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## The Economic Viability of Orchard Production on Small Acreage

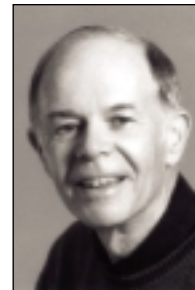
By Karen Klonsky, Janine Hasey, and Rich DeMoura

### Abstract

This study explored the difference in costs of production among different size orchards in California. Costs differ with respect to pruning, pest control, harvest, equipment ownership, and land cost per acre. The results show that while 100-acre orchards are profitable, 5-acre and 20-acre orchards cannot cover land ownership costs.

Although California agriculture usually connotes large farms and extensive agricultural production areas, in fact, over half of California's 80,000 farms are smaller than 50 acres and the median size farm is 35-acres (National Agricultural Statistical Service). Further, in the 2002 Census of Agriculture, 40 percent of principal operators reported that farming is not their primary occupation. Over a third said they worked 200 days or more off the farm reflecting what has come to be referred to as "lifestyle" farming.

As interest in rural lifestyles grows, county boards of supervisors are increasingly faced with requests for changes in zoning to allow division of parcels into smaller parcels to be sold as homesites or "ranchettes." Inevitably, conflicts arise between farmers who want to subdivide their land and those who want to maintain the integrity of agricultural areas. In these situations, county administrators frequently seek to identify the minimum economically viable parcel size in order to determine the minimum allowable parcel size that can still be zoned as agricultural. Unfortunately, there is no one definition of an economically viable parcel size. A more tangible approach is to determine the differences in production costs and revenue related to scale.



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Facing a zoning decision regarding the minimum parcel size for agricultural production, the County Board of Supervisors in Sutter County, California requested a study to determine the difference in the profitability of agricultural production on varying parcel sizes. The demographics of Sutter County are similar to California as a whole, with over half the farms under 50 acres and one third of principal operators working off the farm more than 200 days a year (National Agricultural Statistical Service). Two thirds of the farms in Sutter County include orchards. California leads the nation in four tree crops grown in Sutter County: almonds, clingstone peaches, dried plums, and walnuts.

### Methodology

Walnuts were selected for this study for several reasons. Walnuts are the primary crop in the Meridian Basin, the area of Sutter County under dispute. Further, the future of walnuts as a profitable crop is promising. Walnuts are also the main tree crop chosen by landowners on small acreage homesites and ranchettes. Representative costs to produce walnuts in Sutter County are developed for three hypothetical orchards of 5-, 20-, and 100-acres of production.

The 5-acre and 20-acre orchards are contiguous and are part of slightly larger parcels commonly referred to as homesites or ranchettes. The 100-acre orchard may be contiguous or non-contiguous consisting of various sized blocks. No specific variety of walnuts is assumed. The spacing is 56 trees per acre. Production operations in this study are based on the study, *Sample Costs to Establish a Walnut Orchard and Produce Walnuts, Sacramento Valley* by the University of California Cooperative Extension.

In order to determine typical practices, telephone interviews were conducted with small growers (those owning and producing walnuts on 20-acres or less). The question presented to the small growers was, "Who does your orchard work?" Additional information was collected from custom equipment operators, farm managers/consultants, handlers, and processors. Interviews were conducted by telephone with approximately twenty individuals in these groups. Another ten were contacted but were not available at the time or did not return the calls. Most of the sources wanted to remain anonymous. Growers contacted were from Sutter and Yuba counties in the

Sacramento Valley of Northern California. Handlers, processors, and custom operators contacted were from Sutter and Yuba counties, the Central Coast, and the Northern San Joaquin Valley of California. Land values were obtained through telephone interviews with local real estate agents for the small parcels. The land value for the 100-acre orchard was obtained from data published by the California Chapter of Farm Managers and Rural Appraisers.

All orchard sizes are assumed to custom hire harvest, the common practice in the area. This means that an independent firm is hired to come in with its own labor and equipment to harvest the walnuts. In addition, the 5- and 20-acre orchards are assumed to custom hire spraying and mowing. In contrast, the 100-acre orchard owns equipment for spraying and mowing. All sizes are assumed to use the same pest and weed control materials and methods. Herbicide is sprayed along the tree rows and the area between the tree rows is mowed five times per season. The orchards all have micro sprinkler irrigation and the same cost of water. Yields are assumed to be identical for all size orchards as well as the price received. The expected revenue per acre is \$3,050 for all orchard sizes with a yield of 5,000 pound per acre and \$0.61 per pound.

### Results

All of the small growers interviewed stated that the farm was not their main source of income but the work on the farm was primarily done by the grower and/or the family. The growers were either retired or had full-time off-farm jobs. In cases where the grower may be getting behind, local or contract labor may be hired for a few days. One of the reasons stated for not having direct hired labor is to avoid worker compensation costs. Operations normally done by the small grower (20-acres or less) are planting, pruning, hauling the prunings out of the orchard and burning, and weed spraying by hand or with a homemade or purchased weed sprayer. Otherwise, operations are coordinated with a neighbor (larger farmer) and done by borrowing the neighbor's equipment or hiring the neighbor to do the job.

Some small growers may have an old tractor and a few implements to do a few cultural operations, but most do not have spray or harvest equipment. Therefore, pesticide spraying and harvesting are commonly coordinated with the neighbor

who has spray and harvest equipment. If the neighbor uses custom operators for services such as spraying and harvesting, the small grower or the spraying and/or harvesting company coordinates the operations with the neighbor. A couple of growers, having approximately 20 acres, purchased used equipment to do their cultural operations, including spraying.

Based on the interview information, the differences in production costs per acre attributable to size are related to pruning, weed control, insect and disease control, harvest, and marketing. Small growers typically do their own pruning using a long pole and an ATV with a trailer for moving the prunings out of the orchard. The larger growers use a hand crew and pruning tower. A tractor and brush rake move the prunings out of the orchard. As mentioned above, small growers tend to apply herbicides themselves using an ATV with sprayer while a larger grower uses a tractor and sprayer. A small operator will custom hire the mowing and pesticide applications while a larger grower will have his own equipment. The interviews with custom operators revealed the use of minimum charges per job, regardless of size, to ensure coverage of their setup costs and costs of moving equipment and labor to the job site.

Assuming the small operators do their own pruning with poles and brush removal with their own ATV while the large grower uses a pruning tower, tractor, and brush rake, the pruning and brush removal costs per acre for the 100-acre orchard is \$119 compared to \$252 for the smaller operations. The difference in cultural costs is \$133 per acre more for the 5-acre and 20-acre growers compared to the 100-acre grower.

Based on the interviews with custom operators, a minimum charge of \$500 per mowing was used in the study. Assuming five mowings per year, this equals a total minimum charge of \$2,500 per farm for the small orchards equaling \$125 per acre for the 20-acre orchard, and \$500 per acre for the 5-acre orchard. In contrast, the large orchard using its own equipment and labor expends \$36 in cultural costs for mowing. This results in additional costs of \$87 per acre for the 20-acre grower and \$462 per acre for the 5-acre grower compared to the 100-acre grower (Table 1).

Similarly, for insect and disease control, the smaller growers custom hire the applications while the larger growers own their

own equipment. Based on the interview results, we use a minimum charge of \$500 per pesticide application for each of six applications (three applications for insects and mites and another three applications for disease). We assume that the cost of materials and the materials used are identical in all situations and based the pesticide use on the University of California IPM Guidelines for walnuts. For the large orchard the cultural costs for the six sprays using its own equipment and labor equals \$270 per acre compared to \$420 per acre for the 20-acre orchard, and \$810 per acre for the 5-acre orchard. The difference in application costs result in an additional cost per acre of \$150 for the 20-acre grower, and \$540 per acre for the 5-acre grower.

A few additional minor differences in cultural costs are assumed. The large orchard applies a harvest aid to assist in nut removal at a cost of \$25 per acre. Also, the 100-acre and 20-acre orchards include a modest cost for pickup truck use. Finally, leaf analysis is slightly higher for the smaller orchards. The total cultural costs that differ by orchard size is \$547 per acre for the 100-acre orchard, \$926 for the 20-acre orchard, and \$1,582 for the 5-acre orchard. The total additional cultural costs in comparison to the 100-acre grower are \$379 per acre for the 20-acre operation, and \$1,035 per acre for the 5-acre operation (Table 3). Cultural costs independent of orchard size total \$454 per acre and include rodent control, irrigation, fertilization, and spraying the tree rows in the dormant season. Consequently, the costs that vary by orchard size represent about two thirds of the total cultural costs for the 20-acre orchard and over three fourths of the costs for the 5-acre orchard.

We assume custom harvest for all three operation sizes. Custom charges for harvest appear to be more variable than for cultural operations. For shaking, sweeping, and pickup we assume a cost of \$193 per acre with a minimum charge of \$1,500 per job. This results in an additional cost per acre of \$109 for the 5-acre operation. Hand raking costs do not vary by size of operation. Based on the interviews with processors, hulling and drying costs are slightly higher for smaller volumes. We used a cost of \$110 per ton for 100-acres, \$115 per ton for 20-acres, and \$120 per ton for 5-acres. At a typical yield of 2.5 tons per acre, this results in only a slight difference in cost by orchard size – \$13 per acre for the 20-acre operation and \$25

per acre for the 5-acre operation. The total difference in harvest cost is only \$13 per acre for the 20-acre operation and \$134 per acre for the 5-acre operation (Table 1).

To summarize, the differences in operating costs related to orchard size result from differences in pruning and brush disposal, weed control, insect and disease control, and harvest. Pruning and brush removal are done by the owner but involve different equipment. Weed, insect, and pest control applications are custom hired by small growers but applied with owned equipment for large orchards, and harvest is typically custom hired by all orchard sizes but costs vary with size. Compared to the 100-acre orchard, the costs for these operations are \$384 per acre higher for the 20-acre orchard and \$1,270 per acre higher for the 5-acre orchard (Table 1, Figure 1).

A grower with average or above yields and well maintained orchards has a good chance of being accepted by a handler. Some of the concerns with small growers are that they are depending upon others for services and that the orchard may not be of primary concern because it doesn't provide the grower's main income. Therefore, the orchard may not be taken care of properly resulting in decreased yields and extra handling and sorting time due to excessive sticks in the harvested nuts and poor quality (e.g., small nuts and off-color nuts). As a result of the extra work in dealing with small lots, handlers typically charge a higher fee for small acreage and/or low total farm tonnage. Each handler has his/her own pricing structure for this situation.

A common issue expressed by the custom sprayers, custom harvesters, and those doing cultural operations, is that these farms usually do not have enough open space for turning the equipment around in the yard or row ends, loading and unloading the equipment (tractors, sprayers, mowers, shakers, etc.), parking and loading the bulk trailers for harvesting, and for general equipment movement. The trees may be planted too close to a fence or building to work around. Most custom operators have a minimum charge for the operation, which can be cost prohibitive to a small grower including the 20-acre grower. In addition to minimum charges, some have a minimum acreage limitation. For the custom operator, there is the cost to deliver and setup the equipment, application or operation and cleanup time.

Values for bare land (vegetable and field crop land) range from \$2,500 to \$6,500 per acre (California Chapter of Farm Managers and Rural Appraisers, 2007). For this study, the land value used for the 100-acre farm is \$3,250 per acre for a total of \$325,000 for the site. Based on interviews with local real estate agents, rural residential parcels range from \$200,000 to \$500,000 per site. We assume that for the rural residential parcels one acre is devoted to a homesite. Therefore, the 20-acre orchard is situated on a 21-acre parcel and the 5-acre orchard is part of a 6-acre parcel. A 21-acre site at \$367,500 equals \$17,500 per acre and a 6-acre site at \$300,000 per site equals \$50,000 per acre. Five acre sites are not zoned in Sutter or Yuba counties, so no comparable sales are available (Table 2).

Property insurance and property tax rates do not vary with parcel size. However, property insurance and property taxes are a percentage of values and therefore are higher on a per acre basis for the small landowners with higher land values. Based on our assumed land values, the property taxes and property insurance costs are \$55 per acre for the 100-acre orchard, \$197 per acre for the 20-acre orchard, and \$522 per acre for the 5-acre orchard. The difference in these cash overhead costs for the 20-acre producer compared to 100-acres of production is an additional \$87 per acre and for the 5-acre producer is \$467 per acre (Figure 2). In addition to property insurance and property taxes, cash overhead also includes liability insurance, office expenses, and repairs on buildings and the irrigation system. Taking all of these costs into account, the cash overhead cost for the 100-acre orchard is \$171 per acre, for the 20-acre orchard is \$313 per acre, and \$827 per acre for the 5-acre orchard. This means an additional expense per acre of \$142 for the 20-acre orchard and \$656 per acre for the 5-acre orchard compared to the 100-acre orchard.

As explained above, the small operations do not own their own tractor or sprayer which means that they also do not have a storage building, shop, or above ground fuel tanks. Therefore, the total investment other than land is actually lower than for the 100-acre operation but on a per acre basis is about the same. We assume an interest rate of 6.25 percent for the opportunity cost of land resulting in an annual opportunity cost per acre of \$203 for the 100-acre orchard, \$1,094 for the 20-acre orchard, and \$3,125 for the 5-acre orchard. The land values assumed

result in an additional ownership cost for land of \$891 per acre for the 20-acre operator and \$2,922 per acre for the 5-acre operation.

The bottom line under the assumptions of this study, including a gross return of \$3,050 per acre (a yield of 2.5 tons per acre at \$0.61 per pound), is that the 100-acre operation shows a positive net return over total costs (cultural costs, harvest costs, cash overhead, and non-cash overhead) of \$877 per acre or \$87,700 per year for the farm (Figure 2, Table 3). The 20-acre operation covers all cash costs (cultural costs, harvest costs, and cash overhead costs) with a net return above cash costs of \$762 per acre although the net return is \$553 per acre lower than the 100-acre operation. However, once ownership costs of land are taken into account along with other capital investment costs (irrigation system, equipment, and tools), the 20-acre operation shows a loss of \$554 per acre. The 5-acre operation shows a positive net return above cultural and harvest costs of \$269 per acre, but this is not enough to cover the cash overhead costs which include property taxes and insurance. The 5-acre orchard shows a loss of \$3,918 per acre, calculated as gross returns over total costs, including cultural costs, cash overhead costs, and non-cash overhead costs (land, equipment, irrigation system, and tools). An increase in the price received from \$0.61 to \$0.72 per pound results in a break-even situation over total costs for the 20-acre orchard and a positive net return over operating costs (cultural costs, harvest costs, and business overhead) for the 5-acre orchard.

### Discussion

Many small farms have been around a long time and the custom operators, handlers, and processors are willing to continue working with these growers, but refuse new 5-acre growers.

The operators, handlers, and processors indicate that it is not profitable for them to deal with the 5-acre grower. For 20-acre growers, most custom operators, handlers, and processors will consider 20-acre growers but on a case by case basis.

Minimum acreages mentioned in this survey by some custom operators were 25-acres and 35-acres. One handler said that they were refusing lots of less than 10 acres. Another handler mentioned that 50 acres was considered small, but did not list it as a minimum.

The minimum charges for custom work and the refusal by handlers and processors to accept their product may make it impossible for a new small grower to develop an economically viable orchard of under 20-acres. Different custom operators have different minimums; some base it on minimum charges only and some on a combination of minimum charges and minimum acreage. Overcoming these barriers will depend in large part on the ability to work in cooperation with neighboring farms as well as the proximity to larger orchards.

Even though the operating costs per acre for small orchards is substantially higher than for a larger orchard, the greatest difference in costs per acre arises from the difference in land values on a per acre basis. A homeowner who is seeking a rural lifestyle and would like to realize some income from a rural property may not consider the land payment as a cost of production but rather as a home ownership cost. In these cases, the orchard may be viewed as a hobby and could actually defray a small part of the land payments. It cannot be overemphasized, however, that the small parcel owner may still find it impossible to find a handler for his nuts even with high yield and quality. The only option remaining at that point is direct marketing to consumers.

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Table 1. Differing operating costs per acre for varying orchard sizes

Operation	Operating Costs per Acre			Increase Cost Compared to 100-acres	
	100 acres	20 acres	5 acres	20 acres	5 acres
Pruning & brush disposal	\$119	\$252	\$252	\$133	\$133
Weed control	49	136	511	87	462
Insect and disease control	270	420	810	150	540
Harvest	521	534	655	13	134
Total	\$959	\$1,342	\$2,228	\$384	\$1,270

Table 2. Land values for varying orchard sizes

Parcel Size	Reported Range	Parcel Cost for the Study	Per Acre Study Cost
100-acres	\$250,000 - \$650,000*	\$352,000	\$3,250
21-acres**	\$200,000 - \$500,000***	\$367,500	\$17,500
6-acres**	Not zoned in Sutter County**	\$300,000	\$50,000

\* CA Chapter of the American Society of Farm Managers and Rural Appraisers. Land and Lease Values.

\*\*One acre of the parcel is dedicated to a homesite.

\*\* Interviews with local real estate agents.



Table 3. Walnut production costs and returns per acre for 100, 20, and 5-acre orchards, Sutter and Yuba Counties, 2006

	Producing acres::	100	20	5
Walnuts: Returns 5,000 lbs x \$0.61		3,050	3,050	3,050
Cultural costs:			\$/acre	
Prune: Alternate Years 1/2 cost	101	207	207	
Brush Disposal	18	45	45	
Weed: Mow Tree Row Middle 5X	36	125	500	
Disease: Spray Walnut Blight 3X	156	232	427	
Insect: Spray Codling Moth 2X	63	112	242	
Fertilize: Leaf Analysis	2	3	9	
Weed: Spray Tree Row (in season)	13	11	11	
Insect/Mite: Miscellaneous	51	76	141	
Harvest Aide: Spray 50% of orchard	25			
Pickup Truck Use	82	115		
<b>SUBTOTAL DIFFERENT CULTURAL COSTS</b>	<b>547</b>	<b>926</b>	<b>1,582</b>	
ATV Miscellaneous Use	56	56	56	
Rodents: Gopher Control	3	3	3	
Irrigate: (water & labor)	206	206	206	
Fertilize: Nitrogen	100	100	100	
Weed: Spray Tree Row (dormant season)	59	59	59	
Pest Control Advisor Services	30	30	30	
<b>SUBTOTAL IDENTICAL CULTURAL COSTS</b>	<b>454</b>	<b>454</b>	<b>454</b>	
<b>TOTAL CULTURAL COSTS</b>	<b>1,001</b>	<b>1,379</b>	<b>2,036</b>	
Harvest: Shake, Sweep, Pickup	192	192	301	
Harvest: Haul	38	38	38	
Harvest: Hand Rake	16	16	16	
Harvest: Dry, Hull	275	288	300	
<b>TOTAL HARVEST</b>	<b>521</b>	<b>534</b>	<b>655</b>	
Interest on Operating Capital @ 9.25%	42	62	90	
<b>TOTAL OPERATING COSTS/ACRE</b>	<b>1,564</b>	<b>1,975</b>	<b>2,781</b>	
Cash Overhead:				
Office Expense	50	75	200	
Liability Insurance	5	21	86	
Property Taxes	46	188	513	
Property Insurance	9	9	9	
Investment Repairs	61	20	19	
<b>TOTAL CASH OVERHEAD COSTS/ACRE</b>	<b>171</b>	<b>313</b>	<b>827</b>	
<b>TOTAL CASH COSTS PER ACRE</b>	<b>1,735</b>	<b>2,288</b>	<b>3,608</b>	
<b>NET RETURNS PER ACRE ABOVE CASH COSTS</b>	<b>1,315</b>	<b>762</b>	<b>-558</b>	
Non-Cash Overhead:				
Buildings 2,400 square feet	71			
Fuel Tanks Above Ground	5			
Shop/Field Tools	16	26	21	
Micro Sprinkler Irrigation System	56	60	60	
Land	203	1,094	3,125	
Equipment	87	136	154	
<b>TOTAL NON-CASH OVERHEAD COSTS</b>	<b>438</b>	<b>1,316</b>	<b>3,360</b>	
<b>TOTAL COSTS PER ACRE</b>	<b>2,173</b>	<b>3,604</b>	<b>6,968</b>	
<b>NET RETURNS PER ACRE ABOVE TOTAL COSTS</b>	<b>877</b>	<b>-554</b>	<b>-3,918</b>	

Figure 1. Operating costs to produce walnuts for varying size orchards

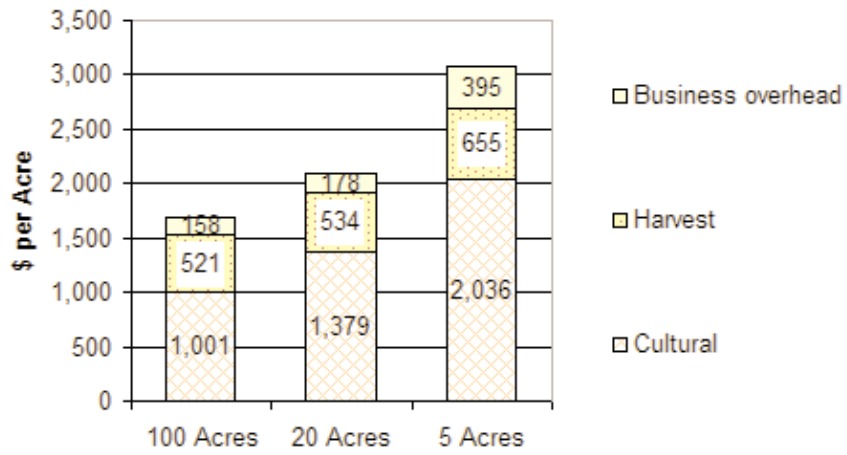


Figure 2. Total costs to produce walnuts for varying size orchards

