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2020
SAMPLE COSTS TO ESTABLISH AND PRODUCE
PISTACHIOS

Low-Volume Irrigation
San Joaquin Valley South

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Prepared By:

Roger Baldwin	UCCE Human-Wildlife Conflict Resolution Specialist, UC Davis
Mark Battany	UCCE Water Management and BioMeterology Advisor, San Luis Obispo County
Robert Beede	UCCE Farm Advisor (Retired, Emeritus), Kings County
Gurreet S. Brar	California State University, Fresno, Professor, Pomology
Mae Culumber	UCCE Farm Advisor, Fresno County
Louise Ferguson	UCCE Pomology Specialist, UC Davis
Elizabeth Fichtner	UCCE Farm Advisor, Tulare County
Phoebe Gordon	UCCE Farm Advisor, Madera County
Brad Hanson	UCCE Weed Specialist, UC Davis
David Haviland	UCCE Farm Advisor, Kern County
Kurt Hembree	UCCE Farm Advisor, Fresno County
Craig E. Kallsen	UCCE Farm Advisor, Kern County
Giulia Marino	UCCE Pomology Specialist, UC Davis
Blake Sanden	UCCE Farm Advisor, (Retired, Emeritus), Kern County
Themis J. Michailides	UCCE Plant Pathology Specialist, UC Davis
Florent Trouillas	UCCE Plant Pathology Specialist, UC Davis
Daniele Zaccaria	UCCE Agricultural Water Management Specialist, UC Davis
Linda Harris	UCCE Food Safety and Technology Specialist, UC Davis
Donald Stewart	SRA, Agricultural Issues Center and The Department of Agricultural and Resource Economics, UC Davis
Daniel A. Sumner	Director Agricultural Issues Center and Frank H. Buck Jr. Distinguished Professor, Department of Agricultural and Resource Economics, UC Davis

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STUDY CONTENTS

INTRODUCTION

Sample costs to establish a pistachio orchard and produce pistachios in the southern San Joaquin Valley are presented in this study. This analysis does not represent any single farm and is intended as a guide only. It can be used to help guide production decisions, estimate potential returns, prepare budgets and evaluate production loans. Sample costs given for labor, materials, equipment and contract services are based on June 2020 figures. A blank column titled Your Costs is provided in Tables 1 thru 4 for your convenience.

For an explanation of calculations used in the study, refer to the section titled Assumptions. For more information contact Donald Stewart, University of California Agriculture and Natural Resources, Agricultural Issues Center, Department of Agricultural and Resource Economics, at 530-752-4651 or destewart@ucdavis.edu. To discuss this study with a local extension advisor, contact your county cooperative extension office. ucanr.edu/CountyOffices/.

Sample Cost of Production studies for many commodities are available and can be downloaded from the

Department website, coststudies.ucdavis.edu. Archived studies are also available on the website.

Costs and Returns Study Program/Acknowledgements. A "costs and returns" study is a compilation of specific crop data collected from meetings with professionals working in production agriculture from the region the study is based. The authors thank the farmer cooperators, UC Cooperative Extension and other industry representatives who provided information, assistance and expert advice. **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**. *The University is an affirmative action/equal opportunity employer.*

ASSUMPTIONS

The assumptions refer to Tables 1 through 9 and pertain to sample costs to establish an orchard and produce pistachios in the southern San Joaquin Valley under low-volume (drip) irrigation. Pistachio trees have a long production life if well maintained. The economic life used in this cost analysis is 40 years.

The cultural practices described and materials used are considered typical for a well-managed orchard in the region, but they will not apply to every situation. The grower farms the orchard; therefore, no salaries are included for management. The orchard is assumed to have a well-drained, deep, clay-loam soil with an electrical conductivity of less than 4 ds/m and irrigated with water with a similarly low salt content. Timing of and types of cultural practices will vary among growers within the region and from season to season due to variables such as weather, soil, pest pressure and the differences can be significant.

Farm. The hypothetical farm consists of 80 contiguous acres. Pistachio orchard establishment and production are on 76 acres. Roads, irrigation filtration systems, harvest staging and turning areas occupy the remaining four acres.

Establishment Cultural Practices and Material Inputs

Land Preparation. The orchard is established on soil whose profile is relatively uniform in texture and previously planted to row crops. Soil profile assessment of individual subject properties by means of backhoe pits is critical prior to planting. An individual competent in evaluating soils for texture stratification or salinity problems is employed. This study uses one pit per 20 acres. Soil samples are also taken at selected and recorded depths for salinity analysis by a soils and water laboratory. Failure to modify any dense subsoil or stratified soil textures may limit root development and water infiltration. Not all fields will require deep tillage. If there is a hardpan or the soil profile is stratified, then deep tillage is required.

Pre-Plant. Operations done the year prior to planting are included in establishment year one (Table 1). The land is tilled with a slip-plow down the tree row to a depth of four to five feet. The field is then ripped with a one shank ripper in between the slip-plow (in between the tree rows) at the same depth. Currently, in many orchards, deep tillage is only done on the area that will be drip irrigated. Ripping is followed by one pass with a stubble disc. A custom operator does the ripping and stubble discing. The grower then finish-discs and floats the ground twice to smooth the surface.

The use of drip irrigation allows planting on slopes that would not be possible with furrow or flood irrigation. However, on sloping land, leveling and runoff management remains important for wet years when flood events may occur, when using surface and flood water for recharging the soil profile and for leaching during dormant periods. In challenging soils, for example those with high salinity or sodicity, soil amendments may be applied and incorporated at various stages of land preparation.

Trees. In California, growers use *Phytophthora* and *Verticillium* resistant rootstocks derived from *Pistacia integerrima*, or interspecific hybrids of *P. atlantica* and *P. integerrima.* Rootstocks are available as seedlings or clones. Seedlings are genetically more variable, clones within a nursery lot generally are not. However, seedling and clonal rootstocks from different nurseries vary between nurseries. Usually, the rootstocks are first planted in the orchard and the scion cultivar is field-budded to the rootstocks. However, pre-budded nursery trees are available for planting, and are becoming more popular. A number of cultivars are available that vary in bloom and harvest timing and nut quality characteristics.

In this study the 'Golden Hills' female is grafted onto a UCB-1 clonal-rootstock selection in the field. Because pistachios are dioecious, male trees (the 'Randy' cultivar in this study) must be uniformly distributed among the female trees. Currently, the industry buds 1 male tree to every 19 to 35 female trees. This study uses the male: female ratio of 1:24; every fifth tree in every 5th row. Both 'Golden Hills' and 'Randy' are proprietary cultivars from the University of California and require a one dollar per tree royalty fee. The size of unbudded rootstocks can vary considerably. The unbudded trees are delivered to the grower's site by a custom hauler. The trucking fee ($403.20 per load) is based on a 60-mile delivery radius from the nursery and 2,016 trees per load.

Plant/Bud. Pistachios are planted on 17' x 20' spacing, with 128 trees per acre. Seedling rootstocks, grown one year in the nursery, topped at 24 inches before delivery, are planted in February through April. Various clonal or seedling rootstocks are selected based on grower preference and site-specific characteristics such as salinity or a freezing hazard. The commercial planting costs include surveying the field, marking the tree sites, digging the holes and planting the unbudded rootstocks. Immediately after planting, 2-inch x 2-inch x 6-foot wooden stakes are spread in the field and installed by contract labor. Newly planted trees are placed in a plastic protective sleeve tied to the stakes.

Tree stakes are purchased new. Growers may have the option to purchase used stakes and/or the option to sell the stakes after use. Currently, some growers have begun using metal stakes which are more expensive but less subject to breakage. Stakes are normally removed prior to the first mechanical harvest. In late-July of the first year, the trees are commercially budded 28-32 inches above ground level, preferably into new shoot growth. Failed buds on surviving rootstock are re-budded with two buds per tree in September. No attempt is made to push the re-budded trees because they are susceptible to killing frost in November or early December. In the second year, trees should be rebudded as soon as possible. The budding failure rate used is 5% in the first year and 2% in the second. A rootstock failing to take a bud after two attempts should be replaced in March of the second year in the ground. Growers should know the source of the bud wood, and confirm the cultivar is correct.

Re-plants. In years one and two, replanted tree loss in each year is 1% or less. Nursery budded trees or unbudded trees are replanted as soon as possible. Replants placed in older orchards normally have a higher failure rate due to improper irrigation and inadequate vertebrate pest control.

Train, Sucker, and Prune. During spring of the first year (called 'first leaf'), a work crew selects and ties the new rootstock growth destined to be budded to the stake and removes any growth that is within 8 inches of the ground to facilitate herbicide applications. A second pass is made in June to tip or eliminate shoots competing with the one destined for scion budding being tied to the stake. The trees are typically budded from late June through July. Five to seven days after budding, the crew partially girdles (notches) the rootstock directly above the 'Golden Hills 'bud. Simultaneously, 50% to 70% of the rootstock growth is also removed using heading cuts. Both operations encourage uniform and vigorous growth of the 'Golden Hills' bud. Three weeks later (August), or when 6-8 inches of 'Golden Hills' growth is achieved, a fourth pass is made to begin training the 'Golden Hills' shoot to grow up by attaching it to the stake and to continue suppression of new rootstock growth by pinching off its terminals. The crew makes three more tree-training passes at 14-day intervals during August and September. This results in a total of six passes through the orchard by the end of September (2 suckering and tying, notching and heading after

budding, and 4 training). Dormant 'Golden Hills' shoots are headed to 42 inches and the rootstock lateral branches are removed in January (first dormant pruning). Both the rootstock and the dormant 'Golden Hills' shoots are then tied to the stake. If trees are planted and grafted early the first season and growth warrants it, this first heading cut may be accomplished during the first growing season to begin formation of primary branches. In our study, training to develop the primary, secondary, and possibly tertiary scaffolds occurs during the second growing season (called 'second leaf') and takes four passes at 14-day intervals during May, June, and July. In the following dormant season (second dormant pruning), tree training involves removal of rootstock laterals, heading of the secondary or tertiary branches, and cross-tying selected trees that have poorly positioned scaffolds. In the third and fourth years, in-season training during May, June, and July is limited to rootstock sucker removal and cross tying of flat scaffold limbs. It takes four passes in the third year and three passes in the fourth. The costs vary for each pass through the field, and are dependent upon the tasks required. Dormant pruning continues in the third growing season and subsequent years.

Irrigation. The irrigation costs include water at $22 per acre-inch ($264 per acre-foot), costs for pressurizing the irrigation system at $1.96 per acre-inch ($23.52 per acre-foot) and irrigation labor which increases each year with the increase in water. A large percentage of the present pistachio acreage receives surface water from state or federal canal systems, when available. The water districts which distribute this water to the growers have per acre assessment costs in addition to the "operational" water price. These costs vary widely depending upon water district overhead.

The price of district water in the pistachio growing areas of the southern San Joaquin Valley during normal water years ranges from $30 to $600 per acre-foot depending on the irrigation district. The cost of irrigation water obtained from on-site wells is dependent on energy costs, well characteristics, and other irrigation factors. A single line drip irrigation system is usually installed prior to planting. For many orchards planted to fine-textured soils this is sufficient to provide for an adequate wetted root zone. However, some orchards have a second line installed, at the end of the fifth year. In the first year, the trees are irrigated in February, immediately after planting, and periodically throughout the growing season until early September. In the following years, irrigation is from early April to late October or mid-November. In marginal water and soil quality areas it may be necessary to apply a winter "pre-irrigation" for leaching and recharge. Costs for the drip lines are shown in the Non-Cash Overhead costs, installation labor is shown in the pre-plant costs. The amount of water applied to the orchard during establishment is much less than at maturity. The soil in this study's orchard is assumed to be non-saline and well-drained. Table A shows the applied water for each year.

Applied depth of water is only an estimate (and most appropriate to the southern San Joaquin Valley) and will vary according to the size of the tree canopy achieved at a given age, surrounding environment, and weather-related variables such as rainfall and evaporative demand. Final applied water will vary depending upon the irrigation efficiency of the system. Values in Table A are based on an irrigation efficiency of 90%. Irrigation values in Table A for years 1 and 2 assume the irrigation emitter is a dripper or capped fan jet. Effective rainfall has not been considered because it is too variable in the southern SJV and the applied water values do not include any water applied to leach salts.

Table A.
Total Applied Water

Year	Acre-Inches
1	5.0
2	10.0
3	14.5
4	19.5
5	25.5
6	32.0
7	38.0
8	44.0
8+	49.5

Fertilization. Nitrogen (N), the major nutrient required for proper tree growth and optimum yields, is applied as UAN32 (32-0-0) though the drip system with the rate increased each year during the establishment years (Table B). Values in Table B assume efficient application of N through an efficient irrigation system and accurate irrigation scheduling. Nitrogen applications should be adjusted based on residual N in the soil, N concentrations in the irrigation water, and, once bearing begins, N leaf tissue concentrations and the amount of N removed in nuts at harvest. Multiple applications are applied per year, and assumes N is applied in May and July for the first two years.

Table B.
Applied Nitrogen

Year	Lbs. N/Acre
0	10*
1	15
2	20
3	30
4	40
5	55
6	75
7	135
8+	175

*Post planting.

In subsequent years, N fertilization begins in May and is applied into August. The frequency of micronutrient application strongly depends upon soil type and cropping history. For example, boron uptake varies greatly by soil texture and pH. Based on soil and plant analysis, boron, zinc, and copper are applied during the establishment years (Table 2). Boron (Solubor at 15 lbs. per acre) is applied through the drip system through the first year. In the following years, boron is foliar applied (3 lbs. Solubor per acre) after bloom, in early May in combination with Copper EDTA (1/2 lb. per acre), and zinc (2 lbs. Zinc 36% per acre) at 50% leaf expansion. In many areas of the southern San Joaquin Valley, soils are naturally high in boron and boron fertilization is not necessary. As part of a nitrogen and general nutrient fertilization and amendment program for the juvenile trees, soil nutrients are sampled in the winter after any salt leaching is performed. Leaf nutrients are sampled in late July or early August.

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, Pistachios* available online at http://ipm.ucanr.edu/. Pesticides mentioned in the study are commonly used, but are not official recommendations.

Weeds. The pistachio industry is fortunate in having a variety of pre- and post-emergence herbicides registered for weed control in bearing and/or non-bearing trees. Herbicides should be selected based on the weed species present in the orchard. Herbicides are grouped based on their physiological site of action in controlling weeds and herbicides from different groups should be rotated to avoid weed resistance. Prior to planting, the pre-emergence herbicides, Prowl H_2O and Goal 2XL, are sprayed in the tree row (6 ft. wide swath or 32% of the acres).

Hand weeding by a contract labor crew is done around the base of the trees in the first year (May). After the first year, Prowl and Goal 2XL are applied in the fall (November/December) in the tree row as a winter strip spray. In-season spot treatments using a post-emergent herbicide, Shark or Rely 280, are made three times (April, June, July) during the spring and summer of the first two years. A Roundup and Goal 2XL combination is applied as spot sprays during the same period from the third to sixth year. The total area sprayed with spot sprays will vary with each application. The herbicide sprays are applied with a Utility Vehicle (UTV) and skid sprayer that mounts in the back of the UTV or a self-powered pull-type boom sprayer. The row middles are disced three times (June, July, August) beginning in the first year.

Insects and Mites. Newly planted rootstocks are monitored for aphids and false chinch bugs. After budding, aphids, ants, katydids, darkling ground beetles, or false chinch bugs may require treatment to prevent loss of the emerging 'Golden Hills' bud. Warrior II, Brigade, Sevin XLR, or Acephate 97UP may be required to control a specific pest. These pests and others may require treatment during the first three years between May and August. Warrior II is applied in August of the first year. Acephate 97UP is applied for false chinch bugs in June during years two and three. During the sixth year, when the first commercial crop is expected, insecticide treatments to

control plant bugs (lygus, leaffooted bug, stink bug) may be necessary between April and August. Plant bugs are controlled with Brigade applied in April. Citrus flat mites may also require treatment and are controlled with wettable sulfur applied in July. All treatments are applied with a grower-owned sprayer.

Diseases. Botrytis Blossom and Shoot Blight (Botrytis), Botryosphaeria Panicle and Shoot Blight (Botryosphaeria), and Alternaria Late Blight (Alternaria) do not typically occur at treatable levels during the establishment years. However, treatment for Botrytis blossom and shoot blight during April or early June may be necessary in the event of severe, early season cool and wet weather and/or rain in late May/early June.

Vertebrate. We are assuming bait application for gophers and voles in April and November during the first five years. Beginning in the sixth year, ground squirrels are the primary pest and are baited in the spring (May). Poison bait is placed either in a bait station for squirrels or in the gopher's burrow using a probe. Gophers and voles are baited in April and November during the first five years. Beginning in the sixth year, squirrels are the primary pest and are baited in the spring (May).

Gophers, ground squirrels and even voles are a serious threat to young pistachio trees. However, the presence of endangered species may limit vertebrate pest control options. Poison bait (i.e., rodenticide), burrow fumigation, and trapping are commonly used to control these vertebrate pests. On large acreages, heavily infested with gophers moving in from adjacent areas, burrow fumigation with aluminum phosphide, pressurized exhaust, carbon dioxide or a gas explosive device in combination with trapping, have been effective where baiting has failed. To be effective, a consistent and revolving program across the acreage is required. Trapping and burrow fumigation may also be required and is recommended if vertebrate infestation is localized, costs for these operations are not included.

Endangered Species. It is important to know if your orchard is located in an area where endangered species reside. Trapping and killing endangered species can result in fines. Contact your County Agricultural Commissioner for additional information.

Harvest. Commercial yields normally begin in the fifth or sixth year after the orchard is planted and may be bulk or bin harvested. In this study, harvest begins in the sixth year and the crop is bulk harvested. See Harvest in the next section. Pistachios are generally delivered to processors using bulk trailers.

Production Cultural Practices and Material Inputs

Prune. Mature orchards can be exclusively hand pruned or mechanically pruned combined with selective hand pruning. Both are done with contract labor during the dormant season from mid-November through February. If exclusively hand pruned, low flat branches that harvest poorly or contact the harvester frame, and shoots that increase canopy size or decrease light interception within the canopy interior are removed with thinning cuts followed by tipping\heading cuts on long, one-year-old fruitwood in the upper canopy. The thinning cuts maintain tree shape and harvestability, the tipping cuts generate new bearing shoots. Mechanical pruning, topping and hedging, can also maintain canopy size, height and volume, and reduce alternate bearing but needs to combined with limited hand thinning cuts to remove, crossing, broken and low branches to improve harvestability and increase light penetration within the canopy. Combined mechanical and hand pruning is started after the orchard achieves full bearing in years 12 -13. The relative reliance on hand pruning versus mechanical pruning varies widely among orchards. A mechanical pruning company is hired to top the trees every year and to hedge half the trees every other year by double-sided hedging every other year on every other row. The prunings are hand stacked in alternate row middles and shredded commercially, leaving the residue/debris on the orchard floor. The residue is later incorporated into the soil during the winter (February) sanitation discing.

Winter Orchard Sanitation. Mechanical trunk shaking is first done to remove the overwintering nuts (mummies) not removed during pruning. A hand poling crew may be sent through to remove the remaining nuts. The tree rows are blown free of mummy nuts and debris using a tractor-mounted blower. The row centers are then disced to incorporate the mummies and shredded prunings.

Irrigation. Irrigation costs include water at $22 per acre-inch ($264 per acre-foot), costs for pressurizing the irrigation system at $1.96 per acre-inch ($23.52 per acre-foot). The first irrigation in March replenishes the water in the root zone and prepares the system for use during the season, however, root zone refilling and leaching, if needed, can occur anytime from late December through March. That irrigation includes costs for use of the UTV, labor for cleaning the filters, repairing the lines and monitoring all the emitters. The irrigation in April is primarily for applying fertilizer. The study assumes that 49.5 acre-inches are applied annually in production years between April and mid-November. A dual-line system is employed, however, a properly designed, single-line system will meet the water requirements of mature trees. The selected system should be designed for a maximum application rate of 0.4 to 0.5 inches of water per acre per day to meet summer peak water demand.

Over the past decade, pistachio orchards have been planted on ground with increasingly saline soils and water. While pistachio, compared to most fruit and nut crops, is more tolerant of high salinity, soil and water salinity over certain thresholds will decrease both water use and yield. Recent studies by UC researchers (2016-2019) have measured the actual crop evapotranspiration (ET) rates of well-watered commercial orchards located on non-saline and salt-affected soils in the southwestern area of the San Joaquin Valley to determine water use under a variety of growing environment conditions. Table C. shows these ET rates and the applied-water requirements for mature pistachio orchards grown with micro-irrigation on representative non-saline, moderately saline and high saline soils for the period between April 1 and November 15. This table does NOT include additional water that may be needed for leaching salts. The classification of orchards as Non-Saline, Moderately Saline and Highly Saline in this study is based on threshold values of the soil parameters indicated in Table D. An average irrigation distribution uniformity (DU) and efficiency of 90% was considered for single and dual line drip irrigation systems. The level of salinity adversely affects the water requirements and nut yield. Moderately saline orchards had around 14% lower water requirements and 26 % lower yield than the non-saline orchard. Highly saline orchards had around 32% less water requirements and around 53% less nut yield than the non-saline orchard.

Table C. Monthly actual ET and applied-water requirements for mature pistachio orchards grown with micro-irrigation on representative non-saline, moderately saline and highly saline soils for the period between April 1 and November 15.

Orchard Type	Period (inches)	Apr 1-30	May 1-31	June 1-30	July 1-31	Aug 1-31	Sept 1-30	Oct 1-31	Nov 1-15	Total
Non-saline	ET	3.1	6.0	8.6	8.7	7.9	5.8	3.6	0.8	44.4
Non-saline	Applied water	3.5	6.7	9.6	9.7	8.7	6.4	4.0	0.9	49.5
Moderately saline	ET	3.3	6.6	7.8	8.0	6.5	3.9	1.9	0.3	38.5
Moderately saline	Applied water	3.7	7.4	8.7	8.9	7.2	4.4	2.1	0.4	42.8
Highly saline	ET	3.0	5.1	5.8	5.8	5.0	2.9	1.9	0.6	30.1
Highly saline	Applied water	3.3	5.7	6.5	6.5	5.6	3.2	2.1	0.7	33.6

Table D. Soil electrical conductivity, (ECe); sodium adsorption ratio (SAR) and boron in the three classifications of soil salinity used in this study.

Orchard Type	ECe (dS/m)	SAR	Boron (ppm)
Non-saline	<4	<10	<2
Moderately saline	4-7	10-15	2-4
Highly saline	>7	>15	>4

Fertilization. Pistachio is an alternate bearing crop, although research suggests that the uptake of nitrogen from the soil is similar between years of the cycle. The nitrogen fertilization rate used in this study is assumed to be the

average of the "on" and "off" years and is based on research indicating 28 pounds of actual nitrogen use per 1,000 pounds of dry in-shell nuts with additional nitrogen applied to account for growing the tree and application efficiency losses.

Table E. Pistachio Production Nitrogen & Potassium Fertilization Program.

Fertilizer	lbs. / Gallon of Product	Gallons / Ton Product	lbs. Nutrient/Gallon of Product Nitrogen	Potassium
UAN32	11.06	181	3.54	0.00
10-0-10	9.70	206	0.97	0.97
15-0-5	9.70	206	1.46	0.49

Application Date	Fertilizer Source	Gallons (lbs.) Per Acre	lbs. Nitrogen Per Acre	lbs. Potassium Per Acre
April	UAN32	7.0 (77)	25	0
May	10-0-10	51.5 (500)	50	50
June	10-0-10	51.5 (500)	50	50
July	15-0-5	51.5 (500)	75	25
Total			200	125

Nitrogen is applied through the drip system beginning in late April during the establishment years, and continues into nut development. Nitrogen (UAN32) is applied alone in April and in liquid blends (10-0-10 & 15-0-05) combined with potassium (K). A total of 200 pounds of N and 125 pounds of K are applied annually due to the high potassium requirement of pistachios (see Table E. for monthly rates). Zinc (zinc sulfate 36%) and boron are foliar applied at 50% leaf expansion (typically mid-April). Boron (as Solubor) is also applied through the drip system in June or July in orchards with chronically low tissue levels.

Leaf Samples. Leaf tissue sampling is done annually beginning in Year 1 to determine needed adjustments in the nutritional program. Leaf samples are taken from non-fruiting spurs in late July or early August. Although not used in this general study, U.C. researchers Drs. Brown and Siddiqui have developed a protocol for May leaf tissue sampling to improve nitrogen and potassium application efficiency in individual bearing orchards. The PCA collects one sample per 20 acres or 4 samples for this farm and sends to a lab for analysis.

Soil Samples. Soil salt and nutrient sampling is done annually for juvenile trees, and twice annually for producing trees, Beginning in Year 1, soil samples are taken at the end of February, as suggested by nitrogen management plans, and for producing trees again in late July or early August. These soils sample will assist in determining needed adjustments to the nutritional and salt-management program and for reporting purposes. Soil sampling is done to a depth of 3 feet or deeper. The PCA collects one sample per 20 acres or 4 samples for this block and sends to a lab for analysis.

Pest Management. The pesticides and rates mentioned in this cost study are listed in *UC Integrated Pest Management Guidelines, Pistachios*. For more information on other pesticides available, pest identification, monitoring, and management visit the UC IPM website at http://ipm.ucanr.edu/. Cultural practices are also discussed in the *Pistachio Production Manual*. For information and pesticide use permits, contact your local county agricultural commissioner's office. Adjuvants may be required for some pesticides are an added cost. The adjuvants are not included as a cost in the applications. Pesticide costs may vary by location and grower volume.

Pest Control Adviser/Certified Crop Advisor (PCA/CCA). Licensed pest control advisers provide the written recommendations required for many pesticides. In addition, the PCA monitors the orchard for pest, disease, and nutritional problems. Growers may hire private PCAs or receive the service as part of an agreement with an

agricultural chemical and fertilizer company. The grower contracts with a private PCA. The PCA hangs the navel orangeworm (NOW) traps and monitors them on a weekly basis. The trap cost is included in the PCA monitoring fee.

Weeds. Pre-emergent and post-emergent herbicides, Prowl H_2O, Goal 2XL, and Roundup PowerMax (glyphosate) are applied as a winter strip spray in the tree row (6 ft. swath) in February following winter sanitation. Weeds in the tree rows during the growing season are controlled with two spot sprays (May, July) with Rely 280 herbicide. Each application is assumed to be applied to 11% of the total acres.

Insects and Mites. *Navel Orangeworm:* Winter sanitation should remove all mummies from the tree canopy and trunk crotch, after which they are blown from the tree rows and mowed or disced before March. In mid-March, the PCA hangs navel orangeworm (NOW) pheromone traps in the trees at 4 traps over the 76 acres. The PCA monitors the traps weekly from mid-March through September. Additionally, growers use NOW egg traps in the spring in the tree at 5 traps over the 80 acres. The PCA monitors the egg traps weekly from mid-March through May. From July to late-August, the field is monitored for NOW damage by observing early split nuts. During harvest, NOW egg-laying activity is monitored in split nuts and maturing hull tissue. In mid-August, Intrepid plus Brigade insecticide are applied as a NOW cover spray, timed when the nut hull begins to slip and early splits appear. Altacor and Warrior II, together in a tank mix, are applied two to three weeks later.

Other Insects and Mites: In April, Warrior II is applied to control plant bugs (stink bug, lygus, leaffooted bug, *phytocoris spp.*, etc.). In May, Movento is applied for Gill's mealybug. Wettable sulfur is applied in July to control citrus flat mite.

Disease. Two foliar fungicide applications are targeted for Botryosphaeria Panicle and Shoot Blight (Botryosphaeria or 'Bot'), and Alternaria Late Blight (Alternaria) in producing trees. Treatment timing is dependent on the disease or the diseases most prevalent. The grower applies Luna Experience fungicide in June for Botryosphaeria and Merivon in July for *A*lternaria control. See next paragraphs for further 'Bot' and Alternaria control. Rain during bloom may cause Botryosphaeria or Botrytis infection. In a wet year, an additional spray may be needed for Botrytis in April, but is not included in this study.

Botryosphaeria. Botryosphaeria Panicle and Shoot Blight ('Bot') can be a serious problem in some areas and/or years. It is a panicle (nut cluster), shoot blight, and canker disease. The cost to control Bot with fungicides and pruning can range from $200 to $1,000 per acre. Pruning out infected clusters and one-year-old branches during the winter is tedious and expensive, but critical to controlling the disease. In addition to removing infected rachises by pruning blighted shoots, orchards with Bot may require several fungicide applications beginning in early May to mid- or late-July. For fungicide efficacy information, refer to the UC IPM publication, Fungicides, Bactericides, and Biologicals for Deciduous Tree Fruit, Nut, Strawberry, and Vine Crops 2017, at: http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf. In this publication, group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Fungicides with a different group number are suitable to alternate in a resistance management program.

Alternaria. Alternaria late blight disease is a serious problem in certain locations (micro-climatic regions) where pistachios are grown and develop high humidity during the summer months. These are lower-elevation locations in San Joaquin Valley, regions surrounded by flood irrigated agricultural land, orchards next to canals and rivers. The cost to control 'Alternaria' with fungicides and cultural practices can range from $100 to $300 per acre. Pruning trees to open canopies and increase ventilation of the orchard can help reduce disease. One spray at the best timing the first week in July with Merivon fungicide should be sufficient when the disease, historically, not been severe in a given field. However, in areas that have been conducive to this disease, three sprays will be required starting

in early June, late June, and late July to keep the disease under control. In addition, improving infiltration of the soil in orchards with standing water by using an application of gypsum will reduce humidity and reduce the disease. *Alternaria spp* (cause of Alternaria Late Blight) are very prone to fungicide resistance selection. Fungicides with a different group number are suitable to alternate in a resistance management program.

Aflatoxins. Aflatoxins are potent toxins and carcinogens, and are primarily produced by two fungi: *Aspergillus flavus* and *A. parasiticus* that are common inhabitants in the soil of pistachio orchards. These fungi may grow at low levels in pistachio nuts. Aflatoxins are controlled using the atoxigenic *Aspergillus flavus* strain AF36. AF36 is applied in late June to mid-July at 10 pounds per acre yearly. The material is custom spread with an ant-bait spreader. Application timing can range between early-June to mid-July, based on soil temperatures.

Vertebrates. Gophers, are baited in their burrows using a strychnine bait in April, August, and November. Ground squirrels are baited in May by applying a diphacinone bait in stations located near ground squirrely activity. There are 20 bait stations on the 80-acre property. A worker, in the employ of the grower/owner, uses the UTV to move around the field for baiting purposes. Baiting can sometimes be incorporated with weed spot spraying. Trapping may also be required and is recommended if vertebrate infestation is localized, but is not included in this study. Birds, especially crows and ravens eating and damaging a maturing crop, can be a major problem in some areas, but control costs are not shown because they are highly variable.

Harvest, Yield and Revenue

Harvest. Pistachio trees typically reach full production by the 12th or 13th year. The action of removing nuts from the tree at harvest is called 'shaking' the tree. The cost of the harvest varies with tree age and, depending upon the variability in nut maturity, the number of times the tree needs to be shaken. Typically, with 'Golden Hills' only a single shake is required so the cost of an additional shake in not included.

Commercial harvest is done by either the "bulk" or "bin" method. The "bulk" method has become more common in recent years and is used in this study. The costs are approximately the same for both methods. Pistachios are harvested mechanically using a shaker and associated receiver that together form a catching frame set. The catching frame and receiver each have a deck that, when in place, are supported above a horizontal shaker head. The shaker travels down one side of the tree in unison with the receiver on the opposite side. The two units work together. The shaker hydraulically clamps and vibrates the tree trunk, dislodging the nuts onto the decks of the harvester and receiver. A built-in blower removes unwanted debris and a conveyor unloads the harvest into bins or a trailer attached to the receiver. An observation of broken or poorly harvested canopy sectors during harvest can be used to guide pruning during the following dormant season.

The "bin" harvest system employs 4' x 4' x 3' wooden or plastic bins that are distributed throughout the field and carried four at a time on the receiver. Full bins are dropped back in the row and picked up six at a time by a bin carrier. The bins are delivered to a loading area where they are dumped into large bottom-dump trailers using a specialized forklift which picks up, clamps the bins, and then rotates the nuts into the trailers.

The "bulk" harvest system utilizes a large trailer attached to the receiver which continuously conveys harvested nuts into the trailer until it approaches capacity. A mobile bank-out wagon then butts up to the back of the receiver trailer and actuates a lever which transfers the nuts into the bank-out wagon by way of a cleated conveyor belt incorporated into the floor of the trailer. This eliminates the need for the harvesting equipment to stop for unloading.

The bank-out wagon then travels to a loading area. The nuts are dumped onto elevators which deposit the crop into large, bottom-dump type trailers for hauling to the processor. Upon arrival at the processor, the temperature inside the trailer bed is monitored, nuts are weighed, hulled, dried, graded, and stored until being roasted, packed and

shipped.

Yields. Pistachios are an alternate bearing crop, a high yield year followed by a low yield the next year. Although an economic yield usually begins the sixth year (counting the year of planting as Year 1), the alternate bearing cycle begins when the trees are between years 9 to 10. An average of the high-low 2-year yield cycle is used for calculating grower returns in this study and these values are shown in Table F.

Table F. Annual Total Yields
Pounds/Acre

Year	Total Yield	Split In-shell	Shelling Stock	Closed Shell
6	600	510	30	60
7	1,300	1,105	65	130
8	2,200	1,870	110	220
9+	2,800	2,380	140	280

Table G. Calculation of Payable Yield from Total Yield
(as shown in Table F)

	% Split Inshell	% Shelling Stock	% Closed Shell	% Total Yield
Total Yield	85	5.0	10	100
Payable Yield	85	2.5*	5*	90

* Percentage of shelling stock and closed shell is converted to kernel (nutmeat) weight, commonly, by multiplying the total yield percentage by 50%.

The values in Table F are the total weight of nuts harvested from the orchard. Total yield is divided into three categories as follows: split in-shell (unstained and light-stained split in-shell); shelling stock (dark-stained split nuts, nuts with adhering hull, loose kernels-and-shells, undersized, shell-damaged nuts, as well as loose kernels) and closed shell (unsplit nuts having an edible kernel). Each category makes up a percentage of the total yields shown in Table F. Blanks and other unmarketable nuts (such as insect and vertebrate damage) are not included in the total yield. Shelling stock and closed shell yields as they appear in Table F, include the weight of the kernel (i.e. nutmeat) and the shell. However, growers are paid on the basis of 'payable yield', also called 'edible' or 'marketable' yield and not on total yield values as shown in Table F. To calculate payable yield, the weight of the shells are subtracted from the shelling stock and closed shell nut categories. Payable yield, then, is defined as the pounds of edible split in-shell plus only the edible kernels from shelling stock and edible kernels from closed shell. For the 'Golden Hills' cultivar, the total yields are divided into the three industry nut-quality categories as follows: 85 % split in-shell, 5% shelling stock and 10% closed shells.

Revenue. Growers are paid based on the weight of split in-shell nuts and the weight of edible kernels. In our study, as shown in Table G, 85% of the total yield (as shown in Table F) is split in-shell, and 7.5% is kernels (from shelling stock and closed shell shown in Table G). Usually, separate prices exist per weight of split in-shell versus kernels. The split in-shell price is for the shell plus kernel weight. The closed shell and shelling stock payment is based on the kernel price. At some processing plants, for the shelling stock and closed shell categories, the kernel weight is assumed to be 50% of the total nut weight while at some plants the recovered kernels are weighed separately.

The price per pound of split in-shell was assumed to be $2.25/lb. and for kernels at $2.70/lb. To calculate grower returns based on the data in Table G, the total yield per acre (from Table F) is first multiplied by 0.85 (to give the split in-shell weight) and the total yield multiplied again, by 0.075 to give the kernel weight). This split in-shell weight is multiplied by the price per lb. (in this case $2.25), which is added to the kernel weight multiplied by the price per lb. (in this case $2.70) to give the total gross grower return per acre. Another way of looking at grower returns is as a weighted average price for the relative weights of in-shell and kernels based on the annual yield as shown in Table F. For this specific example, the weighted average payment to the grower for the annual nut yields shown in Table F is $2.115 per lb.

The prices for nuts for split in-shell and for kernels were estimated in August 2020 for future 2020-2025 grower

returns. This return is based on historical price data, world-wide production and other information available from the California Ag. Statistics Service (CASS), Administrative Committee for Pistachios (ACP), American Pistachio Growers (APG) and Rabobank (2019). Actual prices in any year may fluctuate significantly from this estimate based on market conditions. Increasingly, the price growers are paid for nuts is tied to a sliding scale, based on the degree of navel orangeworm damage. Prices assume that less than 2% of the edible weight is insect damaged. As the demand for shell-free kernel consumption increases, adjustments may also be made in the return growers receive for kernels.

Assessments. Under a state marketing order, mandatory assessment fees are collected and administered by the California Pistachio Research Board. Growers are charged the assessment to pay for industry research programs. Assessment rates vary from year to year and are expected to vary from $0.025 to $0.045 per pound over the useful life of this publication. We used an assessment rate of $0.030 per pound based on total annual yield. Assessments are calculated based on annual yield (as shown in Table F) and not payable yield.

Risk. The risks associated with pistachio production should not be underestimated. While this study makes every effort to model a production system based on typical, real world practices, it cannot fully represent financial, agronomic and market risks, which affect profitability and economic viability of agricultural production. Because of many potential risk factors, effective risk management must combine specific tactics in a detailed manner, in various combinations for a sustainable operation. Moreover, Table 5 reflects a ranging analysis of returns based on various assumptions which is therefore, hypothetical in nature. **It is important to realize that actual results may differ from the returns shown here**. Any returns above total costs are considered returns on risk and investment to management (or owners).

Labor, Equipment, and Interest

Labor. Labor rates of $25.51 per hour for machine operators and $19.84 for irrigation and general labor includes payroll overhead of 41.72%. The basic hourly wages are $18 for machine operators and $14 for irrigation and general labor. The overhead includes the employers' share of federal and California state payroll taxes, workers' compensation insurance for orchard/nuts (code 0045), and a percentage for other possible benefits. 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 are considered a return to grower owner's management and risk. However, grower owners wanting to account for management may wish to add a fee. Commonly, pistachio grower owners hire professional management services. The manager makes most of the production decisions, including cultural practices, action to be taken on pest management recommendations, labor, and approval of invoices payable by the grower owner.

California Minimum Wage and Overtime Rules. In 2016, The California State Government passed new legislation concerning overtime and minimum wage rates that may affect farm labor costs. The California minimum wage rate for companies with more than 25 employees and will rise each year by $1.00 per hour until it reaches $15.00 per hour in 2022. Businesses with 25 or fewer employees are given an additional year to comply with the changes. The minimum wage rate increases $1.00 per hour each year to $15.00 per hour in 2023.

Recent California regulations also decrease the overtime threshold—the number of hours required to be worked before overtime benefits are received—for agricultural workers. The regulations decrease the overtime threshold for agricultural workers from 60 hours per week and 10 hours per day by 5.0 hours per week and 0.5 hours per day each year until it reaches 40 hours per week and 8.0 hours per day in 2022. Businesses with 25 or fewer employees are given an additional three years to comply with the regulation's changes. January 1st, 2019 (2022 for employers

with 25 or fewer employees) employees will also be entitled to overtime for 8 hours on the seventh consecutive day of work. These regulations may cause increased cost of labor used on farms, whether as direct hires, as farm labor contractor employees or as a component of custom services.

For more information and to view the California minimum wage and overtime phase-in schedules visit www.dir.ca.gov/dlse/faq_minimumwage.htm

Equipment Operating Costs. Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients formulated by American Society of Agricultural and Biological Engineers (ASABE). Fuel and lubrication costs are also determined by ASABE equations based on maximum power takeoff (PTO) horsepower, and fuel type. Prices for on-farm delivery of diesel and gasoline are $2.92 and $3.20 per gallon, respectively. The cost includes a 13.0 percent sales tax on diesel fuel and 2.25 percent sales tax on gasoline. The cost also includes state excise tax for diesel and gasoline at $0.36 and $0.42, which are refundable for on-farm use when filing your income tax. Federal Highway tax and local District sales taxes are not included.

Fuel/Lube/Repairs. 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 7 for each piece of equipment used for the selected operation by the hours per acre. Tractor time is 10 percent higher than implement time for a given operation to account for setup, travel and down time.

Pickup/UTV. Business use of 20,000 miles per year is assumed for the pickup and shown under cultural operations. The Utility Vehicle, (UTV) is used for spot spraying and rodent baiting and is included in those specific operating costs. Use of the UTV for monitoring the orchard and checking the irrigation system costs are shown under cultural operations.

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 5.25% 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 is considered a typical lending rate by a farm lending agency as of June 2020.

Cash Overhead

Cash overhead consists of various cash expenses paid out during the year that are assigned to the whole farm and not to a particular operation. These costs can include property taxes, interest on operating capital, liability and property insurance, operating services, equipment repairs, regulatory fees and management.

Property Taxes. Counties charge a base property tax rate of 1 percent on the assessed value of the property. In some counties special assessment districts exist and charge additional taxes on property including equipment, buildings, and improvements. Property taxes are calculated as 1 percent of the average value of the property and not influenced by the Williamson Act or additional county taxes. Average value equals new cost, plus salvage value divided by 2 on a per acre basis.

The Williamson Act. California Land Conservation Act has helped preserve agricultural and open space lands since 1965. Local governments and landowners enter into voluntary contracts to restrict enrolled lands to agricultural and open space uses in exchange for property tax reductions. The impact of the Williamson Act on property taxes will vary from year to year and property to property. This is due to how it is annually calculated and then compared to its Proposition 13 (factored base year value). The lower of the two is used for the annual assessment. boe.ca.gov/proptaxes/pdf/lta19029.pdf

boe.ca.gov/proptaxes/faqs/changeinownership.htm

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

Property Insurance. This provides coverage for property loss and is charged at 0.886 percent of the average value of the assets over their useful life.

Liability Insurance. A standard farm liability insurance policy fee of $621, ($7.76/Ac) is included as a cost for the entire 80 acres. This is the cost of the application paperwork for a basic policy. Actual coverage will incur addition costs. A standard farm liability insurance policy will help cover the expenses for which the owner becomes legally obligated to pay for bodily injury claims on owned property and damages to another person's property as a result of a covered accident.

Crop Insurance. A significant number of farm owners purchase crop Insurance in this region. Due to variability in coverages, none is purchased. This is available to growers for unavoidable loss of production, damage or poor quality resulting from adverse weather conditions such as cool wet weather, freeze, frost, hail, excessive heat, rain, wind and damage from birds, drought, earthquakes and fire. Coverage levels are from 50-85 percent of the approved average yield as established by verifiable production records from the farm. Actual insurance coverage is by unit, not by acre. rma.usda.gov/.

Pistachio Grower Associations. Associations, such as the "The American Pistachio Growers" are nonprofit associations that represents member pistachio growers, processors and other industry partners. The American Pistachio Growers Association is a voluntary organization that assists in research on pistachios and human nutrition, government affairs, product development, market development, and promotion." Dues are required for membership and these costs are not included.

Food Safety Modernization Act (FSMA) Produce Safety Rule. This regulation applies to all ranches that sell more than $25,000 annually (adjusted yearly for inflation - $28,075 as of April 2, 2020) and addresses multiple aspects of ranch management that focus on biological hazards that pertain to food safety. The costs include ranch management education and certification, worker safety and training, record keeping, assessing risks of soil amendments of animal origin (if used), and wildlife intrusion, and water source testing. The compliance dates for most of the rule went into effect for all farms in January 2020 but the compliance dates for the water provision of the rule were extended to January 2022, 2023, or 2024 depending on the farm size (annual sales). The water provision applies to any water source that meets the definition of "agricultural water" or water that directly contacts the edible harvestable portion of the crop or food contact surfaces. For pistachios, this is primarily water used for spray applications that go into the tree canopy. The water test monitors microbiological quality by measuring colony forming units (CFU) the amount of generic *E. coli*: https://producesafetyalliance.cornell.edu/sites/producesafetyalliance.cornell.edu/files/shared/documents/Insights-to-get-you-organized.pdf

Governmental Regulation-Compliance Costs. The state has imposed a wide range of regulations, all of which accrue direct and indirect costs for staying in compliance. These regulations include the Irrigated Lands Regulatory Program (ILRP), air quality and dust abatement, training and costs associated with keeping employees safe, pesticide regulation, and the Sustainable Groundwater Management Act (SGMA). Direct costs imposed by regulatory fees and memberships are estimated at $20 an acre, which does not include the time needed to attend meetings, fill out and submit forms, and any necessary training on the part of the grower owner. These may add up to several days to a week of managerial labor a year. Infrastructure required for worker safety may cost thousands of dollars in a one-time cost, as well as additional smaller costs for equipment such as PPE, or charges

for renting equipment. The accumulated training for employees is estimated to be two days to a week per person, however this may vary. Some costs, such as for sanitation, are included in other areas of the cost study.

Irrigated Lands Regulatory Program, (ILRP). In response to the ILRP local coalitions were formed that impose membership fees and an additional per-acre fee that differs by coalition. These coalitions collect farm evaluations, sediment and erosion control plans where necessary, nitrogen management plans and nitrogen management summaries. Nitrogen management plans require the signature of a qualified individual, which may be the farm manager if they obtain the required certification. Counties also impose fees associated with installing new or improving old wells.

Sustainable Groundwater Management Act, (SGMA). This new regulation will decrease the availability and increase cost of water when it is fully implemented in 2042. Current costs are much lower and are comprised of fees imposed by groundwater sustainability agencies. Not all agencies currently impose fees. Air quality and dust abatement fees are imposed in several ways: Conservation Management Plans are required for farmed parcels that are 100 contiguous acres or larger. This parcel, if independently farmed, is except from this requirement. Other air quality compliance costs include burn permits and fees for diesel, gas, or propane motors.

County Agricultural Commissioner's require monthly pesticide use reports, which may be submitted by the farm's pest control advisor (PCA). Pesticide use reports are submitted by the entity doing the application, and if certain applications are outsourced to a PCA or application company, the cost required to submit a use report may be factored into the cost of the service.

Other regulatory costs are associated with farm worker safety. There are numerous options for training employees in pesticide use and safety, heat safety, sexual harassment prevention, wildfire smoke awareness, and night time work safety. The most economical training option for small operations may be by having a designated on-farm trainer. Other costs of regulation include providing adequate rest, shade, water, and sanitation for employees, illumination when working at night, and private spaces for lactating employees. Some pesticides require specific training for handlers. Decontamination facilities must be available in the event of pesticide exposure to workers.

Some of these costs, such as pesticide storage and decontamination facilities, are included in the cost of buildings. Compliance with labor and safety requirements is incurred through paid time for employees spent in training, which may add up to less than a week of work a year, as well as the managerial time and costs required to become a certified trainer, which may be several hundred dollars and less than a week of work a year.

Office Expense. Office and business expenses are estimated at $100 per acre. These expenses include office supplies, telephone/internet, bookkeeping, accounting, and miscellaneous administrative charges. The cost is a general estimate and based on specific data.

Sanitation Services. Sanitation services provide portable toilets for the orchard and cost the farm $64 per acre. The cost includes one double toilet unit with washbasins, delivery and pickup, and 10 months of weekly servicing. Costs also include soap or other suitable cleansing agent, and single use towels. Separate potable water and single-use drinking cups and shaded area are supplied. Contract labor providers may include this service for their work force in the sanitation fees. California regulations require one toilet and hand washing facility for every 20 employees of each sex, located within a quarter-mile walk or if not feasible, at the closest point of vehicular access.

Investment Repairs. Annual repairs on investments or capital recovery items that require maintenance are calculated as 2 percent of the purchase price. Repairs are not calculated for land and establishment costs.

Non-Cash Overhead

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 (see Boehlje and Eidman in References). 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 and Biological Engineers (ASABE) based on equipment type and years of life. The life in years is estimated by dividing the wear out life, as given by ASABE, by the annual hours of use in this operation. For other investments including irrigation systems, buildings, and miscellaneous equipment, the value at the end of its useful life is zero. The salvage value for land is the purchase price because land does not depreciate. The purchase price and salvage value for equipment and investments are shown in the tables.

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 5.5% 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 June 2020.

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 pistachios are harvested minus any returns from production. In Table 1, the total Accumulated Net Cash Cost in the sixth year represents the establishment cost. For this study, the cost is $11,308 per acre or $859,408 for the 76-acre orchard. The establishment cost is spread over the remaining 34 producing years of the 40-year orchard life.

Drip Lines. Single drip lines are laid out prior to planting. The labor cost for laying out the line is included in the irrigation system cost. A second line is installed during the fifth year and the materials and labor are included in the overall costs. The cost for the drip line layout is calculated from basic information provided by an irrigation company, and does not represent any specific system. Presently, no research has been conducted to evaluate single versus double-line drip on pistachio tree performance. Inclusion of double-line drip in this study is for budgeting purposes only, and does not constitute a recommendation.

Irrigation System. The water is delivered from an irrigation district. The system cost includes a booster pump, filtration, fertilizer injector, and main lines. Costs are a general estimate for the system and not for any specific layout.

Land. Irrigated, open crop land the San Joaquin valley is valued at $20,000 per acre for the 80-acre farm, or $21,053

per producing acre (76 planted acres).

Building. The building(s) are metal building(s) on a cement slab with a fenced equipment yard.

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

Fuel Tanks. One 1,000-gallon diesel and one 500-gallon gasoline, 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.

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. Annual ownership costs for equipment and other investments are shown in the Whole Farm Annual Equipment, Investment, and Business Overhead Costs table. Equipment costs are composed of three parts: non-cash overhead, cash overhead, and operating costs. Both of the overhead factors have been discussed in previous sections. The operating costs consist of repairs, fuel, and lubrication and are discussed under operating costs.

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

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UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 1. COSTS PER ACRE TO ESTABLISH PISTACHIOS

San Joaquin Valley-2020

	Cost Per Acre						
Year:	1st	2nd	3rd	4th	5th	6th	Your Costs
Total Yield: Dry, In-Shell Pounds Per Acre:						600	
Operation:							
Pre-Planting:							
Backhoe (custom)	175						
Fertilize: Soil Analysis (samples from holes dug)	3						
Subsoil-Slip Plow	200						
Rip (4'-5')	150						
Stubble Disc	60						
Disc & Float 2x	52						
Weed: Pre-plant, Strip Spray (Prowl/Goal)	37						
Irrigate: Layout Drip Lines	79						
TOTAL PRE-PLANTING COSTS	756						
Planting:							
Survey, Mark, & Plant Trees	186						
Tree Costs/Rootstock Royalty/Delivery (1% replant in Year 2)	1,306	31					
Spread Stakes & Stake Trees	247						
Plant: Field Bud Trees	154						
Plant: Rebud (5% in 1st Year & 2% in 2nd Year)	7	4					
TOTAL PLANTING COSTS	1,900	35					
Cultural:							
Irrigate: Water & Labor (Yr. 5 includes labor for 2nd drip line)	150	269	380	500	712	808	
Weeds: Spot Spray 3x (Shark, Yr. 1-2. Roundup, Goal, Yr. 3+)	23	23	35	35	35	35	
Train/Sucker: 6x Yr. 1, 4x Yr. 2-3, 3x Yr. 4	50	70	90	70			
Vertebrate: Gophers Yr. 1+ (Bait), Squirrel Yr. 6+ (Bait)	22	22	22	22	22	60	
Fertilize: Nitrogen injected through dripline (UAN32)	14	11	17	22	31	42	
Weeds: Disc Middles 3X	32	32	32	32	32	32	
Weeds: Hand (contract)	120						
Insects: Ant, Aphid, Katydid (Warrior II)	88						
Fertilize: Boron (Solubor) injected through dripline	27						
Fertilize: Boron (Solubor), Zinc (Zn 36%), Copper (Cu Chelate 14%)		28	28	28	28	28	
Prune: Dormant & Season		50	75	100	125	150	
Fertilize: Boron (Solubor), Zinc (Zn 36%) Foliar 2x		25	25	25	25	25	
Insects: Chinch Bug/Aphid (Acephate 97UP)		27	27				
Weeds: Winter Strip Spray (Prowl Goal)		37	37	37	37	37	
Prune: Shred Prunings (custom)					38	38	
Plant: Remove & Stack Tree Stakes					102		
Insects: Plant Bugs (Brigade)						35	
Insects: Citrus Flat Mites (Wettable Sulfur)						28	
Fertilize: PCA-Soil Sample/Analysis	3	3	3	3	3	5	
Fertilize: PCA-Leaf Sample/Analysis	2	2	2	2	2	3	
PCA Consulting Service	35	35	35	35	35	35	
Pickup Truck Use	66	66	66	66	66	66	
UTV Use	66	66	66	66	66	66	
TOTAL CULTURAL COSTS	698	767	940	1,044	1,357	1,493	
Harvest:							
Bulk (shake/catch/haul)						256	
California Pistachio Research Board Assessment						18	
TOTAL HARVEST COSTS	-	-	-	-	-	274	
Interest On Operating Capital @ 5.25%	116	21	28	27	37	27	
TOTAL OPERATING COSTS/ACRE	3,469	822	968	1,071	1,394	1,794	

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 1. CONTINUED

San Joaquin Valley-2020

	Cost Per Acre						
Year:	1st	2nd	3rd	4th	5th	6th	Your Costs
Total Yield: Dry, In-Shell Pounds Per Acre						600	
Cash Overhead:							
Office Expense	100	100	100	100	100	100	
Liability Insurance	8	8	8	8	8	8	
Sanitation Fees	64	64	64	64	64	64	
Compliance Cost	20	20	20	20	20	20	
Vertebrate bait Stations	6	6	6	6	6	6	
Property Taxes	228	228	228	228	230	230	
Property Insurance	20	20	20	20	20	20	
Investment Repairs	61	61	61	61	68	68	
TOTAL CASH OVERHEAD COSTS	507	507	507	506	516	516	
TOTAL CASH COSTS/ACRE	3,976	1,329	1,475	1,577	1,910	2,310	
INCOME/ACRE FROM PRODUCTION ($2.115/Lb.)						**1,269**	
NET CASH COSTS/ACRE FOR THE YEAR	3,976	1,329	1,475	1,577	1,910	1,041	
PROFIT/ACRE ABOVE CASH COSTS							
ACCUMULATED NET CASH COSTS/ACRE	3,976	5,305	6,780	8,357	10,267	**11,308**	
Non-Cash Overhead (Capital Recovery Costs):							
Buildings	74	74	74	74	74	74	
Fuel Tanks	15	15	15	15	15	15	
Shop Tools	22	22	22	22	22	22	
Irrigation Drip Lines (1 line Yrs. 1-4, 2 lines Yr. 5+)	29	29	29	29	59	59	
Irrigation System (Booster Pump/Filtration System)	75	75	75	75	75	75	
Land	1,158	1,158	1,158	1,158	1,158	1,158	
Equipment	50	44	44	39	43	50	
TOTAL INTEREST ON INVESTMENTS (Non-Cash Overhead)	1,423	1,416	1,416	1,412	1,445	1,452	
TOTAL COSTS/ACRE FOR THE YEAR	5,399	2,745	2,891	2,989	3,355	3,762	
INCOME/ACRE FROM PRODUCTION ($2.115/Lb.)						**1,269**	
TOTAL NET COSTS/ACRE FOR THE YEAR	5,399	2,745	2,891	2,989	3,355	2,493	
NET PROFIT/ACRE ABOVE TOTAL COSTS							
TOTAL ACCUMULATED NET COST/ACRE	5,399	8,144	11,035	14,024	17,379	19,872	

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

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

San Joaquin Valley-2020

			Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		
			Total Per Acre												
	Unit	$/Unit	units	$	units	$	units	$	units	$	units	$	units	$	Your Costs
OPERATING COSTS															
Custom:				**1,033**		**160**		**205**		**211**		**203**		**487**	
Backhoe	Acre	175.00	1.00	175		0		0		0		0		0	
Soil Sample/Analysis	Each	60.00	0.10	6	0.05	3	0.05	3	0.05	3	0.05	3	0.10	6	
Slip Plow Tree Row (20")	Acre	200.00	1.00	200		0		0		0		0		0	
Rip (1-shank)	Acre	150.00	1.00	150		0		0		0		0		0	
Stubble Disc	Acre	60.00	1.00	60		0		0		0		0		0	
Mark/Spread/Trees/Plant	Tree	1.45	128.00	186	0.00	0		0		0		0		0	
Stake Trees	Tree	0.38	128.00	49				0		0		0		0	
Prune: Sucker/Train-Labor	Hour	19.84	2.52	50	3.52	70	4.53	90		0		0		0	
Hand Weed-Tree Base	Acre	120.00	1.00	120				0		0		0		0	
Leaf Sample/Analysis	Each	60.00	0.04	2	0.04	2	0.04	2	0.04	2	0.04	2	0.04	2	
Prune: Labor	Hour	19.84	0.00	0	2.52	50	3.78	75	8.58	170	6.30	125	7.56	150	
PCA/Consultant Fee	Acre	35.00	1.00	35	1.00	35	1.00	35	1.00	35	1.00	35	1.00	35	
Shred Prunings	Acre	75.00		0		0		0		0	0.50	38	0.50	38	
Harvest: Bulk (Shake/Catch/Haul)	Tree	2.00		0		0		0		0		0	128.00	256	
Tree/Tree Aids:				**1,648**		**34**		**0**		**0**		**0**		**0**	
Tree Unbudded	Tree	9.00	128.00	1,152	3.00	27									
Rootstock Royalty	Tree	1.00	128.00	128	3.00	3									
Tree Delivery	Tree	0.20	128.00	26	3.00	1									
Bud Tree	Tree	1.20	134.00	161	3.00	4									
Tree Stakes 2" x 2" x 6'	Each	1.42	128.00	182											
Irrigation:				**120**		**240**		**347**		**467**		**611**		**767**	
Water: District	AcIn	22.00	5.00	110	10.00	220	14.50	319	19.50	429	25.50	561	32.00	704	
Water: Pressurize System	AcIn	1.96	5.00	10	10.00	20	14.50	28	19.50	38	25.50	50	32.00	63	
Fertilizer:				**41**		**28**		**33**		**39**		**47**		**51**	
Solubor (Boron)	Lb.	1.80	15.00	27	6.00	11	6.00	11	6.00	11	6.00	11	6.00	3	
Copper Chelate 14%	Lb.	5.87			0.50	3	0.50	3	0.50	3	0.50	3	0.50	3	
ZnSO4 36%	Lb.	1.18			4.00	3	4.00	3	4.00	3	4.00	3	4.00	3	
UAN32 (N)	Lb.-N	0.56	25.00	14	20.00	11	30.00	17	40.00	22	55.00	31	75.00	42	

Table 2. CONTINUED

San Joaquin Valley-2020

			Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		
			Total Per Acre												
	Unit	$/Unit	units	$	units	$	units	$	units	$	units	$	units	$	Your Costs
Herbicide:				**35**		**35**		**47**		**47**		**47**		**47**	
Prowl H2O	Pint	5.00	2.56	13	2.56	13	2.56	13	2.56	13	2.56	13	2.56	13	
Goal 2XL	Pint	12.43	1.28	16	1.28	16	2.54	32	2.54	32	2.54	32	2.54	32	
Shark EW	FlOz	10.58	0.60	6	0.60	6									
Roundup PowerMax	Pint	3.50					0.63	2	0.63	2	0.63	2	0.63	2	
Insecticide:				**64**		**9**		**9**		**0**		**0**		**27**	
Traps NOW (Free)	Acre														
Brigade WSB	Oz	0.83				0							20.00	17	
Warrior II	Oz	3.20	20.00	64											
Wettable Sulfur 92%	Lb.	0.50				0							20.00	10	
Acephate 97UP	Lb.	11.45			0.75	9	0.75	9							
Intrepid 2F	Pint					0									
Fungicide:				**0**		**0**		**0**		**0**		**0**		**0**	
Rodenticide:				**5**		**5**		**5**		**5**		**5**		**10**	
RCO Avalon	Lb.	5.00	1.00	5	1.00	5	1.00	5	1.00	5	1.00	5	2.00	10	
Assessments:														18	
California Pistachio Research Board	Lb.	0.03											600.00	18	
Labor:				**339**		**231**		**234**		**224**		**388**		**284**	
Equipment Operator	Hrs.	25.51	9.01	230	7.90	202	7.90	202	7.48	191	9.48	242	9.51	243	
Non-Machine	Hrs.	19.84									2.30	46		0	
Irrigation; (Yrs. 1 & 5 L-Lines)	Hrs.	19.84	5.50	109	1.50	30	1.65	33	1.65	33	5.05	100	2.10	42	
Machinery:				**69**		**60**		**60**		**52**		**56**		**70**	
Fuel - Gas	Gal	3.20	4.38	14	4.17	13	4.17	13	4.17	13	4.88	16	4.60	15	
Fuel - Diesel	Gal	2.92	9.60	28	7.63	22	7.63	22	6.06	18	6.06	18	9.21	27	
Lube				6		5		5		5		5		6	
Machinery Repair				21		19		19		16		18		22	
Operating Interest @ 5.25%				116		21		28		27		37		27	
TOTAL OPERATING COSTS				3,469		822		968		1,071		1,394		1,786	

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 3. COSTS PER ACRE TO PRODUCE PISTACHIOS

San Joaquin Valley-2020

Operation	Equipment Time (Hrs./Ac)	Cash and Labor Costs per Acre: Labor Cost	Fuel	Lube & Repairs	Material Cost	Custom/ Rent	Total Cost	Your Cost
Cultural:								
Prune: Mechanical Topping/Pruning	0.00	0	0	0	0	70	70	
Prune: Mechanical Hedging 1/2 Yr.	0.00	0	0	0	0	35	35	
Prune: Prune & Stack	0.00	0	0	0	0	250	250	
Prune/WS: Shake/Blow/Rake	0.42	53	6	2	0	71	132	
Prune/WS: Shred Brush/Mummies	0.00	0	0	0	0	75	75	
Prune/WS: Disc Mummies/Prunings	0.25	8	3	2	0	0	13	
Weeds: Winter Strip (Goal/Prowl/Roundup)	0.25	8	0	0	31	0	39	
PCA: Leaf/Soil - Sample/Analysis	0.00	0	0	0	0	8	8	
Fertilize: (ZnSO4/Solubor)	0.34	11	5	3	11	0	29	
Irrigate: Water & Labor	0.00	41	0	0	1,186	0	1,227	
Insects: NOW Hang Traps (pheromone)	0.00	0	0	0	0	0	0	
Insects: NOW Hang Traps (egg)	0.00	0	0	0	0	0	0	
Fertilize: (UAN32)	0.00	0	0	0	14	0	14	
Insects: Plant Bugs (Warrior II)	0.34	11	5	3	16	0	34	
Vertebrate: Gopher	0.75	23	1	1	8	0	32	
Vertebrate: Squirrel	0.50	15	1	1	5	0	22	
Fertilize:(10-0-10)	0.00	0	0	0	103	0	103	
Weeds: Spot Spray 2x (Rely 280)	0.33	10	0	0	16	0	27	
Insects: Mealybug (Movento)	0.34	11	5	3	64	0	82	
Disease: BOT (Luna Experience)	0.34	11	5	3	71	0	89	
Aflatoxin: (AF36)	0.00	0	0	0	10	15	25	
Fertilize:(15-0-05)	0.00	0	0	0	50	0	50	
Disease: Alternaria (Merivon)	0.00	0	0	0	38	0	38	
Insects: Mites (Sulfur)	0.34	11	5	3	10	0	28	
Insects: NOW (Intrepid/Brigade WSB)	0.34	11	5	3	52	0	70	
Insects: NOW (Altacor/Warrior II)	0.34	11	5	3	54	0	72	
UTV	2.08	64	3	2	0	0	69	
Pickup	2.00	61	11	8	0	0	80	
PCA: Consulting Service	0.00	0	0	0	0	35	35	
TOTAL CULTURAL COSTS	8.96	356	57	37	1,737	560	2,747	
Harvest:								
Harvest: Bulk (Shake/Catch/Haul)	0.00	0	0	0	0	320	320	
Assessments:	0.00	0	0	0	84	0	84	
TOTAL HARVEST COSTS	0.00	0	0	0	84	320	404	
Interest on Operating Capital at 5.25%							59	
TOTAL OPERATING COSTS/ACRE	8.96	356	57	37	1,821	880	3,210	

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 3. CONTINUED

San Joaquin Valley-2020

CASH OVERHEAD:			
Liability Insurance			8
Office Expense			100
Sanitation (10 months)			64
Compliance Cost			20
Vertebrate Bait Stations			6
Property Taxes			287
Property Insurance			24
Investment Repairs			68
TOTAL CASH OVERHEAD COSTS/ACRE			578
TOTAL CASH COSTS/ACRE			3,788
NON-CASH OVERHEAD:	Per Producing Acre	Annual Cost Capital Recovery	
Drip Lines 2	700	59	59
Irrigation System: Pump/Filters	1,200	75	75
Land Pistachio	21,052	1,158	1,158
Fuel Tanks	181	15	15
Shop Tools	225	22	22
Buildings	1,080	74	74
Establishment Cost	11,308	742	742
Equipment	540	65	65
TOTAL NON-CASH OVERHEAD COSTS	36,287	2,209	2,209
TOTAL COSTS/ACRE			5,997

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 4. COSTS AND RETURNS PER ACRE TO PRODUCE PISTACHIOS

San Joaquin Valley-2020

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Weighted	2,800	Lb.	2.12	5,922	
TOTAL GROSS RETURNS				5,922	
OPERATING COSTS					
Herbicide:				**47**	
Goal 2 XL	1.28	Pint	12.43	16	
Prowl H2O	2.56	Pint	5.00	13	
Roundup Power Max	0.64	Pint	3.50	2	
Rely 280	0.94	Pint	16.80	16	
Insecticide:				**195**	
NOW Traps (pheromone)	0.07	Acre	0.00	0	
NOW Traps (eggs)	0.07	Acre	0.00	0	
Warrior II	10.00	Oz	3.20	32	
Movento	8.00	FlOz	7.95	64	
Wettable Sulfur (92%)	20.00	Lb.	0.50	10	
Intrepid 2F	24.00	FlOz	1.83	44	
Brigade WSB	9.60	Oz	0.83	8	
Altacor	4.50	Oz	8.44	38	
Fungicide:				**108**	
Luna Experience	12.00	FlOz	5.88	71	
Merivon	6.00	FlOz	6.27	38	
Rodenticide:				**13**	
RCO Avalon	2.50	Lb.	5.00	13	
Fertilizer:				**178**	
Zinc Sulfate - 36%	4.00	Lb.	0.50	2	
Boron (Solubor)	5.00	Lb.	1.80	9	
UAN32	25.00	Lb. N	0.56	14	
10-0-10	103.00	Gal	1.00	103	
15-0-05	51.50	Gal	0.97	50	
Irrigation:				**1,186**	
Water - District	49.50	AcIn	22.00	1,089	
Water - Pressurize	49.50	AcIn	1.96	97	
Custom:				**880**	
Mechanical Topping/Pruning	1.00	Acre	70.00	70	
Mechanical Hedging	0.50	Acre	70.00	35	
Pruning Labor	12.60	Hour	19.84	250	
Shred Prunings	1.00	Acre	95.00	71	
Shake Trees	0.75	Hour	75.00	75	
Soil Sample/Analysis	0.10	Each	60.00	6	
AF36 Application	1.00	Acre	15.00	15	
Leaf Sample/Analysis	0.04	Each	60.00	2	
Harvest: Bulk (Shake/Catch/Haul)	128.00	Tree	2.50	320	
PCA Consulting Service	1.00	Acre	35.00	35	
Assessment:				**84**	
Pistachio Research Board	2,800.00	Lb.	0.03	84	
Aflatoxins:				**10**	
AF36	10.00	Lb.	1.00	10	
Labor:				**356**	
Equipment Operator Labor	10.80	Hrs.	25.51	275	
Non-Machine Labor	2.00	Hrs.	19.84	40	
Irrigation Labor	2.05	Hrs.	19.84	41	
Machinery:				**95**	
Fuel-Gas	5.01	Gal	3.20	16	
Fuel-Diesel	14.14	Gal	2.92	41	
Lube				9	
Machinery Repair				29	
Interest on Operating Capital @ 5.25%				59	
TOTAL OPERATING COSTS/ACRE				3,210	
TOTAL OPERATING COSTS/LB				1.15	
NET RETURNS ABOVE OPERATING COSTS				2,712	

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 4. CONTINUED

San Joaquin Valley-2020

CASH OVERHEAD COSTS	
Liability Insurance	8
Office Expense	100
Sanitation (10 months)	64
Compliance Cost	20
Vertebrate Bait Stations	6
Property Taxes	287
Property Insurance	24
Investment Repairs	68
TOTAL CASH OVERHEAD COSTS/ACRE	578
TOTAL CASH OVERHEAD COSTS/LB	0.21
TOTAL CASH COSTS/ACRE	3,788
TOTAL CASH COSTS/LB	1.35
NET RETURNS ABOVE CASH COSTS	2,134
NON-CASH OVERHEAD COSTS (Capital Recovery)	
Drip Lines (2)	59
Irrigation System: Pump/Filters	75
Land Pistachio	1,158
Fuel Tanks	15
Shop Tools	22
Buildings	74
Establishment Cost	742
Equipment	65
TOTAL NON-CASH OVERHEAD COSTS/ACRE	2,209
TOTAL NON-CASH OVERHEAD COSTS/LB	0.79
TOTAL COST/ACRE	5,997
TOTAL COST/LB	2.14
NET RETURNS ABOVE TOTAL COST	-77.91

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 5. MONTHLY COSTS PER ACRE TO PRODUCE PISTACHIOS

San Joaquin Valley-2020

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Total
Cultural:												
Prune: Mechanical Top/Prune	70											70
Prune: Mechanical Hedging 1/2 Yr.	35											35
Prune: Prune & Stack	250											250
WS: Shake/Blow/Rake	132											132
Prune/WS: Shred Brush/Mummies	75											75
Prune/WS: Disc Prunings/Mummies		13										13
Weeds: Winter Strip (Goal/Prowl/Rup)		39										39
PCA: Leaf/Soil - Sample/Analysis		3						5				8
Fertilize:(ZnSO4/Solubor)		29										29
Irrigate: Water & Labor			86	74	148	249	296	249	75	51		1,227
Insects: NOW Hang Traps (pheromone)			0									0
Insects: NOW Hang Traps (egg)			0									0
Fertilize: UAN32				14								14
Insects: Plant Bugs (Warrior II)				34								34
Vertebrate: Gopher				11				11			11	32
Vertebrate: Squirrel					22							22
Fertilize:(10-0-10)					52	52						103
Weeds: Spot Spray 2x (Rely 280)					13		13					27
Insects: Mealybug (Movento)					82							82
Disease: Bot (Luna Experience)						89						89
Aflatoxin: (AF36)						25						25
Fertilize:(15-0-05)							50					50
Disease: Alternaria (Merivon)							38					38
Insects: Mites (Sulfur)							28					28
Insects: NOW (Intrepid/Brigade WSB)								70				70
Insects: NOW (Altacor/Warrior II)									72			72
UTV	6	6	6	6	6	6	6	6	6	6	6	69
Pickup	7	7	7	7	7	7	7	7	7	7	7	80
PCA: Consulting Service	3	3	3	3	3	3	3	3	3	3	3	35
TOTAL CULTURAL COSTS	578	101	103	150	333	430	442	351	164	68	27	2,747
Harvest:												
Harvest: Bulk (Shake/Catch/Haul)									320			320
Assessments:									84			84
TOTAL HARVEST COSTS	0	0	0	0	0	0	0	0	404	0	0	404
Interest on Operating Capital @5.25%	2.53	2.97	3.42	4.07	5.53	7.41	9.35	10.89	13.37	-0.42	-0.12	59.00
TOTAL OPERATING COSTS/ACRE	581	104	106	154	338	438	452	362	581	67	27	3,210

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 5. CONTINUED

San Joaquin Valley-2020

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Total
CASH OVERHEAD												
Liability Insurance	1	1	1	1	1	1	1	1	1	1	1	8
Office Expense	9	9	9	9	9	9	9	9	9	9	9	100
Sanitation (10 months)									64			64
Compliance Cost									20			20
Vertebrate Bait Stations									6			6
Property Taxes	144						144					287
Property Insurance	13						13					25
Investment Repairs	6	6	6	6	6	6	6	6	6	6	6	68
TOTAL CASH OVERHEAD COSTS	172	16	16	16	16	16	172	16	106	16	16	578
TOTAL CASH COSTS/ACRE	753	113	122	170	354	454	624	378	687	83	43	3,788

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 6. RANGING ANALYSIS

San Joaquin Valley-2020

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

	YIELD (LBS/AC)						
	2,200.00	2,400.00	2,600.00	2,800.00	3,000.00	3,200.00	3,400.00
OPERATING COSTS/ACRE:							
Cultural	2,747	2,747	2,747	2,747	2,747	2,747	2,747
Harvest	317	346	375	404	433	462	491
Interest on Operating Capital @ 5.25%	58.62	58.75	58.88	59.00	59.13	59.25	59.38
TOTAL OPERATING COSTS/ACRE	3,123	3,152	3,181	3,210	3,239	3,268	3,297
TOTAL OPERATING COSTS/LB	1.42	1.31	1.22	1.15	1.08	1.02	0.97
CASH OVERHEAD COSTS/ACRE	578	578	578	578	578	578	578
TOTAL CASH COSTS/ACRE	3,701	3,730	3,759	3,788	3,817	3,846	3,875
TOTAL CASH COSTS/LB	1.68	1.55	1.45	1.35	1.27	1.20	1.14
NON-CASH OVERHEAD COSTS/ACRE	2,209	2,209	2,209	2,209	2,209	2,209	2,209
TOTAL COSTS/ACRE	5,910	5,939	5,968	5,997	6,026	6,055	6,084
TOTAL COSTS/LB	2.69	2.47	2.30	2.14	2.01	1.89	1.79

Net Return Per Acre Above Operating Costs for Pistachios

PRICE ($/lb.)	YIELD (lb./acre)						
Weighted	2200.00	2400.00	2600.00	2800.00	3000.00	3200.00	3400.00
0.62	-1,770	-1,676	-1,582	-1,488	-1,394	-1,300	-1,206
1.12	-670	-476	-282	-88	106	300	494
1.62	430	724	1,018	1,312	1,606	1,900	2,194
2.12	1,530	1,924	2,318	2,712	3,106	3,500	3,894
2.62	2,630	3,124	3,618	4,112	4,606	5,100	5,594
3.12	3,730	4,324	4,918	5,512	6,106	6,700	7,294
3.62	4,830	5,524	6,218	6,912	7,606	8,300	8,994

Net Return Per Acre Above Cash Costs for Pistachios

PRICE ($/lb.)	YIELD (lb./acre)						
Weighted	2200.00	2400.00	2600.00	2800.00	3000.00	3200.00	3400.00
0.62	-2,348	-2,254	-2,160	-2,066	-1,972	-1,878	-1,784
1.12	-1,248	-1,054	-860	-666	-472	-278	-84
1.62	-148	146	440	734	1,028	1,322	1,616
2.12	952	1,346	1,740	2,134	2,528	2,922	3,316
2.62	2,052	2,546	3,040	3,534	4,028	4,522	5,016
3.12	3,152	3,746	4,340	4,934	5,528	6,122	6,716
3.62	4,252	4,946	5,640	6,334	7,028	7,722	8,416

Net Return Per Acre Above Total Costs for Pistachios

PRICE ($/lb.)	YIELD (lb./acre)						
Weighted	2200.00	2400.00	2600.00	2800.00	3000.00	3200.00	3400.00
0.62	-4,557	-4,463	-4,369	-4,275	-4,181	-4,087	-3,993
1.12	-3,457	-3,263	-3,069	-2,875	-2,681	-2,487	-2,293
1.62	-2,357	-2,063	-1,769	-1,475	-1,181	-887	-593
2.12	-1,257	-863	-469	-75	319	713	1,107
2.62	-157	337	831	1,325	1,819	2,313	2,807
3.12	943	1,537	2,131	2,725	3,319	3,913	4,507
3.62	2,043	2,737	3,431	4,125	4,819	5,513	6,207

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 7. WHOLE FARM ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS

San Joaquin Valley-2020

ANNUAL EQUIPMENT COSTS

Description	Price	Yrs. Life	Salvage Value	Capital Recovery	Cash Overhead		Total
					Insurance	Taxes	
85HP 4WD Tractor	76,000	15	14,796	6,911	40	454	7,405
Disc Tandem 14'	18,000	12	2,493	1,936	9	102	2,048
Blower Flory 2500 (PTO)	6,500	10	1,226	767	3	39	809
Weed Sprayer UTV 100 Gal	3,460	10	612	412	2	20	434
Spot Sprayer UTV 20 Gal	850	10	150	101	0	5	107
Pickup Truck 1/2-Ton	32,000	8	11,168	3,903	19	216	4,138
Orchard Sprayer PTO 500 Gal	28,000	8	6,322	3,770	15	172	3,957
UTV-4WD	8,700	5	3,899	1,339	6	63	1,407
TOTAL	173,510	-	40,666	19,139	95	1,071	20,305
60% of New Cost*	104,106	-	24,400	11,483	57	643	12,183

ANNUAL INVESTMENT COSTS

Description	Price	Yrs. Life	Salvage Value	Capital Recovery	Cash Overhead			Total
					Insurance	Taxes	Repairs	
INVESTMENT								
Drip Lines (2)	53,200	20	0	4,452	24	266	1,064	5,805
Irrigation System: Pump/Filters	91,200	40	0	5,684	40	456	1,824	8,004
Land Pistachio	1,599,952	40	1,599,952	87,997	1,418	16,000	0	105,414
Fuel Tanks	14,500	20	1,015	1,184	7	78	290	1,559
Shop Tools	18,000	15	1,260	1,737	9	96	360	2,202
Buildings 2-2,400sqft	86,400	30	0	5,945	38	432	1,728	8,143
Establishment Cost	859,408	34	0	56,403	381	4,297	0	61,080
TOTAL INVESTMENT	2,722,660	-	1,602,227	163,401	1,916	21,624	5,266	192,208

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/ Farm	Unit	Price/ Unit	Total Cost
Liability Insurance	80	Acre	7.76	621
Office Expense	80	Acre	100.00	8,000
Sanitation (10 months)	76	Acre	64.00	4,864
Compliance Cost	76	Acre	20.00	1,520
Vertebrate Bait Stations	76	Acre	5.70	433

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 8. HOURLY EQUIPMENT COSTS

San Joaquin Valley-2020

Description	Pistachios Hours Used	Capital Recovery	Cash Overhead		Operating			Total Costs/Hr.
			Insurance	Taxes	Lube & Repairs	Fuel	Total Oper.	
UTV-4WD	298	2.01	0.01	0.09	1.06	1.37	2.43	4.54
85HP 4WD Tractor	257	3.89	0.02	0.26	3.73	12.19	15.92	20.08
Orchard Sprayer PTO 500 Gal	183	9.05	0.04	0.41	4.84	0.00	4.84	14.34
Pickup Truck 1/2-Ton	152	9.37	0.05	0.52	3.90	5.33	9.24	19.17
Blower Flory 2500 (PTO)	32	2.30	0.01	0.12	0.10	0.00	0.10	2.53
Spot Sprayer UTV 20 Gal	25	0.40	0.00	0.02	0.23	0.00	0.23	0.65
Disc Tandem 14'	19	7.00	0.03	0.37	2.89	0.00	2.89	10.29
Weed Sprayer UTV 100 Gal	19	1.65	0.01	0.08	0.93	0.00	0.93	2.66

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 9. OPERATIONS WITH EQUIPMENT & MATERIALS

San Joaquin Valley-2020

Operation	Operation Month	Tractor	Implement	Labor Type/ Material	Rate/ acre	Unit
Prune: Mechanical	Jan			Topping/Pruning	1.00	Acre
Prune: Mechanical	Jan			Hedging	0.50	Acre
Prune: Prune & Stack	Jan			Pruning Labor	12.60	Hour
WS: Shake/Blow/Rake	Jan	85HP 4WD Tractor	Blower Flory 2500 (PTO)	Equipment Operator Labor	0.51	Hour
				Shake Trees	0.75	Hour
				Non-Machine Labor (raking)	2.00	Hour
Prune/WS: Shred	Jan			Shred Prunings	1.00	Acre
Prune/WS: Disc	Feb	85HP 4WD Tractor	Disc Tandem 14'	Equipment Operator Labor	0.30	Hour
Weeds: Winter Strip	Feb		UTV-4WD	Equipment Operator Labor	0.30	Hour
				Goal 2 XL	1.28	Pint
			Weed Sprayer UTV 100 Gal	Prowl H2O	2.56	Pint
				Roundup Power Max	0.64	Pint
PCA: Sample/Analysis	Feb			Soil Sample/Analysis	0.05	Each
	Aug			Leaf Sample/Analysis	0.04	Each
				Soil Sample/Analysis	0.05	Each
Fertilize:	Feb	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				Zinc Sulfate - 36%	4.00	Lb.
				Boron (Solubor)	5.00	Lb.
Irrigate:	Mar			Irrigation Labor	0.10	Hour
				Water - District	3.50	AcIn
				Water - Pressurize	3.50	AcIn
	Apr			Irrigation Labor	0.10	Hour
				Water - District	3.00	AcIn
				Water - Pressurize	3.00	AcIn
	May			Irrigation Labor	0.20	Hour
				Water - District	6.00	AcIn
				Water - Pressurize	6.00	AcIn
	June			Irrigation Labor	0.45	Hour
				Water - District	10.00	AcIn
				Water - Pressurize	10.00	AcIn
	July			Irrigation Labor	0.45	Hour
				Water - District	12.00	AcIn
				Water - Pressurize	12.00	AcIn
	Aug			Irrigation Labor	0.45	Hour
				Water - District	10.00	AcIn
				Water - Pressurize	10.00	AcIn
	Sept			Irrigation Labor	0.15	Hour
				Water - District	3.00	AcIn
				Water - Pressurize	3.00	AcIn
	Oct			Irrigation Labor	0.15	Hour
				Water - District	2.00	AcIn
				Water - Pressurize	2.00	AcIn
Insects: NOW	Mar			NOW Traps (pheromone)	0.07	Acre
Insects: NOW	Mar			NOW Traps (eggs)	0.07	Acre
Fertilize:	Apr			UAN32	25.00	Lb. N
Insects: Plant Bugs	Apr	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				Warrior II	5.00	Oz
Vertebrate Pest:	Apr		UTV-4WD	Equipment Operator Labor	0.30	Hour
				RCO Avalon	0.50	Lb.
	Aug		UTV-4WD	Equipment Operator Labor	0.30	Hour
				RCO Avalon	0.50	Lb.
	Nov		UTV-4WD	Equipment Operator Labor	0.30	Hour
				RCO Avalon	0.50	Lb.
Vertebrate Pest:	May		UTV-4WD	Equipment Operator Labor	0.60	Hour
				RCO Avalon	1.00	Lb.
Fertilize:	May			10-0-10	51.50	Gal
	June			10-0-10	51.50	Gal
Weeds: Spot Spray 2x	May		UTV-4WD	Equipment Operator Labor	0.20	Hour
			Spot Sprayer UTV 20 Gal	Rely 280	0.47	Pint
	July		UTV-4WD	Equipment Operator Labor	0.20	Hour
			Spot Sprayer UTV 20 Gal	Rely 280	0.47	Pint
Insects: Mealybug	May	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				Movento	8.00	FlOz

UC COOPERTIVE EXTENSION AND AGRICULTURAL ISSUES CENTER

Table 9. CONTINUED

San Joaquin Valley-2020

Operation	Operation Month	Tractor	Implement	Labor Type/ Material	Rate/ acre	Unit
Disease: BOT	June	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				Luna Experience	12.00	FlOz
Aflatoxin:	June			AF36	10.00	Lb.
				AF36 Application	1.00	Acre
Fertilize:	July			15-0-05	51.50	Gal
Disease: Alternaria	July			Merivon	6.00	FlOz
Insects: Mites	July	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				WettableSulfur92%	20.00	Lb.
Pest: NOW	Aug	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				Intrepid 2F	24.00	FlOz
				Brigade WSB	9.60	Oz
Pest: NOW	Sept	85HP 4WD Tractor	Orchard Sprayer PTO 500 Gal	Equipment Operator Labor	0.41	Hour
				Altacor	4.50	Oz
				Warrior II	5.00	Oz
UTV	Sept		UTV-4WD	Equipment Operator Labor	2.50	Hours
Pickup	Sept		Pickup Truck 1/2-Ton	Equipment Operator Labor	2.40	Hours
PCA: Consulting	Sept			PCA Yrs. 7	1.00	Acre
Harvest: Bulk	Sept			Harvest-Bulk	128.00	Tree
Assessments:	Sept			Pistachio Research Board	2,800.00	Lb.