

ECONOMIC CONSIDERATIONS IN PISTACHIO PRODUCTION

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Managing a pistachio orchard requires numerous economic decisions over the long productive life of the trees. You have to first determine the orchard design, including the orchard location, type of irrigation system and floor management. Subsequent decisions require regular assessments of production practices such as pest and disease management, pruning, fertilizer program and irrigation scheduling.

A feasibility study is a business analysis tool designed to determine if a specific alternative is economically sound. Therefore, a feasibility study (either formal or informal) should be conducted *anytime* a firm considers *any* change in its present operating situation. The ultimate purpose of conducting a feasibility study is to avoid the costs associated with making a wrong decision.

This chapter uses a feasibility study framework to present a brief discussion of the economic issues faced by pistachio growers in establishing, expanding or replanting a pistachio orchard, as well as in ongoing production. Readers can use all or part of this outline when studying their own situations.

ASSESSING ECONOMIC FEASIBILITY OF PISTACHIO PRODUCTION

There are several basic business analysis tools that are invaluable components of feasibility studies for analyzing the myriad of decisions facing the pistachio orchard manager. They include 1) whole farm budgets, 2) enterprise budgets, 3) partial budgeting, 4) cash flow projections and 5) capital budgeting. Choice of a budget type for analysis depends on the decision being made. Whole farm budgets are appropriate when the manager wants to know how the proposed change will affect the entire business, which may include income tax management. In particular, the timing and

magnitude of resource requirements may impact the functioning of other enterprises. Enterprise budgets are appropriate when the manager is concerned with the potential profitability of the change and the enterprises are not competing for resources. Partial budgets are extremely useful when the impact of the change can be clearly identified and the unchanged costs can be ignored. Capital budgeting is a useful tool for analyzing changes that will have an impact over a long period of time, with the impact varying over time. This may be important because of the alternate bearing nature of pistachios. Examples of an enterprise budget and cash flow budget will be presented in the "Analysis" section of this chapter. No attempt will be made to describe the mechanics of capital budgeting, however. The reader is referred to any standard textbook on farm management for a more detailed treatment of these approaches.

Any feasibility study is designed to look at the impact on the farm business of a particular change in the orchard operation. A feasibility study can be divided into four parts: (1) market situation; (2) resource constraints; (3) the production process; and (4) analysis. In the following sections, each of these topics is introduced as it relates to the establishment, replanting or expansion of a pistachio orchard, as well as to the management of an established orchard.

Market situation

Pistachio production in California has increased dramatically from 1,700 bearing acres in 1977 to 93,000 in 2004. A decision to establish, expand or replant an orchard requires knowledge of current and potential consumption (domestic and abroad) and the price history (variability and projections) to project consumption patterns, competition and

market volatility. Information about marketing and distribution systems, how the market is entered, numbers of producers and handlers, along with yield and acreage trends will give the decision maker an understanding of the profit potential in the short run and the long run. In addition, competition from other major producers and trade agreements will in effect have significant impacts on world supply, and consequently, domestic planting decisions.

The market information required for the feasibility study varies depending on the decision to be made. The decision to establish a pistachio orchard requires an in-depth understanding of the world and domestic markets while the site selection decision for the orchard does not.

Usually, once the decision to grow pistachios has been made, the expected price is the only marketing information needed. The expected income based on the price estimated is compared with estimated costs to calculate expected profit levels and cash flows. Therefore, the remainder of this chapter focuses on the portions of a feasibility study that are undertaken after the market potential and projected price have been established.

Resource constraints

A critical part of any management decision is an assessment of the resources needed for each alternative under consideration and the resources available to the firm. Categories of resources to be included are: land, water, labor, capital and management.

Pistachios are virtually all of the same variety with similar spacing, although rootstock varies. Therefore, the most critical consideration for orchard establishment is location. Pistachios will tolerate a broader range of soils than will almonds or walnuts in that they can tolerate boron and alkaline conditions. Nonetheless, orchards planted on well-drained soil will require less intense management than orchards planted on marginal soil. In choosing poorer soil, you need to assess how prepared you are to exercise superior management with respect to the quality and timing of your cultural practices. On poorer soils, you probably will need more equipment capacity and cultural operations such as

treatments for salts, soil layers, and increasing water infiltration rates. This also means having more tractors to assure that practices take place in a timely manner.

A second consideration in location is proximity to a huller. For example, growers in Chico may be hauling to Madera or farther to process their nuts. Long hauls of pistachios mean more intensive management of harvest. This extra effort may mean harvesting at night to keep the nuts cool and shipping right away. Obviously, the distance to the processor will impact the cost of hauling. Customarily, the processor pays the hauling costs, but the costs are undoubtedly passed on to long-distance growers in the form of lower prices received. Other considerations include access to a reliable, affordable water supply and availability of custom harvest operations.

For these reasons and others, expenditure up front for prime orchard ground may be justified by a higher net income in the future. However, it should be emphasized that real estate should not be purchased simply because it is priced at or below the going rate. If the orchard cannot be expected to generate adequate returns to the investment, then the grower is speculating in real estate and not farming.

Land can be purchased or leased. Leases are most common for established orchards, although establishment leases do exist. Orchard leases can be developed in an infinite number of ways. Typically, orchard leases cover a multiple year period. Orchard leases are most often based on a percent of the gross income but can also be on an annual cash rent basis. Development leases may suspend payment until the orchard comes into bearing, using some combination of cash and share rent in the development years or some graduated scale.

Leases should not be compared solely on the payments to the landlord. The landlord's contribution to operating and overhead costs can be a significant factor in the bottom line. The landlord may contribute all, part, or none of the operating inputs such as fertilizer, pesticides and water. Further, the lease can include the use of some equipment and/or an irrigation system. Payment of property taxes,

repairs to the irrigation system, and road maintenance are also negotiable points in a pistachio orchard lease.

The purchase of an existing orchard or land for orchard establishment is constrained by the availability of all of the other resources for the orchard operation. Is there adequate equipment, management, labor and water accessible for the new orchard? The capital available for land purchase is in the form of credit and cash. In many cases land is purchased with cash. However, major cash outlays limit the availability of cash for supplies, wages and equipment purchases.

A feasibility study provides the basic information required for loan applications and determines whether or not the orchard can make profits sizable enough to cover payments on the interest and principle associated with the loan. Whether cash, credit or a combination is used for land purchases, it is important to calculate the expected return to capital based on realistic expectations of returns.

Careful analysis and projections of income and expenses are particularly important for pistachio producers for at least three reasons. First, pistachio orchards require a large capital outlay up front. Second, pistachios are arguably the slowest orchard crop to come into marketable production in California. Pistachios do not show a marketable yield until the fifth or sixth year, even with quality management. Total cash costs are not covered until at least the seventh year. As a point of comparison, almonds produce a marketable yield in the fourth year and cover cash costs in the fifth year. Despite the fact that pistachios are relatively slow to come into bearing, superior management is critical during the early years to allow for a highly successful orchard. Therefore, there must be enough capital available from outside sources to provide the management required for top orchard management.

Finally, pistachios are alternate bearing in nature. This means that even the best managed orchards will show substantial fluctuations in revenue from year to year. Even in the off years it is essential to continue quality management with respect to irrigation, weed management and pest control. Again, this

means that funds must be available from outside sources to maintain the orchard when revenue from the orchard is inadequate.

Pistachio production is not labor intensive compared to many other crops requiring more field operations, hand harvest and hand packing. However, production decisions that will affect the total hours of labor required should take labor availability into account and not simply labor cost. Also, the timing of the labor needs is critical. Custom hiring of operations during the growing season or harvest will reduce the equipment and labor needs of the firm. Custom hiring will substitute annual custom operator charges for long-term capital outlay for equipment and equipment housing as well as annual repairs and property taxes.

Production practices

The term “production practices” will be used in the broadest sense to include pruning, fertilization, pest management, irrigation and orchard floor management. Analysis of cultural practices includes identifying the resources required for each alternative under consideration and assigning costs to each resource. The feasibility study should cover all resources and the impact on resource use and yield associated with the alternative under consideration.

For example, low volume irrigation is more expensive than surface irrigation. However, low volume irrigation has the advantages of requiring less labor, less water runoff at the end of the field, and the flexibility of being able to irrigate for a few hours or part of the orchard. However, low volume irrigation requires pressurized water which is not available from all irrigation districts and may require taking land out of production for a holding pond and pumping from the pond. In contrast, surface irrigation is an all or nothing proposition. It is not possible to irrigate only part of the orchard at one time and requires constant vigilance by irrigation labor. On the positive side, it does not require pressurized water and may be preferable for orchards relying on water from irrigation districts. Therefore, looking at the decision to replace a surface irrigation system with a low volume system should consider

several factors such as the availability of labor and the source of water, not just the relative costs of the two application methods.

The time frame to be included in the analysis also is important. Using irrigation scheduling as an example, the cost of the water applied is not sufficient information to determine the amount of water to use. In a drought year when growers are trying to conserve water, or they are forced to use expensive ground water instead of surface water, it is tempting to cut the amount of water supplied to the trees. However, the long-term effect of water stress and salt build-up on the trees must be included in the decision process.

Quite often it is difficult or impossible to predict the yields corresponding to alternative management practices. In these cases break-even analysis is extremely useful. If a reasonable estimate of all other factors can be made, then break-even analysis can be used to calculate the least acceptable difference in yield that will justify the change in practices. An example of break-even analysis is included in the "Analysis" section of this chapter.

Some alternative practices require different labor skills than others. Therefore, it is not enough to include the costs of the equipment and the labor in the feasibility study. The availability of trained labor or the cost of training employees must also be included.

Equipment, buildings and irrigation systems that are used over a multi-year time period are the most difficult in terms of assigning costs. The useful life, opportunity cost of ownership, taxes, insurance, housing, and repairs must be included. If the equipment is used for more than one enterprise, then the cost of ownership must be allocated to all enterprises for which it is used.

ANALYSIS

In general, the analysis portion of a feasibility study involves calculating the profitability of the proposed enterprise. However, cash flow and risks associated with the profits must be considered as well. Ignoring any of these three factors will lead to potentially harmful decisions. Also, if borrowed funds will be needed, the lender will require that all three of these factors be evaluated.

Profitability

Profitability of an operation can be projected using the estimated prices and costs. Profit is the difference between expected revenue and expected costs. Expected revenue is simply the multiple of the expected price and the expected yield.

Either a whole farm budget or an enterprise budget for pistachios should be prepared to determine the profitability of the operation. Net (after tax) income should be estimated for each year of the project's life. If the project is expanding an established pistachio orchard, for example, the productive life of the new orchard could be 35 years. The task of preparing a projected budget often goes uncompleted, yet it is critical to determining a proposed orchard's true economic viability.

Using a computer spreadsheet facilitates the work in showing that income levels will vary widely from year to year during the life of an orchard. In particular, losses will be incurred during the first several years because there are high development costs and the trees do not yet produce a crop. As the trees mature, yields and sales receipts will increase, on average, only to decline again at the end of the orchard's life. Without preparing budgets for each year, a manager will not know when profits will actually be earned or at what point the orchard's *economic* life will end (the point at which profits decline below the minimum level needed for economic viability).

One simple and effective way to analyze orchard performance over time is to compare industry production figures over time to the individual orchard's production over the same time period. If the orchard under study is falling further and further below average, it may be time for changes in management practices, or for replacement.

Analysis of potential changes in cultural practices during production years can usually be accomplished using partial budgeting techniques. Partial budgeting compares the differences in revenue and costs associated with two or more alternative production practices and ignores the factors that are identical for the alternatives under consideration. This greatly simplifies the

analysis and avoids the need to develop complete enterprise budgets.

Cash flows

Completion of the enterprise budget has been the end of a feasibility study for many growers. However, the most important item has yet to be included in the study -- the cash flow summary. A cash flow summary describes the timing of the inflows and outflows of cash from the farm business. The orchard may be generally profitable over some period of time, but the timing of the outflows may precede the inflows. This is particularly true during the establishment years of the orchard. In this case, some other source of capital is required. Provision for adequate working capital is perhaps the most critical item for the successful operation of a business. It is necessary to prepare a cash flow summary to determine what the cash needs will be for the firm and what sources of cash are available to meet those needs.

To be more specific, the firm will need to know how much capital will be required for month-to-month operation of the business and *when* this capital will be required. Monthly cash needs include expenditures on wages, inventories, utilities, and other inputs. Sources of funds include sales receipts, borrowings and off-farm income.

The monthly cash flow summary is also required to help determine the size of loans, the length of loans, probable pay-back periods, and the amount of interest and principle that can be paid back periodically. It is especially important for pistachio producers to develop a cash flow statement, because business is not often done on a cash-and-carry basis. In agribusiness it is common practice to allow a 30-, 60-, or 90-day payment period for customers. Yet, despite these credit periods available to producers from input suppliers, inputs must be paid for long before payment is received by growers for their harvest. This means that the cash inflows lag behind cash outflows resulting in the need for working capital (which may have to be borrowed).

The alternate-bearing nature of pistachio orchards requires that cash flow planning be conducted for multiple years, as well as month-

to-month. Plans covering at least two years should be prepared to shift cash received during high-bearing years into reserves for use during low-bearing years. This is necessary because the "alternate cash-flowing" nature of the business creates the risk that funds will not be available to cover costs every other year. This unique problem can cost producers significant amounts of money if they have to borrow cash during low-bearing years. Thus, there are real cost savings available to producers who spend time managing their money with a long-run perspective so as to minimize the amount of borrowing.

Break-even analysis

The uncertainty about profit levels and the long time periods between cash outflows and inflows in agricultural production create risk, a factor too often overlooked in feasibility studies. Therefore, it is recommended that two types of risk analysis be included in a feasibility study: break-even and historical.

The "break-even" level of production should be estimated when a producer needs to know the point at which an alternative course of action becomes profitable. For example, this estimate will show at what level of marketed production (averaged from high and low bearing years), given the firm's costs and returns information, the firm will be able to break even, or cover all costs of operation. The importance of a break-even estimate is in knowing the minimum level of production that must be attained to generate profits, and how sensitive that level is to price and cost factors. For example, if the average revenue expected from expanding an existing orchard is above the break-even revenue required to justify such a change, then the proposed expansion will probably be profitable. Knowing this may be enough to convince the manager to go ahead with the expansion even though he/she does not know the exact long-range profit potential.

To illustrate break-even analysis, its use in considering intermittent mechanical pruning to reduce alternate bearing is presented here. For this example, mechanical pruning would take place once every several years with hand pruning in each of the other years. Suppose a grower has very little information concerning

the yield response to mechanical pruning relative to hand pruning, but he/she knows the associated costs for both pruning options over the time period between mechanical pruning activities. Then the break-even yield difference

can be calculated. The break-even yield difference is the difference in average annual yield that will make the two options equally profitable. The net profits for each of the two alternatives can be written mathematically:

$$\text{Net profit}_h = (\text{Yield}_h \times \text{Price}) - \text{Pruning cost}_h \quad (1)$$

$$\text{Net profit}_m = (\text{Yield}_m \times \text{Price}) - \text{Pruning cost}_m \quad (2)$$

where:

Net profit_h = the net profit per acre for a hand pruned orchard

Net profit_m = the net profit per acre for a mechanically pruned orchard

Yield_h = the yield per acre for a hand pruned orchard

Yield_m = the yield per acre for a mechanically pruned orchard

Price = the price received per pound

Pruning cost_h = the pruning cost per acre for a hand pruned orchard

Pruning cost_m = the pruning cost per acre for a mechanically pruned orchard

Setting equation (1) equal to equation (2) and collecting terms to solve for the break-even yield difference leads to :

$$(\text{Yield}_h - \text{Yield}_m) = (\text{Pruning cost}_m - \text{Pruning cost}_h) / \text{Price} \quad (3)$$

Substituting in the known values for the right-hand side of equation (3) gives the break-even yield difference (in units of pounds per acre). If the actual yield difference is greater than the break-even yield difference, then hand pruning is more profitable than mechanical pruning. If the actual yield difference is less than the break - even yield difference, then mechanical pruning is more profitable than hand pruning.

Even if the manager does not know with much accuracy what the actual yield difference will be, he/she should be able to assign a probability to the break-even value. In this example, the manager may be 90% certain that hand pruning will result in more than the break-even number of pounds per acre above the yield for mechanical pruning. Then, without having information about the actual

magnitude of the yield differences, the manager can decide to stick to hand pruning with 90% certainty.

Risk analysis

Historical risk analysis is important in selecting between alternative investments. It involves evaluating the expected volatility of net income levels (profitability) over the life of an investment. With a greater variation in net income, then the venture becomes riskier. By using past (or expected) annual income data, a grower can estimate how widely net income (profit) varies from year to year. This volatility can be compared to the average net income level to get an index of risk. The index of risk is calculated as the standard deviation of net income divided by the average net income for each investment alternative under consideration.

This index can be compared across alternate investments to indicate relative risk levels. The higher the index value, the higher the risk level. For pistachios, there is some income risk built in, in that the trees are alternate bearing. This means that risk analysis should be an important part of the decision whether or not to produce this crop.

Whereas the basic feasibility decision is derived from observable quantities, the risk analysis portion of the decision process is based on estimates of both future events and the probabilities of those events occurring. This means that the final decision is affected significantly by the skill of the grower in estimating the level of risk for each potential risk factor, and that grower's willingness to accept such risks.

Since risk assessment is an inexact process, many growers may fine-tune their production practices and recalculate the projected budget after adjustments have been made to account for risk. It is important to consider the whole-farm effects of the proposed action. In other words, a grower needs to know whether undertaking a project, such as expanding the orchard, will affect existing operations and, if so, how? Diversification across enterprises or

expanding an existing enterprise to gain cost efficiencies may raise or lower the total level of income risk. The key is that such whole-farm factors be considered in terms of their income and risk effects as part of a feasibility study.

THE FINAL CONSIDERATION

A basic economic feasibility analysis involves study of the primary influencing factors, including market potential, resource constraints and the production process. If all these factors are analyzed adequately and are determined to be favorable for economic operation, the venture should be profitable. However, the final profit-determining factor is *management*. An orchard must have competent managers to follow through on the functions of planning, organizing, directing, staffing and controlling in order to ensure a profitable undertaking. This means that decision makers must also assess their own management skills before reaching final conclusions. A feasibility study is conducted to help a firm avoid the costs associated with a wrong decision and indicates whether or not a proposed plan *could* succeed. But it is up to the managers that use the study whether the plan *does* succeed.

Editor's note: Updated cost studies are available from the website at www.coststudies.ucdavis.edu or from local U.C. Cooperative Extension county offices (listed on last page).