground - Copper	1.00	acre	25.00	25	
Spray Ground Growth Regulator	1.00	acre	45.00	45	
Contract:					
Harvest Pick & Haul	700.00	crtn	1.08	756	
Harvest Pack	490.00	crtn	3.46	1,695	
Market Assessment	490.00	crtn	0.47	230	
Pruning-Hand	0.33	acre	350.00	116	
PCA Fees	1.00	acre	35.00	35	

UC COOPERATIVE EXTENSION
Table 3. continued

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Labor (machine)	9.50	hrs	11.25	107	
Labor (non-machine)	10.53	hrs	9.05	95	
Fuel - Gas	10.02	gal	1.51	15	
Lube				2	
Machinery repair				9	
Interest on operating capital @ 7.40%				75	
TOTAL OPERATING COSTS/ACRE				4,250	
NET RETURNS ABOVE OPERATING COSTS				3,589	
CASH OVERHEAD COSTS:					
Office Expense				110	
Liability Insurance				8	
Property Taxes				100	
Property Insurance				27	
Investment Repairs				69	
TOTAL CASH OVERHEAD COSTS/ACRE				314	
TOTAL CASH COSTS/ACRE				4,566	
NON-CASH OVERHEAD COSTS					
Buildings				61	
Fuel Tanks 2-250g				4	
Shop Tools				22	
Land				385	
Gypsum Machine				116	
Establishment				280	
Drip Irrigation				14	
Wind Machine (6)				148	
Equipment				57	
TOTAL NON-CASH OVERHEAD COSTS/ACRE				1,086	
TOTAL COSTS/ACRE				5,651	
NET RETURNS ABOVE TOTAL COSTS				2,189	

UC COOPERATIVE EXTENSION

Table 4. MONTHLY CASH COSTS – BLOOD ORANGES

SAN JOAQUIN VALLEY - SOUTH 2002

Beginning JAN 02 Ending DEC 02	JAN 02	FEB 02	MAR 02	APR 02	MAY 02	JUN 02	JUL 02	AUG 02	SEP 02	OCT 02	NOV 02	DEC 02	TOTAL
Cultural:													
Frost Protection	73										75	73	220
Fertilize - Nitrogen		8	8	8									24
Weed - Pre-emergent			24						24				48
Pest/Fertilizer:Worm/N Mn Zn			41										41
Irrigate			15	25	32	41	49	41	32	15			249
Top Trees 1X/3 Yr				14									14
Hedge Trees 1X/3 Yr				7									7
Prune - Hand 1X/3 Yr				116									116
Shred Brush				30									30
Soil Amendment:Soluble Gypsum				12	15	18	21	18	15	7			105
Weed Control - Spot Spray				10		10		10					30
Pest/Fertilizer:Thrips Katydid					62								62
Pest Control - Thrips Katydid						57							57
Pest Control - Scale							144						144
Leaf Analysis									3				3
Pest Control - Brown Rot										40			40
Soil Amendments: Compost										80			80
Growth Regulators										54			54
Pickup Truck Use	5	5	5	5	5	5	5	5	5	5	5	5	64
ATV Use	4	4	4	4	4	4	4	4	4	4	4	4	49
PCA/Consultant Services		35											35
TOTAL CULTURAL COSTS	82	52	97	231	118	135	223	78	83	205	84	82	1,472
Harvest:													
Pick & Haul Fruit												756	756
Pack & Pack Assessment												1,926	1,926
Assessments												21	21
TOTAL HARVEST COSTS												2,703	2,703
Interest on operating capital	1	1	1	3	4	4	6	6	7	8	9	26	75
TOTAL OPERATING COSTS/ACRE	83	53	98	234	122	139	229	84	90	213	93	2,811	4,250
OVERHEAD:													
Office Expense	9	9	9	9	9	9	9	9	9	9	9	9	110
Liability Insurance	8												8
Property Taxes	50						50						100
Property Insurance	13						13						27
Investment Repairs	6	6	6	6	6	6	6	6	6	6	6	6	69
TOTAL CASH OVERHEAD COSTS	87	15	15	15	15	15	78	15	15	15	15	15	314
TOTAL CASH COSTS/ACRE	170	68	113	249	137	154	307	99	105	228	108	2,826	4,564

UC COOOPERATIVE EXTENSION

Table 5. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS

SAN JOAQUIN VALLEY - SOUTH 2002

ANNUAL EQUIPMENT COSTS

						Cash Overhead		
Yr	Description	Price	Yrs Life	Salvage Value	Capital Recovery	Insur-ance	Taxes	Total
02	ATV 4WD	5,683	7	2,156	779	26	39	844
02	Pickup Truck 1/2 Ton	19,065	7	7,232	2,614	87	131	2,833
02	Weed Sprayer - SP	14,468	10	1,447	1,896	53	80	2,029
TOTAL		39,216		10,835	5,290	165	250	5,705
	60% of New Cost *	23,530		6,501	3,174	99	150	3,423

*Used to reflect a mix of new and used equipment

ANNUAL INVESTMENT COSTS

					Cash Overhead			
Description	Price	Yrs Life	Salvage Value	Capital Recovery	Insur-ance	Taxes	Repairs	Total
Buildings 1,800 sqft	48,000	30		3,641	158	240	960	5,000
Drip Irrigation	12,000	40		839	40	60	240	1,179
Establishment	38,950	36		2,795	129	195	0	3,119
Fuel Tanks 2-250g	3,500	40	350	243	13	19	70	345
Gypsum Machine	4,825	5		1,158	16	24	97	1,295
Land	360,000	40	360,000	23,076	0	3,600	0	26,676
Shop Tools	12,879	15	1,288	1,308	47	71	258	1,684
Wind Machine (6)	101,676	20	10,167	8,897	369	559	2,033	11,859
TOTAL INVESTMENT	581,830		371,805	41,957	772	4,768	3,658	51,157

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/ Farm	Unit	Price/ Unit	Total Cost
Liability Insurance	60	acre	8.40	504
Office Expense	60	acre	110.00	6,600

UC COOPERATIVE EXTENSION

Table 6. HOURLY EQUIPMENT COSTS

SAN JOAQUIN VALLEY - SOUTH 2002

			COSTS PER HOUR						
				Cash Overhead			Operating		
Yr	Description	Actual Hours Used	Capital Recovery	Insur-ance	Taxes	Repairs	Fuel & Lube	Total Oper.	Total Costs/Hr.
02	ATV 4WD	199.30	2.35	0.08	0.12	0.41	0.87	1.28	3.83
02	Pickup Truck 1/2 Ton	199.30	7.87	0.26	0.40	1.40	4.34	5.74	14.26
02	Weed Sprayer - SP	62.50	18.21	0.50	0.76	2.50	0.00	2.50	21.97

UC COOPERATIVE EXTENSION
Table 7. RANGING ANALYSIS
SAN JOAQUIN VALLEY - SOUTH 2002

COSTS PER ACRE AT **VARYING YIELDS** TO PRODUCE BLOOD ORANGES

	YIELD (cartons*/acre)						
	340	390	440	490	540	590	640
OPERATING COSTS/ACRE:							
Cultural Cost	1,473	1,473	1,473	1,473	1,473	1,473	1,473
Harvest Cost (includes assessment)	1,879	2,154	2,428	2,703	2,978	3,253	3,528
Interest on operating capital	70	71	73	75	77	78	80
TOTAL OPERATING COSTS/ACRE	3,422	3,698	3,974	4,251	4,528	4,804	5,081
TOTAL OPERATING COSTS/carton	10.06	9.48	9.03	8.68	8.39	8.14	7.94
CASH OVERHEAD COSTS/ACRE	314	314	314	314	314	314	314
TOTAL CASH COSTS/ACRE	3,736	4,012	4,288	4,565	4,842	5,118	5,395
TOTAL CASH COSTS/carton	10.99	10.29	9.75	9.32	8.97	8.67	8.43
NON-CASH OVERHEAD COSTS/ACRE	1,086	1,086	1,086	1,086	1,086	1,086	1,086
TOTAL COSTS/ACRE	4,822	5,098	5,374	5,651	5,928	6,204	6,481
TOTAL COSTS/carton	14.18	13.07	12.21	11.53	10.98	10.52	10.13

*cartons = 37.5 pounds

NET RETURNS PER ACRE **ABOVE OPERATING COSTS** FOR BLOOD ORANGES

PRICE	YIELD (cartons*/acre)						
$/carton	340	390	440	490	540	590	640
8.00	-702	-578	-454	-331	-208	-84	39
10.00	-22	202	426	649	872	1,096	1,319
12.00	658	982	1,306	1,629	1,952	2,276	2,599
14.00	1,338	1,762	2,186	2,609	3,032	3,456	3,879
16.00	2,018	2,542	3,066	3,589	4,112	4,636	5,159
18.00	2,698	3,322	3,946	4,569	5,192	5,816	6,439
20.00	3,378	4,102	4,826	5,549	6,272	6,996	7,719

NET RETURN PER ACRE **ABOVE CASH COST** FOR BLOOD ORANGES

PRICE	YIELD (cartons*/acre)						
$/carton	340	390	440	490	540	590	640
8.00	-1,016	-892	-768	-645	-522	-398	-275
10.00	-336	-112	112	335	558	782	1,005
12.00	344	668	992	1,315	1,638	1,962	2,285
14.00	1,024	1,448	1,872	2,295	2,718	3,142	3,565
16.00	1,704	2,228	2,752	3,275	3,798	4,322	4,845
18.00	2,384	3,008	3,632	4,255	4,878	5,502	6,125
20.00	3,064	3,788	4,512	5,235	5,958	6,682	7,405

NET RETURNS PER ACRE **ABOVE TOTAL COST** FOR BLOOD ORANGES

PRICE	YIELD (cartons*/acre)						
$/carton	340	390	440	490	540	590	640
8.00	-2,102	-1,978	-1,854	-1,731	-1,608	-1,484	-1,361
10.00	-1,422	-1,198	-974	-751	-528	-304	-81
12.00	-742	-418	-94	229	552	876	1,199
14.00	-62	362	786	1,209	1,632	2,056	2,479
16.00	618	1,142	1,666	2,189	2,712	3,236	3,759
18.00	1,298	1,922	2,546	3,169	3,792	4,416	5,039
20.00	-637	2,702	3,426	4,149	4,872	5,596	6,319