

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

PRODUCTION PRACTICES AND SAMPLE COSTS FOR ORGANIC WALNUTS

SACRAMENTO VALLEY - 1994

STANDARD SPACING/SPRINKLER IRRIGATED

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OVERVIEW OF ORGANIC WALNUT PRODUCTION

Introduction:

Organic walnuts are produced largely in Yolo and Solano Counties in the Sacramento Valley. Varieties that are grown organically include: Chandler, Hartley, Howard and Serr. Although only .5 to 1% of the total walnut acreage in this area is farmed by state registered and certified organic growers, an increasing number of farmers now produce walnuts with fewer synthetic fertilizer and pesticide inputs.

This overview is meant to guide the reader through topics and issues that are integral to organic walnut production. Like conventional farming, there are a number of different approaches to growing walnuts organically, from orchard spacing and floor management to irrigation system design and agricultural inputs. The following is a discussion of common practices and issues related to organic walnut production.

The first section of this overview describes the seasonal flow of operations for the production and processing of organic walnuts. Next, the cover crop/floor management and pest management sections give greater details of these practices. Finally, marketing, risk and the current status of regulations for organically grown walnuts are discussed.

Production and Processing Practices:

Cultural operations begin in early November after a September or October harvest. Ideally, orchards are pruned first and then a winter annual cover crop is sown. Most growers prefer to prune the orchard prior to seeding a cover crop to minimize disturbance of the orchard floor once the cover crop is planted. However, cover crops should be planted no later than mid November in the Sacramento Valley to establish a good stand. Growers are not always able to perform pruning operations by this time, making it necessary to plant a cover crop prior to pruning. Once a cover crop is sown, an irrigation is performed (if necessary) to both germinate the cover crop and irrigate the orchard postharvest. Following this irrigation, growers typically rely on fall and winter rains for cover crop growth and for replenishing moisture in the soil profile. For additional information on cover crop practices, refer to the **Cover Crops/Floor Management** section.

Orchard pruning helps to increase the vigor and producing ability of trees. Pruning practices depend on the orchard's spacing and the walnut variety. For example, standard spaced orchards are usually hand pruned. Terminal bearing varieties, such as Hartley, require only a minimal pruning each year to remove branches that interfere with other trees and operations in the orchard. Lateral bearing varieties, such as Chandler and Howard, require more intensive hand pruning, especially in their formative years to promote shoot growth and to maintain productivity. In contrast, high-density (hedgerow) plantings are usually mechanically pruned on a regular basis to avoid shading and crowding. Larger prunings are either removed from the orchard and burned or put through a chipper and then spread throughout the orchard to return organic matter to the soil. Smaller prunings are most often shredded and chopped in the orchard with a flail mower. Pruning disposal takes place either immediately after pruning or later in the season in conjunction with spring mowing of the cover crop. However, some cover crops may grow around and over prunings and make spring disposal difficult. Suckers are generally summer pruned. Few, if any, trees require removal and replanting on a year-to-year basis.

Fertilizing materials such as compost, sulfate of potash and mined limestone are only applied on a limited basis to orchard soils in this area. Composted poultry manure is sometimes spread for its nitrogen benefit as well as to stimulate microbial activity in the soil. Also, when orchards show a deficiency of the micronutrient zinc, an organically acceptable zinc compound is applied in the spring. Fertilizing materials and foliar nutrients are typically applied when tissue and soil analyses, as well as grower experience, have shown it to be appropriate.

Pest control measures for diseases, insects, mites, vertebrates and weeds are minimal in organic walnut orchards in this region. Control techniques vary depending on the previous year's pest incidence and the yearly climatic conditions. Refer to the **Pest Management** section for further information.

Orchard irrigations are generally performed from May through September. The delivery method and the amount of applied water may vary among locations. Total applied water will be dependent on the system design, seasonal rains, soil type, orchard age, the tree rooting depth, the number and size of trees in the orchard and floor management practices. Sprinkler (solid set or movable pipe) and flood irrigation systems are often used in this area. Microsprinkler irrigation is used less often. Microsprinkler and sprinkler irrigation systems typically deliver water more efficiently than flood irrigation systems and therefore require less total water to irrigate the orchard. Also, cover crops and soil organic matter content may play a role in the total number of irrigations each year. Cover cropped soils, or soils amended with organic matter improve water penetration and infiltration rates. Therefore, irrigation efficiency may be increased by reducing surface ponding and runoff.

Frost protection is not critical for walnut production in the Sacramento Valley. Therefore, growers seldom have on-farm investments specifically for frost protection.

To level the orchard for harvest, growers land plane one or two times. Walnuts are then mechanically harvested either by the grower or by a custom operator. Farmers with large acreages often own the necessary harvest equipment and therefore perform the harvest. Walnut harvest equipment requires a large capital investment, which may not be cost effective for relatively small orchards. Growers without harvest equipment employ a custom operator. Depending upon the variety planted, walnut harvests take place in September or October.

After harvest, walnuts are either hauled to a hulling and drying facility, or hulled and dried in on-farm facilities. Following these operations walnuts are processed (i.e. shelled, sorted and packed) into poly-lined 25-pound boxes. Nuts are inspected during the shelling (cracking) and sorting process for live pest infestations and other defects by the Dried Fruit Association of California (DFA). After passing inspection, nuts are exposed to freezing temperatures for a minimum of one to two weeks to destroy any remaining eggs or larvae of codling moth, navel orangeworm and other stored product pests. A nitrogen gas treatment is sometimes used in addition to a freezing treatment. In contrast, conventionally grown walnuts are fumigated with methyl bromide; this practice is prohibited under organic farming regulations.

After the freezing treatment, walnuts are refrigerated to maintain quality until the product is sold. Some growers have large capital investments in hulling and drying facilities, cracking equipment and/or specialized freezing and refrigeration units to retain control of the product during the different stages of production and processing. Alternatively, custom operators are employed to perform some or all of these practices.

Yields for organic walnuts will vary depending on a number of factors including orchard age, planting density, variety, production location, irrigation practices and yearly growing conditions. In this area, yields for organically produced walnuts range from 1.0 to 2.75 in-shell tons per acre. Depending on the variety and moisture content, crack-out conversion factors can range from 38 to 48%. Using a 42% crack-out conversion factor, approximately 840 to 2,310 meat pounds per acre are harvested.

The following table shows the range of in-shell ton and meat pound yields per acre for four walnut varieties currently grown organically in the Sacramento Valley.

**Yield Ranges for Four Walnut Varieties
Grown Organically in the Sacramento Valley**

Walnut Variety	In-Shell Tons Per Acre	Meat Pounds Per Acre¹
Chandler²	1.5-2.75	1,260-2,310
Hartley³	1.1-2.75	925-2,310
Howard²	1.8-2.20	1,510-1,850
Serr³	1.0-2.00	840-1,680

¹ Based on 42% crack-out conversion factor.

² Hedgerow planting (150 trees per acre).

³ Standard-spacing (50-80 trees per acre).

Cover Crops/Floor Management:

Cover crops can be beneficial for the production of organic walnuts in a number of ways. Leguminous cover crops may increase soil nitrogen through nitrogen fixation. Cover crop root growth and root exudates often stimulate microbial activity which has been shown to promote soil aggregate stability. If cover crops are incorporated into soil in the spring, microbes assist in the decomposition process by breaking down organic matter and releasing nutrients. Cover crops increase the plant diversity of the orchard and can attract and harbor alternate prey for beneficial arthropods (insects, spiders and predatory mites). If grown to the flowering stage, they can provide nectar to attract and sustain beneficial insects. Cover crops can also reduce dust problems in orchard systems which in turn may help reduce spider mite pests. Weed suppression may be another direct benefit of cover cropping depending on the species or mix selected. Also, cover crops help control soil erosion, particularly on sloped or hilly land. Lastly, farm machinery is able to enter orchards sooner after rains or irrigations when a cover crop's mat of root and vegetative growth provides support on wet soil. This may also serve to reduce soil compaction.

There may also be some disadvantages with using cover crops in orchards. Annually sown cover crops increase cash costs for seed and labor, and may require the rental or purchase of specialized farm machinery. Additional inputs such as water and nutrients may be necessary because of competition between the cover crop and trees. The water requirement in particular should be taken into consideration when the cost to deliver or pump water is high. Cover crops may attract arthropod and vertebrate pests to the orchard. Also, harvest and hulling may delay seeding, and cover crops can interfere with pruning schedules. Cover crops can also radiate less heat on cold nights than a bare orchard floor causing a colder orchard that is more subject to freezing temperatures.

Selection of a particular cover crop species should take into account the yearly production cycle of the walnut crop as well as the cold tolerance of the cover crop, which dictates the planting time. Also, growers should select cover crops for the specific needs of an orchard. For example, in walnuts, a cover crop that includes at least one legume is generally preferred so that the supply of soil nitrogen is increased. If growers wish to increase the amount of biomass that is returned to the soil, then a cover crop mix that also includes a grass may be best. In addition, the soil type and irrigation system should be taken into consideration. For example, a reseeded vetch cover crop may not be the best choice for orchards with permanent sprinkler irrigation because vetch tends to climb and wrap around sprinkler heads. To alleviate this difficulty, vetch seed can be planted in a narrower band in the middles. Alternatively, cover crop mixes may include a grass or bell beans to provide a means of support for vetch growth. Some growers are unconcerned about the blockage that may result from vetch growth. Tall-growing cover crops may interfere with sprinkler irrigations if orchards require irrigation before the cover crop is mowed and/or incorporated. Growers in some areas may find that certain cover crop species and mixes are not appropriate for their soils and conditions. Often, the most suitable cover crop in each situation is determined by observation and experimentation over a period of years.

Cover crop management practices depend on the type of cover crop that exists in the orchard. For example, in this region cover crop mixes of legumes (including bell beans, clovers, field peas and/or vetch) and grasses (barley and/or oats) are customarily planted. Cover crops that are annually sown are grown during the winter months and in the spring are mowed once and often incorporated into the soil by discing once. Incorporating the cover crop speeds decomposition of the vegetation and recycling of nutrients for crop production. Moreover, competition for water and nutrients between the trees and the cover crop is also lessened during the spring and summer months when the cover crop is incorporated. Orchard floors are then mowed and cross-mowed or harrowed periodically throughout the summer months to keep the floor and tree rows free of vegetative growth.

Alternatively, some growers mow only a portion of the orchard's cover crop, leaving a remnant strip growing between each tree row. The purpose of the remnant strip is threefold: 1) the area provides a habitat for beneficial insects, 2) the strips are grown to maturity, produce seed and self-reseed a portion of the orchard, and 3) organic matter, and its nitrogen, is returned to soils incrementally rather than all at once in the spring. The portion of the cover crop that is mowed is also shredded and then left on the soil surface to decompose slowly.

Some loss of nitrogen for crop production may occur when the cover crop is not incorporated, however, no known research has been performed to quantify this. Nevertheless, this practice reduces overall tillage or mowing operations and may suppress some weed growth in the orchard. The mulch also reduces evaporative moisture loss from the soil and provides a habitat for beneficial arthropods such as spiders.

Pest Management:

Many pesticides that are currently used by producers of conventionally grown walnuts are not approved for use by organic walnut growers. In general, pest control products used by organic growers are not as effective as synthetic pesticides for immediate or acute problems. Therefore, pest identification, monitoring and prevention are essential elements of successful organic walnut production. In this area, pest infestations for organically produced walnuts are variable from year to year. When necessary, some techniques are used to reduce pest incidence and populations in the orchard.

Diseases. Important diseases that occur in Sacramento Valley organic walnut orchards include: walnut blight (*Xanthomonas campestris* pv. *juglandis*), deep bark canker (*Erwinia rubrifaciens*), oak root fungus (*Armillaria mellea*) and *Phytophthora* crown and root rot (*Phytophthora* spp.). Walnut blight, most prevalent in wet, rainy years or under any moist conditions, infects newly developing tissues, including buds, catkins and nuts. As a result, yields are decreased. Copper sprays are used to reduce disease incidence, however, control is difficult since the disease has developed resistance to copper. Deep bark canker generally occurs when trees are water-stressed, and is usually not a problem on varieties other than Hartley. *Erwinia rubrifaciens* itself does not kill trees; rather the disease weakens trees, thus decreasing overall production. The pathogen can best be managed or reduced with such corrective measures as good water and soil management. Also, care should be taken to avoid spreading the disease to healthy trees through mechanical shaking injuries at harvest.

Oak root fungus and *Phytophthora* both develop in weather and soils that are moist and cool, attacking the crown and roots of walnut trees. Once trees are infected, the pathogens are difficult to eradicate. Pathogen infection results in poor growth and an overall decline in tree vigor. To minimize the risk of pathogen infection, management strategies include: planting resistant rootstock (Paradox), sanitation of farm machinery, and good soil and water management. Complete tree removal (including tree roots) may be the best control option for oak root fungus. It is important that a tree's root system be thoroughly removed before replanting because soil fumigation to control soil-borne pathogens is prohibited under organic farming regulations.

Insects. Growers indicate that insect damage and crop loss levels are tolerable for walnuts produced organically in this area. For one reason, naturally-occurring insect predators and parasites are often present in organic orchards in large enough numbers to reduce pest populations in general. Growers sometimes augment these populations by releasing parasitic wasps of the genus *Trichogramma* to regulate pest densities on a year-to-year basis. Another reason is that late blooming varieties such as Chandler and Hartley are usually used in organic production; these varieties avoid the first flight of codling moth (*Cydia pomonella*) and also avoid the early rains that increase walnut blight incidence. Growers do report, however, that four insect pests periodically infest orchards and are responsible for some crop loss in years when conditions are optimal for insect development. The insect pests are: codling moth, navel orangeworm (*Amyelois transitella*), redhumped caterpillar (*Schizura concinna*) and walnut husk fly (*Rhagoletis completa*). These pests overwinter in orchards in soil, trash, tree bark or mummy nuts, emerging in the spring or summer to mate and lay eggs in or near walnuts. Depending upon the pest, hatched larvae feed on the foliage, husks, or the developing kernel itself.

Like conventional growers, organic growers find that orchard sanitation is important for reducing and/or controlling codling moth, navel orangeworm and walnut husk fly. Walnuts with damaged and open hulls, nuts with stings and mummy nuts are either disced into the soil or picked up and submerged in water to drown pests. Other growers shred mummy nuts along with leaf litter and twigs, leaving the residue on the orchard floor as a habitat for such generalist predators as ground beetle (*Carabidae* spp.) and earwigs (*Forficulidae* and *Labiduridae* spp.). The bacterium *Bacillus thuringiensis* (Bt) may be used to reduce populations of redhumped caterpillar. For monitoring walnut husk fly, traps containing lures and sticky boards are placed in orchards. When an infestation occurs, the orchard (or a portion of) is treated with Pyrellin E.C., a botanical insecticide derived from two plant extracts, pyrethrum and rotenone. Pyrethrum formulations are currently organically acceptable for insect control in California *provided they do not contain the synergist piperonyl butoxide*. Some organic growers have experienced a decrease in beneficial insect and predatory mite populations with pyrethrum use. For this reason, insect sprays should be avoided whenever possible.

Vertebrates. Gophers and ground squirrels are controlled by trapping, drowning, shooting or with strychnine bait placed underground within orchards. These practices are allowed under current organic farming regulations.

Weeds. Weeds in orchard centers are most often controlled by discing, mowing or cultivating with a spring-tooth harrow. Also, living or dead mulches of vetch and other cover crops help reduce weed populations. Weeds in tree rows are removed by cross discing, mowing or harrowing. In addition to these operations, weeds in tree rows are controlled with a string weed trimmer, hand hoeing, and/or flame weeding. Flame weeding does not actually burn weeds back; they are killed by desiccation when the plant's cells burst upon exposure to the high temperatures that a flame weeder produces. The number of mechanical cultivations, mowings, hand or flame weedings varies among growers, but usually ranges from five to eight total operations per growing season.

Marketing and Associated Risks of Organically Grown Walnuts:

Walnuts that are produced organically are usually sold for a higher price than the comparable conventionally grown and shelled product. However, returns to growers will vary depending on a number of factors, including nut variety and quality, industry supply and consumer demand. For example, the market for organically produced walnuts is not well developed and, in some years, supply may be greater than demand. As a result, market gluts occur, thus reducing grower returns. However, growers with uniform production and consistent yields are better able to sell their product effectively on a year-to-year basis. Some growers also process (shell, sort and pack) and store their own product, and have developed markets to sell directly to wholesalers, retailers and/or the export market. While on-farm processing and storage serves to reduce market risks, capital investment and related operating costs are increased significantly. To cover these additional costs, organic walnut grower/processors receive higher returns per meat pound than organic walnut growers who do not process their own nuts.

Organically grown walnuts must meet the same minimum quality grades and standards as conventionally grown walnuts. To meet the requisite standards for number one quality in-shell walnuts, nuts must be bleached. Typically, nuts are also fumigated to kill live in-shell pest infestations. However, neither practice is allowed by state, federal and certification agency rules and regulations for organic walnuts. Therefore, for the commercial market, organic walnuts are currently sold only as a shelled product. Light-colored kernel halves that are free of internal damage bring growers top prices. Kernel pieces are sold for industrial use and receive lower prices. Culled nuts may be sold for processing into oil. Reject levels for organically produced walnuts can range from 1 to 12% or more in years with severe pest infestations, particularly when organically acceptable pest control methods are either not available or efficacious. It is therefore important to recognize that both market and production costs and risks affect the profitability and economic viability of each organic walnut operation, and that growers face significant challenges on year-to-year basis.

Regulations of Organically Grown Commodities:

As of January 1, 1992 all growers who choose to produce and market organic commodities must register on a yearly basis with the State of California under the California Organic Foods Act of 1990. Enforced under this act are the provisions of Article 4.5 (commencing with Section 26569.20) of Chapter 5 of Division 21 of the California Health and Safety Code and of the California Food and Agricultural Code commencing with Section 46000. These provisions contain rules and regulations that must be adhered to by all producers, processors and handlers of organic commodities. The act states that prior to January 1, 1995, producers of organic commodities could not apply prohibited materials or substances to annual or two-year crops for a minimum of twelve months prior to seed planting or twelve months prior to the appearance of flower buds for perennial crops to qualify as organic. Beginning January 1, 1995 through December 31, 1995, this rule increased to a twenty-four month period of prohibition. On or after January 1, 1996 the restriction increases to thirty-six months. State registration fees apply and are estimated by the registrant's total gross sales from the previous year. If no sales occurred in the previous year, fee remittance is based on the projected gross receipts. First year registrants must pay a one-time only assessment equal to one and one-half times the yearly state registration fee. The state program is administered through the California Department of Food and Agriculture (CDFA).

On October 1, 1993, the federal Organic Foods Production Act of 1990 (OFPA) became effective. This act sets forth production standards and regulates all organic commodities on the national level. However, due to budget and time constraints, final recommendations for the law's implementation have not been completed. Therefore, even though the law is now in place, implementation and enforcement has been delayed. Nevertheless, growers would be wise to conform to federal production standards (in addition to state regulations) at this time. The federal program is administered through the United States Department of Agriculture (USDA).

The OFPA preempts state law except in those cases where the state applies to the USDA for approval of stricter standards. Two differences between state and federal laws are noteworthy. First, the federal law stipulates that organic foods must not be produced on land to which a prohibited substance has been applied for a minimum of three years immediately preceding harvest of the crop to qualify as organic. Second, federal law states that growers must be certified by a federally accredited certifying agent on an annual basis if yearly gross sales total more than \$5,000. This federal requirement should not be confused with, and is separate from, state registration.

In 1992 approximately 45% of the registered organic farmers in California were certified by a certification agency. Approximately 90% of those certified were certified by California Certified Organic Farmers (CCOF). In addition to CCOF, five other organizations actively certify growers in the state. They are: Farm Verified Organic (FVO), the Organic Crop Improvement Association (OCIA), the Organic Growers and Buyers Association (OGBA), Quality Assurance International (QAI) and Scientific Certification Systems (SCS). Each agency should adhere to all state and federal laws regulating organic commodities, and in addition may enforce standards and procedures specific to their own agencies. Organizations differ with respect to the certification process and the associated costs. The above organizations are registered with the State of California. However, none are currently accredited by the USDA since the USDA's certification program has not yet been implemented. Additional sources of information are located in the references section of this publication.

Under Assembly Bill (AB) 1713 (Chapter 948, Statutes of 1993), the California Organic Foods Act of 1990 was modified to establish an Organic Processed Food Registration (OPFR) Program. The OPFR program requires that processors of organic foods register with the Department of Health Services (DHS) and pay an annual fee. Therefore, growers who process (shell, sort and pack) walnuts are required to register with DHS in addition to registering with CDFSA.

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

COST AND RETURNS STUDY FOR ORGANIC WALNUTS

SACRAMENTO VALLEY - 1994

STANDARD SPACING/SPRINKLER IRRIGATED

The practices described for the hypothetical organic orchard used in this report are considered common for walnuts in the Sacramento Valley. Sample costs given for labor, materials, equipment and contract services are based on 1994 prices. **The use of trade names is not an endorsement or a recommendation nor is criticism implied by omission of similar products.** A blank **Your Cost** column is provided to enter your actual costs on **Table 1. Costs Per Acre - Operations** and **Table 2. Detail of Costs Per Acre - Inputs**. Costs and practices detailed in this study are not be applicable to all situations. This study is only intended as a guide and can be used in making production decisions, determining potential returns, preparing budgets and evaluating production loans.

This report consists of the set of **Cost of Production Assumptions For Organic Walnuts** and six tables.

- Table 1. Costs Per Acre - Operations**
- Table 2. Detail of Costs Per Acre - Inputs**
- Table 3. Monthly Cash Costs Per Acre**
- Table 4. Annual Equipment, Investment And Business Overhead Costs**
- Table 5. Hourly Equipment Costs**
- Table 6. Ranging Analysis**

For an explanation of calculations used for the study refer to the attached assumptions, call the Department of Agricultural Economics, Cooperative Extension, University of California, Davis, California, (530) 752-9376 or call the farm advisor in the county of interest.

A study entitled "*Sample Costs to Establish a Walnut Orchard and Produce Walnuts, English Variety & Sprinkler Irrigated in the Sacramento Valley - 1995*" is available for those interested in orchard establishment costs and for production costs of conventionally grown walnuts.

The above study can be requested through the Department of Agricultural Economics, U.C. Davis, or from selected county Cooperative Extension offices.

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COST OF PRODUCTION ASSUMPTIONS FOR ORGANIC WALNUTS

This study reflects the practices and costs associated with a production/processing operation for organically grown walnuts in the Sacramento Valley. While every effort is made to model the system based on real world practices, this report cannot fully represent the costs and practices that are specific to each orchard, production region or processing operation. Production, processing and management techniques are individualized to meet the specific needs of each operation. Therefore, this study should be interpreted as a representative operation and not as a statistical average. Costs are represented on an annual per acre basis.

The orchard in this analysis is assumed to have been established as a conventional orchard for walnut production. It is considered to have completed the transition period and is registered and certified as organic. Changing a farming system from conventional to organic practices requires a transition period. Rules and regulations for organic production must be adhered to during this time period. Crops grown in transition years may not be legally sold or labeled as organic. Commodities that are produced organically can often be sold for a higher price than conventionally grown products. However, industry supply, consumer demand and market competition all affect grower returns.

The following is a description of general assumptions pertaining to sample costs for the organic walnut orchard and processing operation analyzed in this study.

1. LAND:

The total orchard size is 40 acres. Land is owned by the grower and is valued at \$4,200 per acre. This figure is within the range of values for land with orchard potential in the Sacramento Valley. Land costs per acre will vary within the region and within each county. Land is assumed to be fairly level, with well drained soils of moderate depth and fertility.

2. ORCHARD ESTABLISHMENT:

The establishment cost is the sum of cash costs for land preparation, planting, trees, cash overhead and production expenses for growing walnut trees through the first year that walnuts are harvested (year four). The orchard establishment cost is used to determine the non-cash overhead expenses, depreciation and interest on investment during the production years. Site selection is determined by a number of factors including location, slope, soil type, fertility and depth. (For more detailed information on this cost refer to the study entitled *Sample Costs To Establish a Walnut Orchard and Produce Walnuts, English Variety & Sprinkler Irrigated, In The Sacramento Valley - 1995*).

3. TREES:

Walnut varieties (for production and cross pollination) are not specified. Factors affecting varietal selection include adaptability to climatic region, the time of leafing and bloom, whether a variety is terminal or lateral bearing and nut quality. Trees are assumed to be planted on a 24' x 24' spacing with 75 trees per acre. The orchard life is 36 years beyond the four establishment years.

4. SPRINKLER IRRIGATION:

A permanent under-tree sprinkler irrigation system is used for the orchard. Water for the sprinkler irrigation system is pumped from a depth of 100 feet in a 300 foot well using a 60 horsepower (hp) pump. The cost for the sprinkler irrigation system includes the mainline and lateral pipe, risers, filtration system and labor charges for installation. In addition, 100% of the cost to refurbish the well and charges for the 60 hp pump and are included in the sprinkler irrigation system. The irrigation system has a lifespan equal to that of the orchard, is an improvement to the property, and is therefore included in **Table 4. Annual Equipment, Investment and Business Overhead Costs** as an investment.

Incorporation of the cover crop in the spring minimizes the competition for soil moisture between the cover crop and trees. (See the **Cover Crops/Floor Management** section below). The pumping cost for irrigation water is estimated at \$36.96 per acre-foot or \$3.08 per acre-inch. A total of 36 acre-inches of water is used to irrigate the orchard: three inches for a postharvest irrigation and 33 inches for irrigations performed during the growing season. The orchard is irrigated eight times between May and September.

5. PRODUCTION PRACTICES:

Production practices in this study are listed in **Table 1. Costs Per Acre - Operations**. This table shows the order in which the operations are performed, as well as the hours per acre required for each operation. Labor and custom rates, material and fuel and repair costs are also included in this table. **Table 2. Detail of Costs Per Acre - Inputs** shows the material inputs and rates of application. In addition, **Table 3. Monthly Cash Costs Per Acre** shows the monthly cash costs and sequence of operations.

6. COVER CROPS/FLOOR MANAGEMENT:

A winter annual cover crop is sown each year in the fall. The cover crop is grown primarily for its nitrogen benefit, and therefore contains a high proportion of legumes, but also includes a grass to increase the biomass that is returned to the soil. Land is disced one time to prepare a seedbed for the cover crop. The seed mixture is broadcast in the orchard centers at a rate of 110 pounds per acre. This seeding rate represents a mixture of five species of cover crops: 40 pounds of bell beans, 30 pounds of field peas, 25 pounds of 'Lana' woollypod vetch, 10 pounds of common vetch and 5 pounds of oats). Seed is covered with a springtooth harrow followed by a ring roller. A postharvest irrigation also serves to germinate the cover crop. After this time, the cover crop is dependent on moisture in the soil profile and fall and winter rains for growth and development.

In May the cover crop is mowed once and then incorporated into the soil by one discing. Throughout the remainder of the spring and summer orchard centers are mowed five times to control weeds and vegetative growth. Vegetative growth in the tree rows is controlled with a weed-string trimmer and by hand weeding. No other means of weed control is used in this study. Therefore, no irrigation water is necessary in the late spring or summer months specifically for cover crops.

7. PEST MANAGEMENT:

Few pest management materials are assumed to be used for the production of organic walnuts in this orchard. Biological control by naturally-occurring orchard predators and parasites help reduce overall pest damage. However, some pest management materials are used for prevention and for control of certain diseases and insects. Applications may vary on a year to year basis depending on seasonal conditions, pest populations and individual management techniques. Refer to **Table 1. Costs Per Acre - Operations** and **Table 2. Detail of Costs Per Acre - Inputs** following this section for the pest control techniques and materials used for the organic orchard analyzed in this study.

8. HARVEST:

Walnuts are mechanically harvested in the month of October by a custom operator. The cost to shake, sweep and pick up nuts is \$0.05 per in-shell pound. Hulling and drying is performed off-farm and also costs \$0.05 per in-shell pound. These costs are based on a yield minimum of one ton per acre. Should yield fall below the one ton minimum, harvest costs would increase. After hulling and drying, nuts are hauled to an on-farm cracking facility for processing (see the **Processing** section below). Refer to **Table 1. Costs Per Acre - Operations** for the sequence of practices and the exact harvest costs used in this analysis.

For information on custom harvesting contact the farm advisor or companies contracting for walnuts in the area of interest. If growers choose to do their own harvesting, equipment for the required operations should be inventoried and labor, fuel, repairs, depreciation and interest on investment should be added as a cost of production. Custom charges, then, would not be included.

9. PROCESSING AND STORAGE:

Walnuts are shelled, sorted and packed by the grower/processor into poly-lined 25-pound boxes after harvest, hulling and drying. An inspection for live pest infestations is performed by the Dried Fruit Association of California (DFA). Nuts are then exposed to a freezing treatment for one to two weeks minimum to destroy any remaining eggs or larvae, and then stored on-farm in a refrigeration unit until the product is sold.

10. YIELD & RETURN RANGES FOR ORGANIC WALNUTS:

In this study, the yield per acre for organic walnuts is 2.2 in-shell tons. Using a 42% crack-out conversion factor, nut meat pounds per acre are approximately 1,850. This yield falls within a range of yields received by growers in the area. Yields vary depending on such factors as orchard planting density, age, variety, production location and seasonal growing conditions.

Organic walnuts usually command a higher price than the comparable conventional shelled product. Also, the grower/processor receives higher returns than would organic growers who do not process their own nuts to cover the added capital investment and related operating costs attributable to on-farm processing and storage.

For the walnut orchard and processing operation analyzed in this study, the breakeven yield at a price of \$2.70 per meat pound is 1,068 meat pounds per acre. At a high price of \$3.00 per meat pound, the breakeven yield is 915 meat pounds per acre. It is not profitable to produce and process organic walnuts when prices are at or below \$1.65 per meat pound, and yields are below 2,600 meat pounds per acre. A ranging analysis for varying yields and prices is shown in **Table 6. Ranging Analysis**. All prices are F.O.B. ranch.

11. LABOR:

Basic hourly wages for workers are \$7.00 and \$5.15 per hour for machine operators and orchard workers, respectively. Adding 34% for workers compensation, social security, insurance and other benefits increases the labor rates to \$9.38 per hour for machine labor and \$6.86 per hour for non-machine labor. The labor hours for operations involving machinery are 20% higher than operation time to account for extra labor involved in equipment set-up, moving, maintenance and repair. Wages for managers are not included as a cash cost. Any returns above total costs are considered returns to management and risk.

12. 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 include, but are not limited to, property taxes, interest on operating capital, offices expenses, property and liability insurance, sanitation services and equipment repairs.

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 additional taxes are charged 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 a 10% salvage value divided by two on a per acre basis.

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 7.89% per year. A nominal interest rate is the going market cost for borrowed funds. Interest rates vary depending on the institution, collateral, market conditions and other individual circumstances.

Office and Business Expense: Office and business expenses are estimated at \$65 per acre. These expenses include, but are not limited to, office supplies, telephones, bookkeeping, accounting, legal fees and road maintenance.

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 0.713% of the average value of the assets over their useful life. Liability insurance covers accidents on the farm and costs \$336 per year.

Sanitation Services: Sanitation services provide portable toilets for the orchard and cost the farm \$654 annually.

Cash overhead costs are found in **Tables 1, 2, 3, 4** and **5**.

13. NON-CASH OVERHEAD:

Non-cash overhead is comprised of depreciation and interest charged on equipment and other investments. This study shows the current purchase price for new equipment adjusted to 60% of the new value to indicate that a mixture of new and used equipment is utilized on the farm. Annual equipment and investment costs are shown in **Tables 1, 2 and 4**. They represent depreciation and opportunity cost for each investment on an annual per acre basis.

Depreciation is a reduction in market value of investments due to wear, obsolescence and age and is on a straight line basis. Annual depreciation is calculated as the purchase price minus the salvage value divided by the years the investment is held. The purchase price and years of life are shown in **Table 4**.

Interest is charged on investments to account for income foregone (opportunity cost) that could be received from an alternative investment. The investments are assumed to be owned outright. Therefore, interest on investments is a non-cash cost. Investments include, but are not limited to, land, trees, buildings, irrigation system and equipment. Interest is calculated as the average value of the investment during its useful life, multiplied by a real interest rate of 3.72% per year. Average value for the equipment and buildings equals the new cost plus a 10% salvage value divided by two on a per acre basis.

The average value for land is equal to the purchase price because land does not depreciate. The interest rate used to calculate opportunity cost is the ten year average of the agricultural sector longrun 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.

14. EQUIPMENT CASH COSTS:

Equipment costs are composed of three parts; cash overhead, non-cash overhead and operating costs. Both of the overhead factors are detailed in previous sections. The operating costs consist of fuel, lubrication and repairs.

In allocating the equipment costs on a per acre basis, the following hourly charges are calculated first and shown in **Table 5**. Repair costs are based on the purchase price, annual hours of use, total hours of life and repair coefficients formulated by the American Society of Agricultural Engineers (ASAE). Fuel and lubrication costs are also determined by ASAE equations based on maximum PTO horsepower (hp) and the type of fuel used. The fuel and repair costs per acre for each operation in **Table 1**. is determined by multiplying the total hourly operating cost in **Table 5**. for each piece of equipment used for the cultural practice by the number of hours per acre for that operation. Tractor time is 10% higher than implement time for a given operation to account for setup time. Prices for on-farm delivery of diesel and gasoline are \$0.85 and \$1.17 per gallon, respectively.

15. ASSESSMENTS:

Under a state marketing order, mandatory assessment fees are collected by the California Walnut Commission (CWC). This assessment is charged to the grower to pay for walnut marketing, advertising and research programs. The CWC has a current fee of \$0.009 per pound for in-shell nuts. Based on an in-shell yield of 2.2 tons per acre, the CWC assessment therefore totals \$39.60 per acre.

A stepped scale organic grower registration fee of \$300 is assessed by the State of California on the gross sales amount of \$199,800. The fee is calculated by multiplying the assumed yield (1,850 meat pounds per acre) by the price received (\$2.70 per meat pound) and the number of acres (40). This is only an estimate of potential fees and will vary depending on yields and returns. Contact the County Agricultural Commissioner in your area for further details.

The grower is assumed to be certified by California Certified Organic Farmers (CCOF). Annual membership fees are \$125. Inspection fees are \$175. An assessment fee of 0.5% of gross sales, or \$999, is included as a cost of production. These fees are specific to this study. Fees are based on the number of acres and parcels contained in an operation as well as whether or not the farm is totally organic. Therefore, individual situations will vary.

A \$100 processor fee is also assessed by the State of California's Organic Processed Food Registration (OPFR) program since the walnuts are shelled, sorted and packed on farm. For additional information, contact the Department of Health Services.

16. ACKNOWLEDGEMENT:

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REFERENCES

- Agrios, George N. 1988. *Plant Pathology*. Academic Press, Inc. San Diego, California.
- Buchner, Rick, et al. 1995. *Sample Costs to Establish a Walnut Orchard and Produce Walnuts, English Variety and Sprinkler Irrigated in the Sacramento Valley*. Department of Agricultural Economics, University of California. Davis, California.
- Bugg, Robert L. and Carol Waddington. 1994. Using cover crops to manage arthropod pests of orchards: A review. *Agriculture, Ecosystems and Environment*, 50: 11-28.
- California Certified Organic Farmers, Inc. (CCOF). 1994. *California Certified Organic Farmers 1994 Handbook*. California Certified Organic Farmers, Inc. Santa Cruz, California.
- California Food and Agricultural Code. (section 14904 and commencing with section 46000.)
- California Health and Safety Code. (commencing with section 26569.20.)
- Chaney, David E., Laurie E. Drinkwater and G. Stuart Pettygrove. 1992. *Organic Soil Amendments and Fertilizers*. UC Sustainable Agriculture Research & Education Program. University of California, Division of Agriculture and Natural Resources. Publication 21505.
- Debach, P. and D. Rosen. 1991. *Biological control by natural enemies*. Cambridge University Press. Cambridge, U.K.
- Flint, Mary Louise. 1990. *Pests of the Garden and Small Farm. A Grower's Guide to Using Less Pesticide*. University of California, Statewide Integrated Pest Management Project, Division of Agriculture and Natural Resources. Publication 3332.
- Integrated Pest Management Education and Publications. 1991. *Managing Insects and Mites with Spray Oils*. University of California, Statewide Integrated Pest Management Project, Division of Agriculture and Natural Resources. Publication 3347.
- Integrated Pest Management Education and Publications. 1991. *U.C. IPM Pest Management Guidelines*. University of California, Statewide Integrated Pest Management Project, Division of Agriculture and Natural Resources. Publication 3339.
- Integrated Pest Management Education and Publications. 1987. *Integrated Pest Management for Walnuts*. University of California, Statewide Integrated Pest Management Project, Division of Agriculture and Natural Resources. Publication 3270.
- Kader, Adel A., Technical Editor. 1992. *Postharvest Technology of Horticultural Crops*. University of California, Division of Agriculture and Natural Resources. Publication 3311.

- Klonsky, Karen, and Laura Tourte. 1994. *State Registration and Organic Certification: A Guide for California Growers*. Department of Agricultural Economics, University of California. Davis, California.
- Miller, P.R., et al. 1989. *Covercrops for California Agriculture*. University of California, Division of Agriculture and Natural Resources. Leaflet 21471.
- Ogawa, Joseph M. and Harley English. 1991. *Diseases of Temperate Zone Tree Fruit and Nut Crops*. University of California, Division of Agriculture and Natural Resources. Publication 3345.
- Organic Foods Production Act of 1990, Title 21, 1990 Farm Bill, Public Law 101-624.
- Parnes, Robert. 1990. *Fertile Soil: A Grower's Guide to Organic & Inorganic Fertilizers*. agAccess. Davis, California.
- Ramos, David E., Technical Editor. 1985. *Walnut Orchard Management*. Cooperative Extension. University of California, Division of Agriculture and Natural Resources. Publication 21410.
- University of California Cooperative Extension. 1989. *Walnut Hedgerow Planting System*. Division of Agriculture and Natural Resources. Leaflet 21467.
- Vaupel, Suzanne. 1992. *What a Farmer Needs to Know. A Summary of California & Federal Organic Production Laws*. Suzanne Vaupel, Vaupel Associates. Sacramento, California.

TABLE 1
U.C. COOPERATIVE EXTENSION
COSTS PER ACRE TO PRODUCE AND PROCESS ORGANIC WALNUTS - OPERATIONS
SACRAMENTO VALLEY - 1994

Labor Rate: \$9.38/hr. machine labor
\$6.90/hr. non-machine labor

Interest Rate: 7.89%
Yield per Acre: 2.2 in-shell tons
1850.00 meat lbs

Operation	Operation Time (Hrs/A)	Cash and Labor Costs per Acre					Total Cost	Your Cost
		Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/ Rent			
Cover Crop Establishment:								
Disc 1X	0.33	3.71	2.48	0.00	0.00	6.20		
Plant Cover Crop	0.19	4.17	1.36	46.20	0.00	51.73		
Spring Tooth 1X - Cover Seed	0.29	3.31	1.68	0.00	0.00	4.99		
Ring Roll 1X	0.23	2.58	1.21	0.00	0.00	3.79		
TOTAL COVER CROP COSTS	1.04	13.77	6.73	46.20	0.00	66.70		
Cultural:								
Irrigate-Postharvest/Cover Crop	0.03	0.21	0.00	9.24	0.00	9.45		
Prune Orchard	11.50	79.35	0.00	0.00	0.00	79.35		
Brush Removal/Disposal	1.00	36.31	6.40	0.00	0.00	42.71		
Weed Tree Rows 3X	12.00	82.80	0.00	0.00	0.00	82.80		
Copper Spray - Walnut Blight	0.25	2.81	3.34	21.84	0.00	28.00		
Mow Cover Crop	0.33	3.71	2.25	0.00	0.00	5.96		
Disc 1X - Incorporate Cover Crop	0.33	3.71	2.48	0.00	0.00	6.20		
Zinc Application - Foliar Spray	0.25	2.81	3.34	11.79	0.00	17.95		
Irrigate 8X	0.24	1.66	0.00	101.76	0.00	103.42		
Mow - Weed Control 5X	1.65	18.57	11.23	0.00	0.00	29.80		
Summer Prune - Suckers	1.50	10.35	0.00	0.00	0.00	10.35		
Pest Management - Walnut Husk Fly (Trap)	0.10	0.69	0.00	1.54	0.00	2.23		
Land Plane	0.45	5.07	3.25	0.00	0.00	8.32		
Rodent Control	0.20	1.38	0.00	0.00	0.00	1.38		
ATV Use	7.15	80.48	12.03	0.00	0.00	92.51		
Pickup Use	7.15	80.48	45.43	0.00	0.00	125.91		
TOTAL CULTURAL COSTS	44.13	410.40	89.75	146.17	0.00	646.32		
Harvest, Processing & Storage:								
Shake/Sweep/Pickup Nuts	0.00	0.00	0.00	0.00	220.00	220.00		
Hull & Dry	0.00	0.00	0.00	0.00	220.00	220.00		
Haul to Cracking Facility	0.00	0.00	0.00	0.00	15.00	15.00		
Shell/Sort/Pack	0.00	0.00	0.00	0.00	1,110.00	1,110.00		
TOTAL HARVEST, PROCESSING & STORAGE COSTS	0.00	0.00	0.00	0.00	1,565.00	1,565.00		
Assessments:								
DFA Inspection	0.00	0.00	0.00	11.82	0.00	11.82		
CA Walnut Commission Assessment Fees	0.00	0.00	0.00	39.60	0.00	39.60		
CA State Organic Grower Registration Fees	0.00	0.00	0.00	7.50	0.00	7.50		
CCOF Membership Fees	0.00	0.00	0.00	3.13	0.00	3.13		
CCOF Inspection Fees	0.00	0.00	0.00	4.38	0.00	4.38		
CCOF - 0.5% of Gross Sales	0.00	0.00	0.00	24.98	0.00	24.98		
CA State Organic Processed Food Registration Fees	0.00	0.00	0.00	2.50	0.00	2.50		
TOTAL ASSESSMENT COSTS	0.00	0.00	0.00	93.91	0.00	93.91		
Interest on operating capital @ 7.89%							38.17	
TOTAL OPERATING COSTS/ACRE		424.17	96.48	286.28	1,565.00	2,410.10		
TOTAL OPERATING COSTS/MEAT LB							1.30	

U.C. COOPERATIVE EXTENSION
 ORGANIC WALNUTS - SACRAMENTO VALLEY - 1994
 Table 1. continued

Operation	Operation Time (Hrs/A)	----- Cash and Labor Costs per Acre -----					Total Cost	Your Cost
		Labor Cost	Fuel,Lube & Repairs	Material Cost	Custom/ Rent			
CASH OVERHEAD:								
Office Expense						65.00		
Soil/Tissue Analysis						2.75		
Liability Insurance						8.40		
Sanitation Services						16.35		
Property Taxes						104.70		
Property Insurance						74.65		
Investment Repairs						34.63		
TOTAL CASH OVERHEAD COSTS						306.47		
TOTAL CASH COSTS/ACRE						2,716.58		
TOTAL CASH COSTS/MEAT LB						1.47		
NON-CASH OVERHEAD:								
	Per producing Acre	----- Annual Cost -----						
Investment		Depreciation	Interest @ 3.72%					
On-Farm Buildings	937.50	28.13	19.18			47.31		
Cracking Facility	1,125.00	50.63	23.02			73.64		
Freezer/Refrigerator Unit	625.00	28.13	12.79			40.91		
Fuel Tank & Pump	158.88	7.15	3.25			10.40		
Shop Tools	275.00	16.50	5.63			22.13		
Land	4,200.00		156.24			156.24		
Orchard Establishment	4,576.00	114.40	93.63			208.03		
Irrigation System	1,443.75	32.48	29.54			62.02		
Product Bins	325.00	29.25	6.65			35.90		
Pruning Equipment	30.00	2.70	0.61			3.31		
Forklift	375.00	16.88	7.67			24.55		
Weed-String Trimmer Equipment	10.00 1,518.49	1.80 130.69	0.20 31.07			2.00 161.76		
TOTAL NON-CASH OVERHEAD COSTS	15,599.62	458.73	389.48			848.20		
TOTAL COSTS/ACRE						3,564.78		
TOTAL COSTS/MEAT LB						1.93		

TABLE 2
U.C. COOPERATIVE EXTENSION
DETAIL OF COSTS PER ACRE TO PRODUCE AND PROCESS ORGANIC WALNUTS - INPUTS
SACRAMENTO VALLEY - 1994

Labor Rate: \$9.38/hr. machine labor
\$6.90/hr. non-machine labor

Interest Rate: 7.89%

	Quantity/Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
OPERATING COSTS					
Seed:					
Bell Beans	40.00	lb	0.27	10.80	
'Lana' Woollypod Vetch	25.00	lb	0.70	17.50	
Common Vetch	10.00	lb	0.55	5.50	
Field Peas	30.00	lb	0.38	11.40	
Oats	5.00	lb	0.20	1.00	
Water:					
Pumped	36.04	acin	3.08	111.00	
Pest Management:					
Copper Hydroxide	8.00	lb	2.73	21.84	
Trap - Walnut Husk Fly	0.25	trap	6.15	1.54	
Foliar Nutrients:					
Zinc	1.00	gal	11.79	11.79	
Custom:					
Shake/Sweep/Pickup	4,400.00	lb	0.05	220.00	
Hull & Dry	4,400.00	lb	0.05	220.00	
Hauling Cost	1.00	acre	15.00	15.00	
Shell/Pack/Sort	1,850.00	lb	0.60	1,110.00	
Assessments:					
DFA Inspection Fees	0.92	ton	12.85	11.82	
CWC Assessment Fees	4,400.00	lb	0.01	39.60	
CA State Organic Registration Fees	1.00	acre	7.50	7.50	
CCOF Membership Fees	1.00	acre	3.13	3.13	
CCOF Inspection Fees	1.00	acre	4.38	4.38	
CCOF 0.5% of Gross Sales	1.00	acre	24.98	24.98	
CA State Organic Processor Fees	1.00	acre	2.50	2.50	
Labor (machine)	24.94	hrs	9.38	233.94	
Labor (non-machine)	27.57	hrs	6.90	190.23	
Fuel - Gas	17.84	gal	1.17	20.88	
Fuel - Diesel	26.21	gal	0.85	22.28	
Lube				6.48	
Machinery repair				46.79	
Interest on operating capital @ 7.89%				38.17	
TOTAL OPERATING COSTS/ACRE				2,410.10	
TOTAL OPERATING COSTS/MEAT LB				1.30	
CASH OVERHEAD COSTS:					
Office Expense				65.00	
Soil/Tissue Analysis				2.75	
Liability Insurance				8.40	
Sanitation Services				16.35	
Property Taxes				104.70	
Property Insurance				74.65	
Investment Repairs				34.63	
TOTAL CASH OVERHEAD COSTS/ACRE				306.47	
TOTAL CASH COSTS/ACRE				2,716.58	
TOTAL CASH COSTS/MEAT LB				1.47	

U.C. COOPERATIVE EXTENSION
 ORGANIC WALNUTS - SACRAMENTO VALLEY - 1994
 Table 2. continued

NON-CASH OVERHEAD COSTS (DEPRECIATION & INTEREST):	
On-Farm Buildings	47.31
Cracking Facility	73.64
Freezer/Refrigerator Unit	40.91
Fuel Tank & Pump	10.40
Shop Tools	22.13
Land	156.24
Orchard Establishment	208.02
Irrigation System	62.02
Product Bins	35.90
Pruning Equipment	3.31
Forklift	24.55
Weed-String Trimmer Equipment	2.00 161.76
TOTAL NON-CASH OVERHEAD COSTS/ACRE	848.20
TOTAL COSTS/ACRE	3,564.78
TOTAL COSTS/MEAT LB	1.93

TABLE 3
U.C. COOPERATIVE EXTENSION
MONTHLY CASH COSTS PER ACRE TO PRODUCE AND PROCESS ORGANIC WALNUTS
SACRAMENTO VALLEY - 1994

Beginning NOV 93	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
Ending OCT 94	93	93	94	94	94	94	94	94	94	94	94	94	
Cover Crop Establishment:													
Disc 1X	6.20												6.20
Plant Cover Crop	51.73												51.73
Spring Tooth 1X - Cover Seed	4.99												4.99
Ring Roll 1X	3.79												3.79
TOTAL COVER CROP COSTS	66.70												66.70
Cultural:													
Irrigation - Postharvest/Cover Crop	9.45												9.45
Prune Orchard	79.35												79.35
Brush Removal/Disposal	42.71												42.71
Weed Tree Rows 3X					27.60				27.60	27.60			82.80
Copper Spray - Walnut Blight						28.00							28.00
Mow Cover Crop							5.96						5.96
Disc 1X - Incorporate Cover Crop							6.20						6.20
Zinc Application - Foliar Spray							17.95						17.95
Irrigate 8X							12.93	12.93	25.85	25.85	25.85		103.42
Mow - Weed Control 5X								5.96	5.96	5.96	11.92		29.80
Summer Prune - Suckers									10.35				10.35
Pest Management - Walnut Husk Fly									2.23				2.23
Land Plane											8.32		8.32
Rodent Control											1.38		1.38
ATV Use											92.51		92.51
Pickup Use											125.91		125.91
TOTAL CULTURAL COSTS	131.51				27.60	28.00	43.03	18.89	71.99	59.41	265.89		646.32
Harvest, Processing & Storage:													
Shake/Sweep/Pickup Nuts												220.00	220.00
Hull & Dry												220.00	220.00
Haul to Cracking Facility												15.00	15.00
Shell/Sort/Pack												1,110.00	1,110.00
TOTAL HARVEST, PROCESSING & STORAGE COSTS												1,565.00	1,565.00
Assessments:													
DFA Inspection												11.82	11.82
CA Walnut Commission Assess												39.60	39.60
CA State Organic Registration Fees												7.50	7.50
CCOF Membership Fees												3.13	3.13
CCOF Inspection Fees												4.38	4.38
CCOF - 0.5% of Gross Sales												24.98	24.98
CA State Organic Processor Reg. Fees												2.50	2.50
TOTAL ASSESSMENT COSTS												93.91	93.91
Interest on operating capital	1.30	1.30	1.30	1.30	1.48	1.67	1.95	2.08	2.55	2.94	4.69	15.60	38.17
TOTAL OPERATING COSTS/ACRE	199.52	1.30	1.30	1.30	29.08	29.67	44.98	20.96	74.54	62.35	270.58	1,674.51	2,410.10
TOTAL OPERATING COSTS/MEAT LB	0.11	0.00	0.00	0.00	0.02	0.02	0.02	0.01	0.04	0.03	0.15	0.91	1.30
OVERHEAD:													
Office Expense	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	65.00
Soil/Tissue Analysis									2.75				2.75
Liability Insurance												8.40	8.40
Sanitation Services	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	16.35
Property Taxes		52.35				52.35							104.70
Property Insurance			74.65										74.65
Investment Repairs	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	34.62
TOTAL CASH OVERHEAD COSTS	9.66	62.01	84.31	9.66	9.66	62.01	9.66	9.66	12.41	9.66	9.66	18.06	306.47
TOTAL CASH COSTS/ACRE	209.18	63.32	85.62	10.97	38.75	91.68	54.65	30.63	86.96	72.02	280.24	1,692.57	2,716.58
TOTAL CASH COSTS/MEAT LB	0.11	0.03	0.05	0.01	0.02	0.05	0.03	0.02	0.05	0.04	0.15	0.91	1.47

TABLE 4
U.C. COOPERATIVE EXTENSION
ANNUAL EQUIPMENT, INVESTMENT, AND BUSINESS OVERHEAD COSTS FOR ORGANIC WALNUT PRODUCTION AND PROCESSING
SACRAMENTO VALLEY - 1994

ANNUAL EQUIPMENT COSTS

Yr	Description	Price	Yrs Life	- Non-Cash Over. -		- Cash Overhead -		Total
				Depre- ciation	Interest	Insur- ance	Taxes	
94	60 HP 4WD Tractor	30,030	12	2,252.25	614.41	117.76	165.16	3,149.58
94	ATV	3,861	7	496.43	78.99	15.14	21.24	611.80
94	Chipper - 3PT	2,075	10	186.70	42.46	8.14	11.41	248.71
94	Flail Mower - 10'	7,283	10	655.50	149.00	28.56	40.05	873.11
94	Land Plane - 10'	8,375	15	502.47	171.36	32.84	46.07	752.74
94	Offset Disc - 10'	9,410	15	564.60	192.53	36.90	51.75	845.78
94	Orchard Sprayer - 500 Gal	17,055	10	1,535.00	348.94	66.88	93.80	2,044.62
94	Pickup - 1/2 ton	16,500	7	2,121.43	337.59	64.70	90.75	2,614.47
94	Ring Roller - 10'	1,700	15	102.00	34.78	6.67	9.35	152.80
94	Spinner Spreader - 3PT	1,845	15	110.67	37.76	7.24	10.15	165.82
94	Spring Tooth - 10'	3,100	15	186.00	63.43	12.16	17.05	278.64
TOTAL		101,234		8,713.05	2,071.25	396.99	556.78	11,738.07
60% of New Cost *		60,740		5,227.83	1,242.75	238.19	334.07	7,042.84

* Used to reflect a mix of new and used equipment.

ANNUAL INVESTMENT COSTS

Description	Price	Yrs Life	- Non-Cash Over. -		----- Cash Overhead -----			Total
			Depre- ciation	Interest	Insur- ance	Taxes	Repairs	
INVESTMENT								
Cracking Facility	45,000	20	2,025.00	920.70	176.47	247.50	300.00	3,669.67
Forklift	15,000	20	675.00	306.90	58.82	82.50	100.00	1,223.22
Freezer/Refrigerator Unit	25,000	20	1,125.00	511.50	98.04	137.50	50.00	1,922.04
Fuel Tank & Pump	6,355	20	285.95	130.03	24.92	34.96	125.00	600.86
Irrigation System	57,750	40	1,299.38	1,181.56	226.47	317.63	500.00	3,525.04
Land	168,000			6,249.60	1,197.84	1,680.00	0.00	9,127.44
On-Farm Buildings	37,500	30	1,125.00	767.25	147.06	206.25	150.00	2,395.56
Product Bins	13,000	10	1,170.00	265.98	50.98	71.50	25.00	1,583.46
Pruning Equipment	1,200	10	108.00	24.55	4.71	6.60	25.00	168.86
Shop Tools	11,000	15	660.00	225.06	43.14	60.50	100.00	1,088.70
Orchard Establishment	183,040	36	4,576.00	3,745.00	717.79	1,006.72	0.00	10,045.51
Weed-String Trimmer	400	5	72.00	8.18	1.57	2.20	10.00	93.95
TOTAL INVESTMENT	563,245		13,121.33	14,336.31	2,747.81	3,853.86	1,385.00	35,444.31

ANNUAL BUSINESS OVERHEAD COSTS

Description	Units/		Price/	Total
	Farm	Unit	Unit	Cost
Liability Insurance	1.00	farm	336.00	336.00
Office Expense	40.00	acre	65.00	2,600.00
Sanitation Services	1.00	farm	654.00	654.00
Soil/Tissue Analysis	40.00	acre	2.75	110.00

TABLE 5
U.C. COOPERATIVE EXTENSION
HOURLY EQUIPMENT COSTS FOR ORGANIC WALNUT PRODUCTION
SACRAMENTO VALLEY - 1994

----- COSTS PER HOUR -----										
Yr	Description	Actual Hours Used	-Non-Cash Over- Depre- ciation	Interest	- Cash Overhead - Insur- ance	Taxes	Repairs	Operating Fuel & Lube	Total Oper.	Total Costs/Hr.
94	60HP 4WD Tractor	233.1	5.80	1.58	0.30	0.43	1.50	2.88	4.38	12.49
94	ATV	286.0	1.04	0.17	0.03	0.04	0.70	0.98	1.68	2.97
94	Chipper - 3PT	44.0	2.55	0.58	0.11	0.16	0.00	1.44	1.44	4.83
94	Flail Mower - 10'	79.2	4.97	1.13	0.22	0.30	1.99	0.00	1.99	8.60
94	Land Plane - 10'	18.0	16.75	5.71	1.09	1.54	2.41	0.00	2.41	27.50
94	Offset Disc - 10'	26.4	12.83	4.38	0.84	1.18	2.70	0.00	2.70	21.92
94	Orchard Sprayer - 500 Gal	20.0	46.05	10.47	2.01	2.81	8.56	0.00	8.56	69.89
94	Pickup - 1/2 ton	286.0	4.45	0.71	0.14	0.19	2.99	3.36	6.35	11.84
94	Ring Roller - 10'	9.2	6.68	2.28	0.44	0.61	0.49	0.00	0.49	10.49
94	Spinner Spreader - 3PT	8.2	8.15	2.78	0.53	0.75	0.86	1.44	2.30	14.51
94	Spring Tooth - 10'	11.8	9.49	3.24	0.62	0.87	0.89	0.00	0.89	15.10

TABLE 6
U.C. COOPERATIVE EXTENSION
RANGING ANALYSIS FOR ORGANIC WALNUT PRODUCTION AND PROCESSING
SACRAMENTO VALLEY - 1994

COSTS PER ACRE AT VARYING YIELDS TO PRODUCE AND PROCESS ORGANIC WALNUTS

	YIELD (MEAT LB/ACRE)						
	850	1,250	1,600	1,850	2,100	2,350	2,600
OPERATING COSTS/ACRE:							
Cover Crop Cost	67	67	67	67	67	67	67
Cultural Cost	646	646	646	646	646	646	646
Harvest, Processing, & Assessment Cost	762	1,121	1,435	1,659	1,883	2,107	2,331
Interest on operating capital	32	35	37	38	40	41	43
TOTAL OPERATING COSTS/ACRE	1,507	1,869	2,184	2,410	2,636	2,861	3,087
TOTAL OPERATING COSTS/MEAT LB	1.77	1.49	1.37	1.30	1.26	1.22	1.19
CASH OVERHEAD COSTS/ACRE							
TOTAL CASH COSTS/ACRE	1,814	2,175	2,491	2,717	2,942	3,168	3,394
TOTAL CASH COSTS/MEAT LB	2	1.74	1.56	1.47	1.40	1.35	1.31
NON-CASH OVERHEAD COSTS/ACRE							
TOTAL COSTS/ACRE	2,662	3,023	3,339	3,565	3,790	4,016	4,242
TOTAL COSTS/MEAT LB	3.13	2.42	2.09	1.93	1.80	1.71	1.63

U.C. COOPERATIVE EXTENSION
RANGING ANALYSIS FOR ORGANIC WALNUT PRODUCTION AND PROCESSING
SACRAMENTO VALLEY - 1994
Table 6. Continued

NET RETURNS PER ACRE ABOVE OPERATING COSTS FOR ORGANIC WALNUTS

PRICE (DOLLARS PER MEAT LB)	YIELD (MEAT LB/ACRE)						
	850	1,250	1,600	1,850	2,100	2,350	2,600
1.65	-105	194	456	642	829	1,016	1,203
2.00	193	631	1,016	1,290	1,564	1,839	2,113
2.35	490	1,069	1,576	1,937	2,299	2,661	3,023
2.70	788	1,506	2,136	2,585	3,034	3,484	3,933
2.80	873	1,631	2,296	2,770	3,244	3,719	4,193
2.90	958	1,756	2,456	2,955	3,454	3,954	4,453
3.00	1,043	1,881	2,616	3,140	3,664	4,189	4,713

NET RETURNS PER ACRE ABOVE CASH COSTS FOR ORGANIC WALNUTS

PRICE (DOLLARS PER MEAT LB)	YIELD (MEAT LB/ACRE)						
	850	1,250	1,600	1,850	2,100	2,350	2,600
1.65	-411	-113	149	336	523	710	896
2.00	-114	325	709	983	1,258	1,532	1,806
2.35	184	762	1,269	1,631	1,993	2,355	2,716
2.70	481	1,200	1,829	2,278	2,728	3,177	3,626
2.80	566	1,325	1,989	2,463	2,938	3,412	3,886
2.90	651	1,450	2,149	2,648	3,148	3,647	4,146
3.00	736	1,575	2,309	2,833	3,358	3,882	4,406

NET RETURNS PER ACRE ABOVE TOTAL COSTS FOR ORGANIC WALNUTS

PRICE (DOLLARS PER MEAT LB)	YIELD (MEAT LB/ACRE)						
	850	1,250	1,600	1,850	2,100	2,350	2,600
1.65	-1,260	-961	-699	-512	-325	-139	48
2.00	-962	-523	-139	135	410	684	958
2.35	-665	-86	421	783	1,145	1,506	1,868
2.70	-367	352	981	1,430	1,880	2,329	2,778
2.80	-282	477	1,141	1,615	2,090	2,564	3,038
2.90	-197	602	1,301	1,800	2,300	2,799	3,298
3.00	-112	727	1,461	1,985	2,510	3,034	3,558