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**UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION**

**2002**

**SAMPLE COSTS TO  
ESTABLISH A PUMMELO ORCHARD AND PRODUCE**

**PUMMELOS**

**SPECIALITY CITRUS**



**SAN JOAQUIN VALLEY - South**  
Low Volume Irrigation

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UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH A PUMMELO ORCHARD

and PRODUCE PUMMELOS  
San Joaquin Valley South - 2002

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INTRODUCTION

Sample costs to establish a Pummelo orchard and produce Pummelos 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>.

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## ASSUMPTIONS

The assumptions refer to Tables 1 to 7 and pertain to sample costs to establish a Pummelo orchard and produce Pummelos in the Southern San Joaquin Valley. **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 is owned and farmed by the grower and consists of 60 contiguous acres. Pummelo establishment and production costs are based on ten acres. The remaining acreage is in mature orange trees.

### 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.** No specific variety is accounted for in this study. The pummelo is believed to be an ancestor of the grapefruit and is the largest of the citrus fruits. Most cultural and management practices are similar to navel oranges. The trees are planted on 22 X 22-foot spacing, 90 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. Pummelo 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.

**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 includes the water, labor and system operation and monitoring costs. 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

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

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.

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

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

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.

**Fertilization.** Nitrogen is the major nutrient required for proper tree growth and optimum yields. In the first two years, 8-8-8 liquid fertilizer is applied from April or immediately after planting to August through the drip line. Beginning in the third year, the 8-8-8 is applied in June and UN-32 (32-0-0) is applied through the drip lines in several applications - April, late July and mid-August. Low biuret urea (46-0-0), potassium nitrate (13-45-0) and micronutrients (zinc sulfate, manganese sulfate) are applied as foliar fertilizers with the March worm spray. Low biuret urea is also applied with the May kadydid and thrip spray. Nitrogen fertilizer rates used in this study 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 (lbs) to Pummelo Orchards

Year	per tree	per acre	dripline	foliar
1	0.25	22.5		
2	0.25	22.5		
3	0.50	45.0	30.25	14.75
4	0.75	67.5	52.75	14.75
5	1.00	90.0	75.25	14.75
6+	1.50	135.0	120.25	14.75

**Soil Amendments.** In this study, beginning in the fourth year, manure at two-tons per acre is applied annually in October and gypsum at two-tons per acre per year is applied in the spring. 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 argyrospilus*)]. Control for citrus thrips, orangeworms, and katydids begin in the third year. Orangeworms are controlled in March with 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 Lorsban insecticide 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 third year for fruit protection rather than foliage protection. California red scale (*Aonidiella aurantii*) is not treated on young trees.

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 - third year in this study. New plantings with close spacing may have commercial yields in the second or third year. A contracted operator harvests the field. Yield data or history in the production this production area is not available. Yields used in this study are projected from various citrus data and shown in Table D.

**Returns.** See Returns in Production section.

## Production Operating Costs

**Pruning.** Pummelos grow vigorously similar to lemons. Pruning methods and frequencies vary widely on mature trees. In this study, the trees are topped every year. Each row is hedged (both sides of tree) on alternate years and one-half the cost is included each year. The trees are hand pruned every third year and one-third of the cost is included each year. 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. Pruning is generally done after harvest (April in this study). Prunings are stacked into the middle, between rows, and shredded by a custom operator.

**Fertilization.** Nitrogen as UN-32 is applied through the irrigation system in April, and in late July to mid-August. An NPK fertilizer (8-8-8) is applied through the irrigation system during June and supplies approximately one-third of the N requirements. Foliar applications of N as low biuret urea and potassium nitrate plus minor nutrients, zinc sulfate and manganese sulfate, are mixed and sprayed with the March worm treatment. A second low biuret urea application in May is made with the thrips and 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 per 20 acres is taken.

**Soil Amendments.** Manure at two tons per acre is spread commercially each year in October and gypsum at two tons per acre per year is spread in May.

**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 include the water and labor. Irrigation labor includes 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* 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](http://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. Surviving 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. Lorsban insecticide is used in the first application and Success insecticide in the second. Urea and micronutrients are mixed with the worm spray and urea, only, with the first thrip and katydid spray. Esteem (insect growth regulator) is applied in July to control California red scale. The grower alternates each year with Esteem and Lorsban for red scale control. 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 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.

**Harvest.** Pummelo 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.

The fruit is harvested from October through April. A December harvest is shown in this study. Pummelos are hand picked and put into field bins that hold 900 pounds of fruit. The trees are usually picked once, but may occasionally be size picked depending upon the market. The pummelos 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 these services will vary, but a cost of \$4.89 per carton is used in this study.

**Yields.** Typical annual yields are measured by volume – number of cartons. Yields in this study are based on 36-pound grapefruit cartons. According to packers, because of the thick rinds, the carton weights are closer to 26 pounds. Packed cartons represent 90% of the fruit picked. Yields from the third year to full production for cartons are shown in Table D.

**Returns.** The price of \$10.00 per carton is a weighted average based on prices paid to growers over the last five years as furnished by a packinghouse. The 10% culls have no value. Returns over a range of yields are shown in Table 7.

Table D. Projected Pummelo Yields in Cartons Per Acre

Year	total cartons (36 lb)	cartons* (36 lb)
3	106	95
4	200	180
5	250	225
6	333	300
7	389	350
8	444	400
9	500	450
10+	556	500

\*90% Packout

**Assessments.** Commercial Pummelo 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.

**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.



## 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  $((\text{Purchase Price} - \text{Salvage Value}) \times \text{Capital Recovery Factor}) + (\text{Salvage Value} \times \text{Interest Rate})$ .

*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.* 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. It is used to reflect the long-term realized rate of return to these specialized resources that can only be used effectively in the agricultural sector. In other words, the next best alternative use for these resources is in 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 Pummelos are harvested minus any returns from production. The Total Accumulated Net Cash Cost on Table 1, in the third year represents the establishment cost. For this study the cost is \$3,325 per acre or \$33,250 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. 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 be replaced 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.

**Building.** The shop building or buildings total 2,400 square feet of metal buildings 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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UC COOPERATIVE EXTENSION  
**Table 1. SAMPLE COSTS PER ACRE TO ESTABLISH A PUMMELO ORCHARD**  
 SOUTHERN SAN JOAQUIN VALLEY - 2002

	Costs per Acre					
	YEAR	1st	2nd	3rd	4th	5th
<b>YIELD (Cartons/Acre)</b>				95	180	225
<b>Planting Costs</b>						
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)		765	17			
Layout, Plant & Wrap Trees		119	3			
<b>TOTAL PLANTING COSTS</b>		<b>1,594</b>	<b>20</b>			
<b>Cultural Costs:</b>						
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 - N thru drip		20	20	15	23	34
Insect/Fertilizer -Thrips/Foliar N, Mn, Zn				51	62	79
Insect/Fertilizer - Worms/Foliar N				46	46	46
Insect - Ants		5	5	5		
Disease - Brown Rot				32	36	40
Weed - Pre-emergent			45	49	49	49
Weed - Spot Spray		30	30	30	30	30
Weed - Discing 3X		60				
Soil Amendments - Compost					48	48
Soil Amendments - Gypsum					70	70
Pickup Truck Use		66	64	64	64	64
ATV Use		48	48	48	49	49
Leaf Analysis					3	3
PCA/Consultant Services		35	35	35	35	35
<b>TOTAL CULTURAL COSTS</b>		<b>356</b>	<b>371</b>	<b>522</b>	<b>871</b>	<b>951</b>
<b>Harvesting Costs:</b>						
Pick and Haul				118	222	278
Pack, Market Assessment				359	680	850
Assessments				13	13	14
<b>TOTAL HARVEST COSTS</b>				<b>490</b>	<b>915</b>	<b>1,142</b>
Interest on operating capital		106	5	25	44	51
<b>Cash Overhead Costs:</b>						
Office Expense		110	110	110	110	110
Liability Insurance		8	8	8	8	8
Property Taxes		73	73	82	82	82
Property Insurance		9	9	15	15	15
Investment Repairs		46	46	79	79	79
<b>TOTAL CASH OVERHEAD COSTS</b>		<b>246</b>	<b>246</b>	<b>294</b>	<b>294</b>	<b>294</b>
<b>TOTAL CASH COSTS</b>		<b>2,302</b>	<b>642</b>	<b>1,331</b>	<b>2,124</b>	<b>2,438</b>
<b>INCOME FROM PRODUCTION</b>				<b>950</b>	<b>1,800</b>	<b>2,250</b>
<b>NET CASH COSTS FOR THE YEAR</b>		<b>2,302</b>	<b>642</b>	<b>381</b>	<b>324</b>	<b>188</b>
<b>PROFIT ABOVE CASH COSTS</b>						
<b>TOTAL ACCUMULATED NET CASH COSTS</b>		<b>2,302</b>	<b>2,944</b>	<b>3,325</b>	<b>3,649</b>	<b>3,837</b>

UC COOPERATIVE EXTENSION

Table 1. continued

	Costs per Acre					
	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
Wind Machine				148	148	148
Equipment		36	33	33	32	32
<b>TOTAL NON-CASH OVERHEAD COSTS</b>		<b>592</b>	<b>587</b>	<b>737</b>	<b>736</b>	<b>736</b>
<b>TOTAL COST FOR THE YEAR</b>		<b>2,894</b>	<b>1,229</b>	<b>2,068</b>	<b>2,860</b>	<b>3,174</b>
<b>INCOME FROM PRODUCTION</b>				<b>665</b>	<b>1,800</b>	<b>2,250</b>
<b>NET TOTAL COST FOR THE YEAR</b>		<b>2,894</b>	<b>1,229</b>	<b>1,403</b>	<b>1,060</b>	<b>924</b>
<b>NET PROFIT FOR THE YEAR</b>						
<b>ACCUMULATED NET TOTAL COST</b>		<b>2,894</b>	<b>4,123</b>	<b>5,526</b>	<b>6,586</b>	<b>7,510</b>

UC COOPERATIVE EXTENSION  
**Table 2. COSTS PER ACRE TO PRODUCE PUMMELOS**  
 SAN JOAQUIN VALLEY - SOUTH 2002

Operation	Cash and Labor Costs per acre						
	Operation Time (Hrs/A)	Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/ Rent	Total Cost	Your Cost
<b>Cultural:</b>							
Frost Protection	2.19	20	0	200	0	220	
Irrigate	5.44	49	0	200	0	249	
Weed - Pre-emergent	0.50	6	2	40	0	48	
Weed - Spot Spray	0.75	24	2	4	0	30	
Top Trees	0.00	0	0	0	43	43	
Hedge Trees Each Side 1X/2 Yr	0.00	0	0	0	11	11	
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	53	0	56	
Pest/Fertilizer:Worm/N Mn Zn	0.00	0	0	23	22	45	
Pest/Fertilizer:Thrips Katydid/N	0.00	0	0	57	22	79	
Pest - Thrips Katydid	0.00	0	0	34	22	56	
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:Gypsum	0.00	0	0	56	14	70	
Soil Ammendments: Compost	0.00	0	0	34	14	48	
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	
<b>TOTAL CULTURAL COSTS</b>	<b>15.89</b>	<b>192</b>	<b>27</b>	<b>800</b>	<b>417</b>	<b>1,436</b>	
<b>Harvest:</b>							
Pick & Haul Fruit	0.00	0	0	0	618	618	
Pack & Assessment	0.00	0	0	0	1,890	1,890	
Assessments	0.00	0	0	19	0	19	
<b>TOTAL HARVEST COSTS</b>	<b>0.00</b>	<b>0</b>	<b>0</b>	<b>19</b>	<b>2,508</b>	<b>2,527</b>	
Interest on operating capital @ 7.40%						75	
<b>TOTAL OPERATING COSTS/ACRE</b>		<b>194</b>	<b>27</b>	<b>820</b>	<b>2,923</b>	<b>4,039</b>	
<b>CASH OVERHEAD:</b>							
Office Expense						110	
Liability Insurance						8	
Property Taxes						95	
Property Insurance						23	
Investment Repairs						59	
<b>TOTAL CASH OVERHEAD COSTS</b>						<b>295</b>	
<b>TOTAL CASH COSTS/ACRE</b>						<b>4,334</b>	
Non-cash Overhead		Per producing Acre		Annual Cost Capital Recovery			
Buildings		800		61		61	
Fuel Tanks		58		4		4	
Shop Tools		215		22		22	
Land		6,000		385		385	
Establishment		3,325		237		237	
Drip Irrigation		200		14		14	
Wind Machine (6)		1,695		148		148	
Equipment		422		57		57	
<b>TOTAL NON-CASH OVERHEAD COSTS</b>		<b>12,715</b>		<b>928</b>		<b>928</b>	
<b>TOTAL COSTS/ACRE</b>						<b>5,261</b>	

UC COOPERATIVE EXTENSION  
**Table 3. COSTS AND RETURNS PER ACRE TO PRODUCE PUMMELOS**  
 SAN JOAQUIN VALLEY - SOUTH 2002

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
<b>GROSS RETURNS</b>					
Pummelos	500.00	crtn	10.00	5,000	
<b>OPERATING COSTS</b>					
<b>Frost Protection:</b>					
Water-SJV Frost	2.20	acin	6.67	15	
Wind Machine Operation	100.00	hour	1.86	185	
<b>Irrigation:</b>					
Water	30.00	acin	6.67	200	
<b>Fertilizer:</b>					
UN 32	80.25	lb N	0.26	21	
Urea Low Biuret	11.50	lb N	0.46	5	
Zinc Sulfate 36%	2.00	lb	0.40	1	
Techmangan (Mn)	2.00	lb	0.40	1	
8-8-8	500.00	lb	0.06	32	
13-45-0 Potassium Nitrate	25.00	lb	0.32	8	
<b>Soil Amendment:</b>					
Gypsum	2.00	ton	28.00	56	
Manure	2.00	ton	17.00	34	
<b>Herbicide:</b>					
Princep 90S	4.00	lb	4.56	18	
Karmex	4.00	lb	5.59	22	
Roundup Ultra	0.60	pint	6.75	4	
<b>Insecticide:</b>					
Dipel ES	2.00	pint	5.39	11	
Success	6.40	oz	5.32	34	
Lorsban 4E	8.00	pint	6.83	55	
Esteem	17.00	floz	4.96	84	
<b>Fungicide:</b>					
Hydrated Lime	10.00	lb	0.19	2	
Kocide 20/20	10.00	lb	1.28	13	
<b>Assessment:</b>					
Citrus Research/55lb box	364.00	box	0.02	9	
Tristeza Eradication	3.00	acre	10.00	30	
<b>Custom:</b>					
Spray Ground - Worm	1.00	acre	22.00	22	
Prune-Top	1.00	acre	43.00	43	
Prune-Hedge	0.50	acre	22.00	11	
Shred Brush	1.00	acre	30.00	30	
Spread Gypsum & Manure	2.00	acre	14.00	28	
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	
<b>Contract:</b>					
Harvest Pick & Haul	556.00	crtn	1.11	618	
Harvest Pack	500.00	crtn	3.31	1,655	
Pack Assessment	500.00	crtn	0.47	235	
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)	9.48	hrs	9.05	86	
Fuel - Gas	10.02	gal	1.51	15	
Lube				2	
Machinery repair				9	
Interest on operating capital @ 7.40%				75	
<b>TOTAL OPERATING COSTS/ACRE</b>				<b>4,038</b>	
<b>NET RETURNS ABOVE OPERATING COSTS</b>				<b>962</b>	
<b>CASH OVERHEAD COSTS:</b>					
Office Expense				110	
Liability Insurance				8	
Property Taxes				95	
Property Insurance				23	
Investment Repairs				59	
<b>TOTAL CASH OVERHEAD COSTS/ACRE</b>				<b>296</b>	
<b>TOTAL CASH COSTS/ACRE</b>				<b>4,334</b>	
<b>NON-CASH OVERHEAD COSTS</b>					
Buildings				61	
Fuel Tanks				4	
Shop Tools				22	
Land				385	
Establishment				237	
Drip Irrigation				14	
Wind Machine (6)				148	
Equipment				57	
<b>TOTAL NON-CASH OVERHEAD COSTS/ACRE</b>				<b>927</b>	
<b>TOTAL COSTS/ACRE</b>				<b>5,261</b>	
<b>NET RETURNS ABOVE TOTAL COSTS</b>				<b>-261</b>	



UC COOPERATIVE EXTENSION  
**Table 4. MONTHLY CASH COSTS - PUMMELOS**  
 SAN JOAQUIN VALLEY - SOUTH 2002

Beginning JAN 02	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Ending DEC 02	02	02	02	02	02	02	02	02	02	02	02	02	
Cultural:													
Frost Protection	73										75	73	220
Weed - Pre-emergent			24						24				48
Pest/Fertilizer:Worm/N Mn Zn			45										45
Irrigate			15	25	32	41	49	41	32	15			249
Top Trees				43									43
Hedge Trees 1X/2 Yr				11									11
Prune - Hand 1X/3 Yr				116									116
Shred Brush				30									30
Fertilize - Nitrogen				11		33	11						56
Weed Control - Spot Spray				10		10		10					30
Pest/Fertilizer:Thrips Katydid					79								79
Soil Amendment: Gypsum					70								70
Pest Control - Thrips Katydid						56							56
Pest Control - Scale							144						144
Weed Control - Pre-emergent									29				29
Leaf Analysis									3				3
Pest Control - Brown Rot										40			40
Soil Amendments: Manure										48			48
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
<b>TOTAL CULTURAL COSTS</b>	<b>82</b>	<b>44</b>	<b>93</b>	<b>255</b>	<b>190</b>	<b>149</b>	<b>213</b>	<b>60</b>	<b>68</b>	<b>112</b>	<b>84</b>	<b>82</b>	<b>1,436</b>
Harvest:													
Pick & Haul Fruit												618	618
Pack & Pack Assessment												1,890	1,890
Assessments												19	19
<b>TOTAL HARVEST COSTS</b>												<b>2,527</b>	<b>2,527</b>
Interest on operating capital	1	1	1	3	4	5	6	7	7	8	8	24	75
<b>TOTAL OPERATING COSTS/ACRE</b>	<b>83</b>	<b>45</b>	<b>94</b>	<b>258</b>	<b>194</b>	<b>154</b>	<b>219</b>	<b>67</b>	<b>75</b>	<b>120</b>	<b>92</b>	<b>2,633</b>	<b>4,038</b>
OVERHEAD:													
Office Expense	9	9	9	9	9	9	9	9	9	9	9	9	110
Liability Insurance	8												8
Property Taxes	48						48						95
Property Insurance	12						12						23
Investment Repairs	5	5	5	5	5	5	5	5	5	5	5	5	59
<b>TOTAL CASH OVERHEAD COSTS</b>	<b>82</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>74</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>295</b>
<b>TOTAL CASH COSTS/ACRE</b>	<b>165</b>	<b>59</b>	<b>108</b>	<b>272</b>	<b>208</b>	<b>168</b>	<b>293</b>	<b>81</b>	<b>89</b>	<b>134</b>	<b>106</b>	<b>2,647</b>	<b>4,333</b>

UC COOPERATIVE EXTENSION  
**Table 5. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS**  
 SAN JOAQUIN VALLEY - SOUTH 2002

ANNUAL EQUIPMENT COSTS

Yr	Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead		Total
						Insur- ance	Taxes	
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
<b>TOTAL</b>		<b>39,216</b>		<b>10,835</b>	<b>5,290</b>	<b>165</b>	<b>250</b>	<b>5,705</b>
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

Description	Price	Yrs Life	Salvage Value	Capital Recovery	Cash Overhead			Total
					Insur- ance	Taxes	Repairs	
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	33,250	36		2,369	110	166	0	2,645
Fuel Tanks 2-250g	3,500	40	350	243	13	19	70	345
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
<b>TOTAL INVESTMENT</b>	<b>571,305</b>		<b>371,805</b>	<b>40,373</b>	<b>737</b>	<b>4,715</b>	<b>3,561</b>	<b>49,388</b>

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/		Price/ Unit	Total Cost
	Farm	Unit		
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

Yr	Description	COSTS PER HOUR							Total Costs/Hr.
		Actual Hours Used	Cash Overhead			Operating			
			Capital Recovery	Insur- ance	Taxes	Repairs	Fuel & Lube	Total Oper.	
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 PUMMELOS

	YIELD (cartons*/acre)						
	350	400	450	500	550	600	650
<b>OPERATING COSTS/ACRE:</b>							
Cultural Cost	1,436	1,436	1,436	1,436	1,436	1,436	1,436
Harvest Cost (includes assessment)	1,772	2,024	2,275	2,527	2,779	3,030	3,282
Interest on operating capital	71	72	74	75	77	79	80
<b>TOTAL OPERATING COSTS/ACRE</b>	<b>3,279</b>	<b>3,532</b>	<b>3,785</b>	<b>4,038</b>	<b>4,292</b>	<b>4,545</b>	<b>4,798</b>
<b>TOTAL OPERATING COSTS/CRTN</b>	<b>9.37</b>	<b>8.83</b>	<b>8.41</b>	<b>8.08</b>	<b>7.80</b>	<b>7.58</b>	<b>7.38</b>
<b>CASH OVERHEAD COSTS/ACRE</b>	<b>296</b>	<b>296</b>	<b>296</b>	<b>296</b>	<b>296</b>	<b>296</b>	<b>296</b>
<b>TOTAL CASH COSTS/ACRE</b>	<b>3,575</b>	<b>3,828</b>	<b>4,081</b>	<b>4,334</b>	<b>4,588</b>	<b>4,841</b>	<b>5,094</b>
<b>TOTAL CASH COSTS/CRTN</b>	<b>10.21</b>	<b>9.57</b>	<b>9.07</b>	<b>8.67</b>	<b>8.34</b>	<b>8.07</b>	<b>7.84</b>
<b>NON-CASH OVERHEAD COSTS/ACRE</b>	<b>927</b>	<b>927</b>	<b>927</b>	<b>927</b>	<b>927</b>	<b>927</b>	<b>927</b>
<b>TOTAL COSTS/ACRE</b>	<b>4,502</b>	<b>4,755</b>	<b>5,008</b>	<b>5,261</b>	<b>5,515</b>	<b>5,768</b>	<b>6,021</b>
<b>TOTAL COSTS/CRTN</b>	<b>12.86</b>	<b>11.89</b>	<b>11.13</b>	<b>10.52</b>	<b>10.03</b>	<b>9.61</b>	<b>9.26</b>

\*cartons = 36 pounds

NET RETURNS PER ACRE ABOVE OPERATING COSTS FOR PUMMELOS

PRICE	YIELD (cartons*/acre)						
	350	400	450	500	550	600	650
\$/carton							
7.00	-830	-734	-636	-540	-443	-346	-249
8.00	-480	-334	-186	-40	107	254	401
9.00	-130	66	264	460	657	854	1,051
10.00	220	466	714	960	1,207	1,454	1,701
11.00	570	866	1,164	1,460	1,757	2,054	2,351
12.00	920	1,266	1,614	1,960	2,307	2,654	3,001
13.00	1,270	1,666	2,064	2,460	2,857	3,254	3,651

NET RETURN PER ACRE ABOVE CASH COST FOR PUMMELOS

PRICE	YIELD (cartons*/acre)						
	350	400	450	500	550	600	650
\$/carton							
7.00	-1,126	-1,030	-932	-836	-739	-642	-545
8.00	-776	-630	-482	-336	-189	-42	105
9.00	-426	-230	-32	164	361	558	755
10.00	-76	170	418	664	911	1,158	1,405
11.00	274	570	868	1,164	1,461	1,758	2,055
12.00	624	970	1,318	1,664	2,011	2,358	2,705
13.00	974	1,370	1,768	2,164	2,561	2,958	3,355

NET RETURNS PER ACRE ABOVE TOTAL COST FOR PUMMELOS

PRICE	YIELD (cartons*/acre)						
	350	400	450	500	550	600	650
\$/carton							
7.00	-2,053	-1,957	-1,859	-1,763	-1,666	-1,569	-1,472
8.00	-1,703	-1,557	-1,409	-1,263	-1,116	-969	-822
9.00	-1,353	-1,157	-959	-763	-566	-369	-172
10.00	-1,003	-757	-509	-263	-16	231	478
11.00	-653	-357	-59	237	534	831	1,128
12.00	-303	43	391	737	1,084	1,431	1,778
13.00	-637	443	841	1,237	1,634	2,031	2,428