Dairying in California's Imperial Valley: Is it Feasible?

by
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DAIRYING IN CALIFORNIA'S IMPERIAL VALLEY: IS IT FEASIBLE?

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Today, under the pressure of urban encroachment and environmental necessity, dairymen are moving out of the Chino Valley, which for many years has been the prime source of milk and dairy products for the metropolitan Los Angeles area. That exodus raises important questions about other agricultural regions that supply, or might supply, milk to Southern California—specifically, the southern San Joaquin Valley and the Imperial Valley.

This is an example of the kind of fundamental change in California agriculture that challenges UC’s Division of Agriculture and Natural Resources (DANR). What would be the possibilities and problems of a new dairy-production region in the Imperial Valley? Are there limits to potential growth of the dairy industry in the San Joaquin Valley? What would be the competitive advantages of each region?

These are relevant and important questions—not just for Imperial Valley agriculture, but for consumers throughout Southern California. Accordingly, the research project reported on here was organized in 1994.

This publication provides research-based information which, we hope, will substantially contribute to important economic decisions about the future of agriculture in Southern California.

Allyn D. Smith
Director, Agriculture and Natural Resources
Southern Region
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L.J. (Bees) Butler
Javier Ekboir


CHAPTER 1

Introduction

New technologies and economic forces beyond the control of the dairy industry create a continuously evolving industry structure resulting in the geographic relocation of dairy farms. While the process is usually gradual, occasionally dramatic changes occur over a relatively short time. Such a change is inevitable in the Chino Valley of Southern California where growth and development pressures and environmental degradation are forcing dairy enterprises to relocate. (A brief history and analysis of dairying in Southern California may be found in Appendix 1).

The shift of this major supply of raw milk away from the immediate vicinity raises the question of who will supply the Los Angeles/San Diego basin with raw milk.

It is expected that the Southern San Joaquin Valley (referred to in this report as the South Valley) will become the major source of raw milk for the Los Angeles metropolitan area, since it already supplies about 20-25% of Southern California's raw milk requirements. However, as the number of cows in the South Valley increases, land suitable for large dairy operations there is becoming more expensive and scarce. Waste management is also becoming a major problem forcing the imposition of tighter regulations. It is probable, therefore, that alternative areas for supplying raw milk to the Los Angeles/San Diego basin will need to be examined.

Two such areas of particular interest are the Imperial and Palo Verde valleys located in Imperial and Riverside Counties. Since most of the alfalfa hay that is currently supplied to the Chino Valley dairy industry originates in Imperial County, and given its proximity to new and growing markets in Mexico as a result of the North American Free Trade Agreement (NAFTA), it is possible that relocation to the Imperial Valley is as feasible, or more so, than moving to the South Valley.

This study examines the feasibility of dairying in the Imperial and Palo Verde Valleys, and the economic viability of available markets. It is assumed that conditions in the Palo Verde Valley are similar to those in the Imperial Valley, and therefore, reference to the Imperial Valley in this study will also apply to the Palo Verde Valley.
The Heat Stress Problem

The Imperial Valley lies at the end of southern California bordering on Mexico. Even though temperatures are relatively mild most of the year, summer temperatures can be very high. The mean temperature is 72.44°F; the average maximum temperature is 115.30°F. On summer nights maximum humidity can reach 75% while the minimum humidity sometimes passes the 49% mark.

Research has shown that any combination of temperature above 86°F and relative humidity above zero results in mild to severe heat stress for dairy cattle. Heat stress in lactating cows can cause economic losses in two ways. The immediate impact is a decrease in milk production; the long-term impact is impaired reproduction performance. Armstrong (1994a) reports losses of up to 30 percent in milk production and 50 percent in reproductive efficiency in warm or hot climates without some modification to the environment of the animal.

Although heat stress in the Imperial Valley can be severe during the summer months, adequate management and recent improvements in milk production technologies can reduce or even eliminate the negative effects. Successful dairy industries have been developed under similar conditions in Arizona and New Mexico during the last decade (Perez, 1994). However, even though the technology to produce significant amounts of milk in extreme climates is available, it remains to be answered whether a dairy farm in the Imperial Valley would be economically viable. Economic feasibility depends on several factors including (1) technologies appropriate for local ecological conditions, (2) availability of markets for the milk, and (3) availability of services and inputs at competitive prices.

Milk Production in the Imperial Valley

Dairy farms have a long tradition in the Imperial Valley. After the first irrigation canals were opened in 1901, alfalfa rapidly became the major crop. Dairies soon followed because they were a profitable complement to alfalfa production and required limited investment.

Initial outlets for fluid milk were the cities in the Imperial Valley. At first, surplus milk was fed to hogs along with alfalfa. With the introduction of industrial processing, however, the dairy industry expanded. The first creamery opened in 1903 and in two months was producing 100 pounds of high quality butter daily (Anderholt, 1990). The demand for milk expanded substantially with processing and the local dairies responded accordingly.

Anderholt (1990) estimates that in the early 1920's there were 2,000 Imperial Valley dairies with 100,000 dairy cows in production. In 1932, Imperial County was the third largest producer of butter in the state, with an annual output of 5,648,099 pounds. By 1930, local creameries produced ice cream, buttermilk and cheese. These products were distributed locally and in San Diego.
Beginning in the late 1960's, however, the local industry collapsed. Figure 1 shows the change in milk cow numbers in the Imperial Valley during the last half century. (CDFA).

![Figure 1: Milk Cows in Production in the Imperial Valley](image)

Source: CDFA.

There were several reasons for the decline:

- Deficiencies in refrigerated transportation equipment put dairies in the Imperial Valley at a disadvantage in supplying quality milk to the expanding urban markets on the coast. Conversion to Grade A milk required electricity for running water and refrigeration. Lack of electricity in rural areas forced dairy producers to install electrical generators, which were expensive and unreliable. The technology available to handle heat stress was primitive, and a heat wave in the early 1960's proved disastrous for many herds.

- Improvements in farm equipment increased the efficiency of harvesting and baling alfalfa relative to pasturing. Additionally, better roads and transportation equipment reduced the cost of shipping hay to coastal markets. These two developments allowed hay producers to outbid dairy producers in leasing land.

- Finally, the local market for milk disappeared when the last processing plant closed in 1964. Today, only two dairies are in operation in the Imperial Valley, milking about 2,000 cows. One sells its milk to markets in Arizona while the other ships mostly to markets in the Chino Valley.
CHAPTER II

Potential Markets

Eventual success of dairy farms in the Imperial Valley will depend on the existence of markets capable of absorbing their output at profitable prices. There are four potential outlets for milk produced in the Imperial valley: (1) Southern California’s demand for fluid milk products, (2) state and national demand for processed products, (3) Arizona’s milk plants, and (4) the Mexican market. Each of these markets offers a different prospect for new dairies in the Imperial Valley.

In the early decades of this century, dairy products from the Imperial Valley were shipped to San Diego, Los Angeles and surrounding cities. Due to improvements in transportation equipment and growing population, these are again the most likely markets for fluid milk produced in the Imperial Valley. Southern California demand for Imperial Valley fluid milk will depend on local factors which include the decrease in milk production in the Chino Valley, competition from the South Valley, changes in income and tastes, population growth, and ethnic changes. Because of its proximity, in any case, the Imperial Valley may have a comparative advantage over alternative suppliers (depending on transportation costs).

Demand for manufacturing milk depends on variables determined at both state and national levels, such as income growth, changes in tastes, population growth, ethnic changes both at state and national levels, fiscal deficits, and Commodity Credit Corporation (CCC) purchases. In particular, the activity of the CCC is fundamental in stabilizing the market and supporting the income of dairy producers. (Details of the Dairy Price Support and Government Purchase Program may be found in Appendix 3, and Butler, 1992). The CCC is expected to reduce its activities in the future, but it is unclear at this time what effects such changes will have on California’s dairy industry.

Milk production in Arizona expanded rapidly in the last twenty years. Since the local market for fluid milk is already saturated, all additional production is used for manufactured products, mainly
cheese. Dairy producers from the Imperial Valley can sell in Arizona and receive the Class III price minus transportation costs. At these prices, it is difficult to sell into Arizona.

The fourth probable outlet is the Mexican market. Implementation of NAFTA together with the proximity of the border create a potential demand for local production. Its actual existence will depend on multiple factors, among which are (1) macroeconomic and trade policies in both countries, (2) income growth in Mexico, (3) administrative barriers to trade, and, (4) the response of the Mexican dairy industry to potential competition from other members of NAFTA. The local market in Mexicali is the most promising market south of the border. Long delays at the border, however, substantially increase transportation costs.

Each of these markets is analyzed in this study. Detailed analyses are reported in Appendix 2, and briefly summarized in this chapter.

Transportation Factors

Since it is highly inefficient to ship fluid milk over long distances, dairies close to the market are naturally protected by hauling costs. The Imperial Valley is the alternative production site closest to San Diego (about 120 miles) and Los Angeles (nearly 170 miles). In comparison, 205 miles separate Tulare from Los Angeles. However, even though the South Valley is further away from Los Angeles than the Imperial Valley, existing transportation allowances compensate for the higher cost of moving the milk (transportation allowances and credits apply only to Class 1, 2 and 3 milk). Dairies in the Imperial Valley may ask for a hearing to obtain transportation allowances. These subsidies, however, are neither automatic nor guaranteed.

Presently, there are no milk processing plants in the Imperial Valley. In this report, we assume that no plants will be opened there in the near future. This is a pessimistic assumption. Butler (1992) estimates that the minimum optimal size of a fluid plant in California is probably 75,000 gallons per day. At current yields, that volume is the output of approximately 11,800 cows. If the herd in the Imperial Valley reaches that size, it may be profitable to producers in the area to pool their resources to open a plant. The analysis of such an option, though, exceeds the objective of this study.

Potential Demand in the San Diego and Mexicali Markets

In the short run, the most likely buyers of milk produced in the Imperial Valley are processing plants in San Diego and, to a lesser extent, Mexicali.¹ Three facts support this conclusion: (1) transportation costs provide a natural barrier to competition from other regions; (2) milk production in San Diego county is likely to

¹ At the time of writing, the Mexican economy was relatively unstable due to the devaluation of the Mexican peso. In order for the Mexicali market to be a feasible one, the Mexican economy would have to stabilise, and/or the value of the Mexican peso would have to increase.
decrease, and (3) the economic crisis in Mexico makes it particularly difficult for dairies in Mexicali to expand their production.

Given the average milk yields obtained in Southern California, Arizona and Mexicali, approximately 23,000 milk cows are required to produce the 150,000 gallons now processed daily in the vicinity of San Diego. Another 3,000 cows are needed to supply Mexicali at the present level of exports.

Potential Demand in Los Angeles and Vicinity

Even though plants in the Los Angeles-Chino Valley area are also potential buyers, they have the option of buying from the South Valley. In 1993, the Chino Valley produced 5.42 billion pounds of milk (CDFA). In addition, about 20 percent of the Los Angeles region's requirements are covered by milk produced in the South Valley. Consequently, total regional use of milk is approximately 6.78 billion pounds of milk per year. This milk is sold in three markets: (1) regional demand for fluid milk, (2) regional and national demand for processed products (including the CCC), and (3) the Mexican market. Although there are no reliable data on how much milk is actually diverted to each market, from the partial evidence available it is possible to make some inferences.

The potential Los Angeles regional demand for fluid milk from the Imperial Valley will be determined by the reduction in the Chino Valley's supply, competition from the South Valley, tastes, and population and income changes. Per capita consumption of fluid milk in California in 1993 was estimated at 24 gallons (200 pounds) per year (CDFA). Total population in the five counties that comprise Southern California in the same year was estimated at 17.5 million. Total consumption of fluid milk was, then, approximately 3.49 billion pounds of milk. Assuming an average yield per cow of 19,400 pounds of milk, approximately 180,000 cows are required today to meet this five-county demand.

Statewide Trends

In the last 16 years, total consumption of fluid milk in California increased at an annual compound rate of .65 percent. This is well below the annual growth rates in total production and yield per cow. If production continues to grow faster than the demand for fluid milk, the numbers of cows required to supply the regional plants would be lessened.

Balancing these trends are the fast growth of California's population and its greater diversity. The state's population is growing at a rate above the national average (2.4 percent). Additionally, changes in the ethnic and age distribution of the population can modify the future pattern of milk consumption. During the 1990s, five of six

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2 References to Los Angeles and vicinity include the five-county area of Los Angeles, Orange, Riverside, San Bernardino and San Diego.
new residents in California will be Latino or Asian. By the year 2000, the Latino, Asian and African-American populations will comprise almost half of the state’s population. California’s median age will increase by two years to 35, but will still be four years younger than the national average (Butler, 1992).

The Need for Dairy Herd Replacement

Assuming these overall trends in demand and the continuing loss of Chino Valley dairies, how much additional output will be required from the region’s remaining suppliers? One intangible factor is the future location of the manufacturing plants that today operate close to Los Angeles. In deciding their future, processors will have to balance higher transportation costs and longer distances with relocation costs. For some products (for example, cheese) it may be profitable to relocate the plant closer to the milk-producing areas. For others such as ice cream or yogurt, relocation costs may be too high and the plants will remain in Southern California. At this point, not enough information is available to estimate the share of milk demand for manufacture that could remain in the Los Angeles area. Presently, about 3.28 billion pounds of milk are used in Southern California for manufacturing purposes. Close to 2 billion pounds of this are produced in the Chino Valley. At current yield levels, this is the output of about 100,000 cows.

The highest estimate of the potential increased demand for South Valley and Imperial Valley dairy output is obtained assuming that all processing plants remain in the Los Angeles area. In this scenario, 280,000 cows will have to be located in neighboring areas to replace those leaving the Chino Valley. The lower estimate assumes that all manufacturing plants move to alternative locations and only the fluid plants remain. In this case, the size of the required replacement herd is 180,000 cows.

It is an open question whether the South Valley could accommodate 280,000 additional cows, but there is agreement on the feasibility of increasing the herd there by 180,000 cows. However, with increasingly stringent environmental regulations and an already high concentration of animals, it is unclear whether the South Valley will be able to meet the entire future needs of the dairy industry in the Los Angeles area. If not, the industry will have to find alternative suppliers to meet its requirements for fluid milk. Viability of the alternative suppliers will depend on their ability to deliver milk at a price at least as low as the South Valley’s.

From the estimates presented thus far, Imperial Valley dairies should have a distinct comparative advantage in the markets of San Diego and Mexicali. Their access to the Los Angeles market will depend on a variety of factors including environmental regulations in the South Valley and the Imperial Valley, transportation costs, the price of animal feed and technical changes in production and transportation.
CHAPTER III

The Basic Scenario

Some see the Imperial Valley as an alternative location to the South Valley; others question whether it is physically possible to produce milk in the climatic conditions of the Imperial Valley. If costs are not considered, it is always possible to find a technology that will make production possible under extreme climatic conditions. The question to be answered, then, is whether it is economically feasible to produce milk in the Imperial Valley.

In the framework of this study, a dairy in the Imperial Valley is defined as economically feasible if it meets two conditions: (1) net revenue per cow is positive and (2) it equals or exceeds the net revenue per cow obtained in the South Valley. The first condition addresses the issue of whether a dairy can survive and expand while doing business in the Imperial Valley. The second considers whether the Imperial Valley can be as attractive as the South Valley for dairy producers moving out of the Chino Valley.

Dairy profitability depends on a number of factors. Among them are location, ecological conditions, environmental regulations, equipment installed, milk prices and feed availability. The influence of most of these factors is analyzed in this and the following sections. 3

Location affects dairies in several ways. Local ecological conditions impact milk production and investment requirements. For dairymen who hold quota, milk prices differ by region. Feed availability, variety and prices all vary by location. Finally, transportation costs depend on

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3 Environmental regulations, however, are not considered here, although some details are provided in Appendix 4. This is because the most important costs associated with environmental regulations arise from waste disposal practices, which determine the amount of land required that is not directly used in milk production. This additional land is excluded from the analysis for two reasons. First, the Regional Water Quality Control Board in the Imperial Valley is reviewing the regulations for new dairies, and until the final rules are formally approved, they cannot be evaluated. Second, the land is not directly used for dairy operations - for example, the dairy producer can grow feed for cattle, other crops, or lease the land to other farmers. In any case, it is almost certain that the land will not remain fallow. Thus, a production plan would have to be specified in order to include the additional land in the analysis. This plan, however, would be arbitrary and not directly linked to the dairy operation, which would confuse the direct economic results of dairying. Therefore, to simplify the calculations, it is assumed that the income generated by the additional area simply offsets the capital cost and taxes arising from ownership.

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the distance to the market, the existence of processing plants in the vicinity, the volume produced and frequency of trips.

Ecological conditions specific to each area define investment requirements and affect production per cow. In this study, the only ecological conditions considered are the requirements for cow cooling in the Imperial Valley and the influence that the different cooling systems have on reproduction and milk production.

This chapter compares the net revenue per cow obtained from milk production by analyzing two hypothetical dairies, one located in Tulare county and the other at Holtville. The comparison here is based on a series of assumptions about prices, milk production and transportation costs. The following chapter analyzes changes in revenues under alternative assumptions.

Investment Requirements

It is assumed that both dairies have 40 acres, the minimum amount of land required to handle the herd and milking installations. Land is valued at prices representative of each area: $3,500 per acre in Tulare and $2,200 per acre in the Imperial Valley.4

Both farms are assumed to have 1,000 cows and prices of cows and replacements are assumed equal. They also have similar equipment investments, differing only in the cow-cooling equipment required to manage heat stress in the Imperial Valley. These are modern facilities equipped with a milking barn, covered holding corral and drylot corrals with feed mangers, including slope and shade. Investment in physical capital, excluding land and cow cooling equipment, is $1,561 per cow.5 Composition of the capital stock and its disposition on the dairy follow the specifications of Armstrong (1994a).

Heat stress in the Imperial Valley can be extreme during the summer months. However, technological improvements in cow cooling developed in the last five years can alleviate some or all of the detrimental effects of heat stress. Three investment alternatives are considered in the present study:
(1) Korral Kool for high and medium production cows (60% of the total); spray and fans for low production and dry cows (40%). This combination is used to construct the basic scenario. The economic data are based on Daugherty (1993).6
(2) Spray-and-fan for all cows.
(3) No cooling.

Investment in spray-and-fan equipment costs $150 per cow while Korral Kool costs $400 per cow. Each system's efficiency in

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4 These prices were obtained from local banks and real estate agents.
5 Equipment prices were obtained from suppliers and consultants; land prices were obtained from banks financing investment in agriculture in each region.
6 Korral Kool is a "primitive" air conditioning within an enclosed barn. It combines a fine mist with air movement, all controlled by computers. Spray-and-fan is a simple water spray and fanned air movement in an open, shaded area.
compensating heat stress is reflected in specific responses in milk production and reproduction rates. Per cow production responses for each cooling system and lactation stage are reported by Armstrong (1994). Those results were used to construct annual weighted average losses in milk yields, the weights being the proportion of cows assumed to be in each stage of production at any particular moment.

The results reported by Armstrong reflect only increases in milk production under different cooling systems. However, reproduction rates are increased by cow cooling in the same proportion as milk production. Consequently, the same coefficients were used to estimate responses in reproduction rates and in milk production. It is assumed that milk yields per cow and the number of calves sold both decrease by 15 percent when cows are cooled only with spray-and-fan. When no cooling is used, the reduction is assumed to be 30 percent.

**Determination of Dairy Income and Costs**

Revenues from dairying are calculated as total income minus production costs. Income is computed as total production obtained from the dairy (milk, cull cows and calves sold) multiplied by the prices received. Milk prices in California vary by region only when the dairy producer owns quota. The basic scenario assumes that farmers in each location possess no quota—consequently, they receive overbase prices. A five year average of Class 4 prices was used in the basic scenario as an approximation for overbase prices. The value calculated was $10.72 per cwt. Its standard deviation during the same period was $0.26, about 2.4 percent of the calculated average.

Cows in both locations produce 19,400 lb. of milk per year. This figure is the DHIA average production recorded in Tulare in 1993. The dairies also sell 480 calves per year. This assumes that the cow-cooling system in the Imperial Valley compensates heat stress enough to allow cows to reach the same production level as in Tulare. Experiences of dairies in Phoenix, Arizona, and Mexicali support this assumption.

Production costs in both locations are assumed equal except for feed, transportation, cow cooling, taxes and insurance, capital costs, and depreciation. Taxes and insurance, capital costs, and depreciation differ only because they are calculated as a proportion of total investment. Differences in total investment arise from higher land prices in Tulare and cow-cooling requirements in the Imperial Valley.

Feed is the single most important component of milk production costs, representing approximately 50 percent of the total. Minimum cost rations for Tulare and the Imperial Valley were calculated using available feeds and current practices in each location. It is assumed that dairymen in Tulare have access to high and fair quality alfalfa, corn silage and concentrates; in the Imperial Valley, the ration may

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7 Personal communication from Dennis Armstrong.
8 Depreciation is included in this analysis for completeness, but it is not necessarily a cash item. Alternative scenarios can be generated by the reader by not counting depreciation as a cash cost as it is here.
also contain sudangrass. The same concentrates are available in both locations at comparable prices. The considerable size of the feedlot industry in the Imperial Valley justifies this assumption.

Five-year average prices were calculated for each component of the ration. Alfalfa hay prices were obtained from the Federal-State Market News Service (1993) and reflect local conditions. The publication quotes prices in Tulare (delivered basis) and in the Imperial Valley (prices received by farmers); a $5 per ton local transportation cost was added to the latter. Prices for the remaining items in the rations were obtained from several issues of the Agricultural Commissioners’ reports and The Dairyman.

Minimum cost rations for five animal categories were calculated by linear programming with the program PCDairy (Bath, 1994). The categories were for cows producing: 1) 100 lb. of milk per day, 2) 80 lb. of milk per day, 3) 60 lb. of milk per day, 4) 40 lb. of milk per day and 5) dry cows. It was assumed that, at any moment, 30 percent of the cows are in the first category, 30 percent in the second, 13.33 percent in categories 3 and 4 respectively and 12.5 percent are dry. These proportions were used to combine the rations for each cow category in order to obtain weighted average rations for a representative cow in each location. These rations reflect local feed availability and prices.

Table 1 shows the composition of the average rations used in the basic scenario. Even though it is assumed that the same concentrates are available in both locations at the same prices, the composition of the average ration differs between regions, reflecting different uses of other feeds and relative price differentials.

<table>
<thead>
<tr>
<th>Item</th>
<th>Imperial Valley</th>
<th>Tulare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premium alfalfa hay</td>
<td>1.39</td>
<td>2.36</td>
</tr>
<tr>
<td>Fair alfalfa hay</td>
<td>2.46</td>
<td>0.33</td>
</tr>
<tr>
<td>Sudangrass</td>
<td>0.18</td>
<td>——</td>
</tr>
<tr>
<td>Corn silage</td>
<td>1.37</td>
<td>6.84</td>
</tr>
<tr>
<td>Concentrates</td>
<td>4.62</td>
<td>3.92</td>
</tr>
</tbody>
</table>

In calculating the rations for the Imperial Valley only the limited number of items shown in Table 1 was considered. These items were selected because they are the most used in the South Valley (except for Sudangrass) and there are records of prices in previous years. The actual supply of feed in the Imperial Valley is more diverse and includes bermuda grass, citrus, wheat, carrots, etc. However, difficulties in specifying their nutrient content and in calculating average prices prevented the use of these inputs in the scenarios.
Transportation costs are the other major influence on revenue. Actual transportation costs depend on a variety of factors among which are the volume of milk produced in the area, frequency of haulings, existence of backhauls and origin and destination of the milk. Because of the importance of transportation costs, they are not included in the basic scenario but analyzed in a separate section.

Both farms employ 4 milkers (each at $23,040 per year), 1 laborer ($16,128 per year) and 1 herdsman ($30,000 per year). The item miscellaneous includes maintenance, clipping, repairs, business and other costs. Operating costs for each cooling system were obtained from Daugherty (1993) and are included only in the Imperial Valley budget.

It is assumed that 74 percent of the capital is invested in milking barn, homes, corrals and other installations that depreciate in 25 years. The remaining 26 percent is composed of equipment that depreciates in 10 years. The cow cooling equipment used in the Imperial Valley also depreciates in 10 years; its value for the combination of Korrал Kool and spray-and-fan is $300 per cow.

Total interest in investment was calculated with an annual rate of 7 percent.

Revenue Analysis in the Basic Scenario

The basic scenario (laid out on page 21) shows that, when transportation costs are not considered, net revenue per cow in the Imperial Valley is 12.5 percent higher than in Tulare. Cheaper land, a larger variety of feed and a substantially lower price for alfalfa more than compensate for the additional investment required in cow cooling.

Net revenue per cow in the Imperial Valley is $160.77 while in Tulare it is $138.46. Feed costs in the Imperial Valley are $82.66 per cow per year lower than in Tulare while all other costs (including depreciation) are $60.35 per cow per year higher. Clearly, the difference in feed costs is large enough to compensate for the additional costs arising from the cow cooling equipment. Feed costs in the Imperial Valley are approximately 52 percent of total costs while in Tulare their share is about 55 percent. The more expensive items in the Imperial Valley are cow cooling operating costs ($18.86), larger depreciation ($30 more than in Tulare) and higher interest cost on investment ($10.50). The more expensive land in Tulare is offset by higher taxes and insurance in the Imperial Valley.

The difference in revenue between the two hypothesized farms is small. Given the numerous assumptions used to construct the budgets, these figures cannot be considered as proof that the Imperial Valley has an absolute advantage over Tulare County in milk production. They only indicate that, under these assumptions, on-farm production

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9 Reviewers have indicated that these levels of remuneration for labor may be high for the Imperial Valley.
of milk in the Imperial Valley is economically feasible according to the second criterion defined earlier: net revenue per cow is of a magnitude comparable to that obtained in Tulare.

Thus, these results are not a definitive answer to the question of whether it is profitable to dairy in the Imperial Valley. The milk produced still has to be sold and the price received has to be enough to yield a positive profit after paying for hauling costs. As will be seen later, finding the appropriate markets is the key to a successful dairy operation in the Imperial Valley.

Table 2 shows net revenues per cow in Tulare and the Imperial Valley without transportation costs. The following chapter shows how these differences are affected by changes in the assumptions used to construct the budgets, and by transportation costs.
<table>
<thead>
<tr>
<th>Item</th>
<th>units</th>
<th>quantity</th>
<th>$ per unit</th>
<th>Imperial Valley (1)</th>
<th>Tulare County (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed: Premium alfalfa hay</td>
<td>tons</td>
<td>(2)</td>
<td>147.08</td>
<td>303.83</td>
<td></td>
</tr>
<tr>
<td>Fair alfalfa hay</td>
<td>tons</td>
<td>(3)</td>
<td>185.45</td>
<td>31.46</td>
<td></td>
</tr>
<tr>
<td>Corn silage</td>
<td>tons</td>
<td>30</td>
<td>41.23</td>
<td>205.16</td>
<td></td>
</tr>
<tr>
<td>Sudangrass</td>
<td>tons</td>
<td>Table 1)</td>
<td>5.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrates</td>
<td>tons</td>
<td>(4)</td>
<td>636.8</td>
<td>558.45</td>
<td></td>
</tr>
<tr>
<td><strong>Total Feed Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td>1016.24</td>
<td>1098.9</td>
</tr>
<tr>
<td>Labor (includes workman’s comp)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 milkers</td>
<td>worker</td>
<td>4</td>
<td>23040</td>
<td>92.16</td>
<td>92.16</td>
</tr>
<tr>
<td>1 laborer</td>
<td>worker</td>
<td>1</td>
<td>16128</td>
<td>16.13</td>
<td>16.13</td>
</tr>
<tr>
<td>1 herdsman</td>
<td>worker</td>
<td>1</td>
<td>20600</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>replacements (net costs)</td>
<td>cow</td>
<td>1</td>
<td>175</td>
<td>175</td>
<td>175</td>
</tr>
<tr>
<td>breeding costs</td>
<td>units/cow</td>
<td>1</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>taxes and insurance</td>
<td>$</td>
<td></td>
<td>53.93</td>
<td>49.31</td>
<td></td>
</tr>
<tr>
<td>production testing</td>
<td>$</td>
<td></td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>dues and assessments</td>
<td>$</td>
<td></td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>veterinary and medicine</td>
<td>$</td>
<td></td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>supplies</td>
<td>$</td>
<td></td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>miscellaneous</td>
<td>$</td>
<td></td>
<td>140</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>cow cooling</td>
<td>$</td>
<td></td>
<td>18.86</td>
<td>18.86</td>
<td></td>
</tr>
<tr>
<td><strong>total cash costs</strong></td>
<td></td>
<td></td>
<td></td>
<td>1694.32</td>
<td>1753.5</td>
</tr>
<tr>
<td>depreciation: miling barn, homes,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>corrals-25 year life (74% of capital)</td>
<td>$</td>
<td></td>
<td>1155.14</td>
<td>46.21</td>
<td>46.21</td>
</tr>
<tr>
<td>equipment - 10 yr. life (26% of capital)</td>
<td>$</td>
<td></td>
<td>405.86</td>
<td>70.59</td>
<td>40.59</td>
</tr>
<tr>
<td>plus cow cooling in I.V.</td>
<td></td>
<td></td>
<td></td>
<td>(+300 in LV.)</td>
<td></td>
</tr>
<tr>
<td><strong>total depreciation</strong></td>
<td>$</td>
<td></td>
<td>116.79</td>
<td>86.79</td>
<td></td>
</tr>
<tr>
<td><strong>Interest on Investment: Quota</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>$/cwt</td>
<td>1968.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>acres</td>
<td></td>
<td>(5)</td>
<td>6.16</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>Buildings and corrals 50%</td>
<td>$</td>
<td>1155140</td>
<td>40.43</td>
<td>40.43</td>
<td></td>
</tr>
<tr>
<td>Equipment 50%</td>
<td>$</td>
<td>705860</td>
<td>24.71</td>
<td>14.21</td>
<td></td>
</tr>
<tr>
<td>Cows</td>
<td>each</td>
<td>84</td>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total interest on investment</td>
<td>$</td>
<td></td>
<td>155.3</td>
<td>148.44</td>
<td></td>
</tr>
<tr>
<td>total of all costs of production</td>
<td>$</td>
<td></td>
<td>1966.41</td>
<td>1988.72</td>
<td></td>
</tr>
<tr>
<td>less credit for calves</td>
<td>heads</td>
<td>100</td>
<td>47.5</td>
<td>47.5</td>
<td></td>
</tr>
<tr>
<td>net cost with 100% of milk sold</td>
<td>$</td>
<td></td>
<td>1918.91</td>
<td>1942.22</td>
<td></td>
</tr>
<tr>
<td>revenue</td>
<td>$/cwt</td>
<td>10.72</td>
<td>2079.68</td>
<td>2079.68</td>
<td></td>
</tr>
<tr>
<td>net revenue per cow</td>
<td>$</td>
<td>160.77</td>
<td>138.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Dollars per cow per year
(2) The price of premium alfalfa is 105.86 $/ton in Imperial valley and 128.65 $/ton in Tulare.
(3) The price of fair alfalfa is 75.26 $/ton in Imperial valley and 96.12 $/ton in Tulare.
(4) The price of concentrates is 137.74 $/ton in Imperial valley and 142.59 $/ton in Tulare.
(5) The price of land is $3,500 per acre in Tulare and $2,200 per acre in Imperial Valley.
CHAPTER IV

Alternative Scenarios

In the previous chapter, the basic scenario estimated that dairies in the Imperial Valley can produce on-farm milk at a slightly lower cost than those in the South Valley. The numbers in Table 2, however, are concerned with hypothetical dairy farms which may be very different from actual operations. The basic scenario was built with several assumptions. In this chapter, sensitivity analyses are used to determine how the net return per cow changes when these assumptions are modified.

The first group of assumptions is concerned with the composition of the rations. Since feed costs represent more than 50 percent of total milk production costs, small changes in feed prices and availability have an important impact on the economic results of dairying. The first section of this chapter analyzes the dependence of net revenues per cow on alfalfa prices, the main single component of the ration.

Dairymen receive a price differential according to the volume of milk quota they own. The second section considers net revenue changes when milk prices shift and when the producer holds different amounts of quota.

Since climatic conditions in the Imperial Valley during the summer can cause severe heat stress, the next section reports the economic results of milking with three alternative cooling systems.

Selection of the milk market is of primary importance for two reasons: (1) prices for fluid milk may change among different locations and in accordance with the quantity of quota owned by the dairy producer and, (2) transportation costs can absorb a substantial proportion of the net revenue per cow. The concluding three sections evaluate net revenues per cow when different markets are selected.

Changes in Alfalfa Prices

Five year average prices of alfalfa were used to construct the basic scenario. Alfalfa prices differ among regions. The average price for premium alfalfa delivered in Tulare was $128.65 per ton while in the Imperial Valley average prices were $100.86 plus $5 dollars for local delivery. Alfalfa of lower quality (fair) averaged $96.12 per ton in Tulare County and $75.26 in the Imperial Valley. In spite of these price
differences, alfalfa purchases are approximately 17 percent of total milk production cost in both regions, because dairymen in each region adjust the ration according to feed availability and cost.

To analyze the sensitivity of net revenue per cow to changes in the alfalfa price, minimum cost rations were obtained using a linear program for different price levels in each region. The exercise was carried out by increasing and decreasing the base prices by 5 and 10 percent. Composition of the lowest cost rations in the Imperial Valley and Tulare County for each price are detailed in Table 3.

During this period the coefficient of variation of the price of high quality alfalfa in the Imperial Valley was 12 percent while in Tulare County it was 8 percent. This means that in any given year, the observed price of premium alfalfa in the Imperial Valley has a 66 percent chance of differing from the average price by less than 12 percent. The coefficient of variation for the price of fair alfalfa both in the Imperial Valley and Tulare is 19 percent. These numbers give an idea of the magnitude of the expected variability in alfalfa prices.

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Cost</strong></td>
</tr>
<tr>
<td><strong>Rations in the Imperial Valley for Different Alfalfa Prices (in tons per cow per year)</strong></td>
</tr>
<tr>
<td>Premium alfalfa hay</td>
</tr>
<tr>
<td>Fair alfalfa hay</td>
</tr>
<tr>
<td>Corn Silage</td>
</tr>
<tr>
<td>Sudangrass</td>
</tr>
<tr>
<td>Concentrates</td>
</tr>
</tbody>
</table>

| **Minimum cost rations in Tulare for Different Alfalfa Prices (in tons per cow per** |
| Premium alfalfa hay | 2.34 | 2.23 | 2.36 | 1.55 | 0.60 |
| Fair alfalfa hay | 0.70 | 0.67 | 0.63 | 0.33 | 0.33 |
| Corn Silage | 6.19 | 6.03 | 6.84 | 8.30 | 9.92 |
| Concentrates | 3.90 | 4.02 | 3.92 | 4.19 | 4.40 |

Table 4 shows feed costs and net revenues per cow for different alfalfa prices in both regions.

When alfalfa prices increase, total feed costs in Tulare County increase faster than in the Imperial Valley, because the larger diversity of feeds available in the latter area allows dairymen there to substitute less expensive items for alfalfa in the rations. As a result, for low alfalfa prices the difference in net revenue per cow between the two locations

---

10 Assuming that prices are distributed normally.
is $17.34 while for high prices it is $26.05.

In building the rations for the different scenarios, only a limited number of feed items were used. Three criteria were used to select those items: a) they are the most commonly used in the South Valley or are easily available in the Imperial Valley, b) records of their prices in previous years are available and, c) their nutrient content is well known. Since many available feedstuffs were excluded from the analysis because they did not meet these criteria, actual feed costs could be lower.

<table>
<thead>
<tr>
<th>Change in Alfalfa Price</th>
<th>Feed Costs in Imperial Valley</th>
<th>Feed Costs in Tulare</th>
<th>Net Revenue / Cow Imperial Valley (a)</th>
<th>Net Revenue / Cow Tulare (b)</th>
<th>% difference (a-b)/b</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10%</td>
<td>1035.65</td>
<td>1122.05</td>
<td>141.36</td>
<td>115.31</td>
<td>22.59</td>
</tr>
<tr>
<td>+5%</td>
<td>1031.29</td>
<td>1113.86</td>
<td>145.72</td>
<td>123.49</td>
<td>18.00</td>
</tr>
<tr>
<td>Basic scenario</td>
<td>1016.24</td>
<td>1098.90</td>
<td>160.77</td>
<td>138.46</td>
<td>16.16</td>
</tr>
<tr>
<td>-5%</td>
<td>1007.39</td>
<td>1083.61</td>
<td>169.62</td>
<td>153.74</td>
<td>10.33</td>
</tr>
<tr>
<td>-10%</td>
<td>987.60</td>
<td>1065.28</td>
<td>189.42</td>
<td>172.08</td>
<td>10.01</td>
</tr>
</tbody>
</table>

Table 4: Feed Cost and Net Revenue Per Cow for Different Alfalfa Prices (in $ per cow per year)

Influence of Management Efficiency, Milk Prices and Milk Quota

Revenues per cow in California are the result of a combination of milk prices, quota ownership and production per cow, the latter two of which reflect management skills. Better management results in more output with the same quantity of inputs, more revenue per cow, or both.

Since 1994, quota owners receive a fixed price differential of $1.70 for each pound of milk they sell that is covered by quota. In addition, Regional Quota Adjustments (RQA’s) differ between regions in California. It is assumed here that dairies in the Imperial Valley will receive the same RQA as Southern California. Even though dairies may purchase quota, it is not a requirement for production. (Purchasing of quota is not studied in this document. An introductory analysis to that problem can be found in Butler (1992)).

Most dairymen own quota for only a portion of their production. Three scenarios are considered here: (1) the dairy producer owns quota equal to 100 percent of milk output, (2) he owns quota equal to only half of his production and (3) he owns no quota.

The base scenario uses the five year average price of Class 4 milk. That figure is $10.72 with a standard deviation of $1 (9 percent). Revenue per cow is defined as milk price times production per cow. In this analysis, revenue per cow is varied by 5 and 10 percent. These values are similar to the observed price variability.

Table 5 shows net revenues per cow in both regions for five revenue
levels (or management efficiency levels) and three proportions of quota owned. The changes in net revenues may be the result of both price movements and efficiency levels.

Quota ownership is a major determinant of net revenues. Compared to the base scenario (no quota), 50 percent quota ownership in Tulare increases revenues by about 50 percent and 100 percent quota ownership raises net revenues by about 100 percent. Due to the regional differential (RQA), quota ownership in the Imperial Valley has a stronger influence over revenues. With 50 percent ownership, net revenues grow by about 60 percent with respect to the basic scenario, and with 100 percent quota net revenues rise by about 120 percent.

<table>
<thead>
<tr>
<th>Table 5</th>
<th>% Change in Milk Price</th>
<th>NO QUOTA</th>
<th>50% QUOTA</th>
<th>100% QUOTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Revenue Per Cow for Different Milk Prices (or Management Efficiency) and Quota Ownership (in $ per cow per year)</td>
<td>+10%</td>
<td>368.7</td>
<td>346</td>
<td>481.2</td>
</tr>
<tr>
<td></td>
<td>+5%</td>
<td>264.8</td>
<td>242</td>
<td>369</td>
</tr>
<tr>
<td></td>
<td>Basic scenario</td>
<td>160.8</td>
<td>138</td>
<td>256.8</td>
</tr>
<tr>
<td></td>
<td>-5%</td>
<td>56.79</td>
<td>34.5</td>
<td>144.5</td>
</tr>
<tr>
<td></td>
<td>-10%</td>
<td>-47.2</td>
<td>-70</td>
<td>32.31</td>
</tr>
</tbody>
</table>

Net revenues are also very sensitive to changes in milk prices or management efficiency, although quota ownership reduces this variability. When the dairy producer owns no quota, a 10 percent increase in milk price raises net revenues by 130 percent in the Imperial Valley and 150 percent in Tulare. However, when the dairy producer owns 100 percent quota, the increase in net revenues is only 68 percent in the Imperial Valley and 84 percent in Tulare. If the milk price falls by 10 percent, and the dairy producer has no quota, net revenues become negative. With 50 percent quota, a 10 percent decrease in milk prices reduces revenues by about 90 percent in the Imperial Valley to only 12 percent of the base scenario revenue. It becomes negative in Tulare. With 100 percent quota, the induced fall in revenues is about 70 percent in the Imperial Valley and 85 percent in Tulare. Clearly, quota ownership increases net revenues.

When the dairy producer owns no quota, he receives the overbase price, which is approximated by the weighted average of Class 4 prices. These prices have a strong seasonal pattern, being higher in the winter months and lower in the summer. Production in most dairies also has a seasonal pattern. In Tulare County peak milk production occurs in spring and the low point in winter. Dairies in the Imperial Valley could adjust their production schedules to profit from this seasonal behavior.
In that case, dairies in both areas producing the same amount of milk per cow would receive different average prices because of the timing of production. These effects are not reflected in the calculations here—it is assumed that the average price is the same in both locations.

Comparing Milk Cooling Systems

Heat stress in the Imperial Valley can be severe during the summer months and may result in significant production losses for dairies. Recent technological improvements, however, can successfully overcome most of those problems (Armstrong, 1994a). Korral Kool and spray-and-fan are the cooling systems that proved to be the most efficient from an economic perspective. Their performance for different climatic conditions was studied by Armstrong (1994b) and Daugherty (1993).

Three alternative production systems are considered in this study. The basic scenario was constructed with the combination of Korral Kool for cows in high and medium production and spray-and-fan for cows in low production and dry cows. According to Armstrong (1994a), this combination can reduce the negative effects of heat stress enough to allow cows to produce at levels comparable to those in the South Valley.

Spray-and-fan alone is less efficient than the combination when temperatures are over 105°F. In this scenario, it is assumed that with spray-and-fan alone annual milk production and the number of calves born fall 15 percent below the basic scenario. When no cooling is used, both milk production and the number of calves born fall by 30 percent. These estimates are lower bounds on the actual expected losses. However, they indicate the importance of using the proper technology for the climatic conditions of the Imperial Valley.

Table 6 shows projected net revenues per cow for different combinations of quota ownership and cow cooling equipment.

<table>
<thead>
<tr>
<th>COOLING SYSTEM</th>
<th>NO QUOTA</th>
<th>50% QUOTA</th>
<th>100% QUOTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korral Kool and Spray and Fan (basic scenario)</td>
<td>160.77</td>
<td>256.76</td>
<td>352.75</td>
</tr>
<tr>
<td>Spray-and-Fan Only</td>
<td>-127.25</td>
<td>-56</td>
<td>15.26</td>
</tr>
<tr>
<td>None</td>
<td>-412.88</td>
<td>-366.36</td>
<td></td>
</tr>
</tbody>
</table>

The basic scenario is the only one that yields positive returns for all amounts of quota. The combination of a 100 percent quota and spray-and-fan yields a small positive return, but a slight reduction in the price of milk could turn it negative (See Table 5). Spray-and-fan with only 50 percent quota or no quota result in negative revenues. Net
returns are always negative when no cooling is used. Thus, our analysis shows that it is not profitable to produce milk in the Imperial Valley without some cow-cooling system. A discussion of which equipment is the most profitable can be found in Daugherty (1993).

The Impact of Hauling Rates when Selling in Southern California

Finding the right market is a major factor determining the economic feasibility of dairy farms in the Imperial Valley. As seen in Chapter II, milk produced in the Imperial Valley may be shipped to two markets in Southern California: San Diego and the Los Angeles-Chino Valley area.

Presently no haulings are recorded from the Imperial Valley to either market. For this study, hauling costs were estimated by truck companies and industry managers, based on current hauling rates. The estimated cost of shipping to Los Angeles is $0.82/cwt. and the cost to San Diego is estimated at $0.60/cwt. These estimates, however, are based on full rates. The actual costs could be greatly reduced depending on a number of variables, among which are volume and frequency of haulings, existence of backhauls and size of the regional industry.

The distance from the Imperial Valley to San Diego is approximately 120 miles and to Los Angeles about 170 miles. Although Tulare is approximately 200 miles from Los Angeles, the cost of shipping milk from there is much lower than from Holtville. This is because dairymen in Tulare have the option of selling their milk to local plants at a hauling cost estimated at $0.30/cwt. As a result they qualify to receive transportation allowances in order to provide an incentive to move their milk into Los Angeles.

Three scenarios were constructed to analyze the influence of hauling rates on net revenues per cow in the Imperial Valley: (1) dairymen pay the full freight cost, (2) dairymen obtain a discount and pay an intermediate freight cost and, (3) dairymen qualify for transportation allowances and pay only for local hauling.

Table 7 shows net revenues per cow for dairies in the Imperial Valley when they sell either to San Diego or Los Angeles at different hauling rates and amounts of quota owned. Net revenues per cow in Tulare are also included for comparison. Net revenues per cow in the Imperial Valley are positive for all combinations of hauling rates and quota ownership considered.

When no quota is owned, however, the positive margin is very small and a slight reduction in milk prices or increase in input prices could turn it negative. Table 5 showed that a 5 percent drop in milk price caused net revenues per cow, both in Tulare and the Imperial Valley, to fall $104 when the dairy producer owned no quota and that with a 10 percent reduction in the price of milk, revenues fell by about $240.

---

11Personal communication from Manuel Españaola, Kings County Truck Line.
Table 7 shows that, if no quota is owned, a 5 percent drop in the price of milk would make net revenue per cow in both locations negative, except for a local rate in the Imperial Valley. If the dairy producer owns 50 percent quota, net revenue per cow could still be positive after a 10 percent fall in the milk price, depending on the market he sells to and the hauling rate he pays.

<table>
<thead>
<tr>
<th></th>
<th>5/cwt</th>
<th>No Quota</th>
<th>50% Quota</th>
<th>100% Quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS ANGELES (from Imperial Valley)</td>
<td>0.82</td>
<td>1.69</td>
<td>97.68</td>
<td>193.67</td>
</tr>
<tr>
<td>LOS ANGELES (from Imperial Valley)</td>
<td>0.6</td>
<td>44.37</td>
<td>140.36</td>
<td>236.35</td>
</tr>
<tr>
<td>LOS ANGELES (from Imperial Valley)</td>
<td>0.3</td>
<td>102.57</td>
<td>198.56</td>
<td>294.55</td>
</tr>
<tr>
<td>SAN DIEGO (from Imperial Valley)</td>
<td>0.6</td>
<td>44.37</td>
<td>140.36</td>
<td>236.35</td>
</tr>
<tr>
<td>SAN DIEGO (from Imperial Valley)</td>
<td>0.4</td>
<td>83.17</td>
<td>179.16</td>
<td>275.15</td>
</tr>
<tr>
<td>SAN DIEGO (from Imperial Valley)</td>
<td>0.3</td>
<td>102.57</td>
<td>198.56</td>
<td>294.55</td>
</tr>
<tr>
<td>LOS ANGELES (from Tulare)</td>
<td>0.3</td>
<td>80.26</td>
<td>150.06</td>
<td>219.86</td>
</tr>
</tbody>
</table>

When no quota is owned and the milk is shipped to San Diego at a discount rate ($0.40/cwt), net revenue in Tulare is similar to the net revenue obtained in the Imperial Valley. If dairymen in the Imperial Valley could pay only for a local hauling, net revenue per cow would be higher than in Tulare.

When the farmer owns 50 percent quota, shipping to San Diego yields increased revenue per cow for any hauling rate. It is equally profitable to sell to Los Angeles from the Imperial Valley as from Tulare if a discount rate is available. If the dairy producer owns 100 percent quota, shipping milk from the Imperial Valley to San Diego is always more profitable than from Tulare. It is also more profitable to ship to Los Angeles unless full rates are paid.

If transportation allowances are granted, dairymen in the Imperial Valley would pay only a local transportation cost. Then, it would be equally profitable to sell to San Diego or Los Angeles. Other market characteristics not considered in this study (such as premiums for fat content paid by cheese factories) can increase the profitability of one market over the other.

**Selling to Arizona**

Arizona's dairy industry grew very fast in the last decade. In recent years, supply has exceeded demand for fluid milk but there is potential demand for manufacturing milk. Consequently, the price that dairymen in the Imperial Valley can expect to receive from selling in Arizona is the manufacturing milk price. Again, transportation costs depend on a variety of factors. Since there are no data on actual costs, two different rates were considered in this scenario. These were based on actual transportation costs in California, modified according to the distance between Holtville and Phoenix.

Table 8 shows net revenues per cow for different milk prices and
transportation costs. The five year average price of Class III milk ($11.41/cwt) was used to construct the base scenario.

The advantages, if any, of selling to Arizona relative to Southern California depend on the particular combination of quota ownership, hauling rates and prices in each location at any moment. When the dairy producer owns California quota, it is always preferable to sell to southern California. Also, if the transportation cost to Arizona is high, then, for comparable prices, it is always worthwhile to choose Southern California, regardless of the hauling rates there.

Only if transportation costs are relatively low to Phoenix and high to San Diego, is it more profitable to sell to Arizona. These results indicate that the market in Arizona is preferable to Southern California only for favorable combinations of prices and transportation costs. Even that advantage is small and may disappear if any of the prices or costs change slightly.

**Selling to Mexicali**

The Mexicali market seems particularly attractive because of its proximity to the Imperial Valley and the continuing deficit of fluid milk in the area. As was pointed out in Chapter II, the main problems that dairymen would face in entering this market are unfavorable exchange rates and the vitality of the Mexican economy.

Economic instability in Mexico affects the exchange rate between Mexican and U.S. currencies and reduces both the local demand and supply of fluid milk.\(^{12}\) Demand for food in general falls as higher inflation reduces incomes, but milk is considered a necessity for children and a healthy food for adults, so the reduction in demand should be smaller than the reduction in income. Instability also affects the milk supply as dairymen in Mexico reduce investments in equipment and animals. This is because higher inflation and interest rates increase the riskiness of investing in physical capital and increase the returns of investing in financial assets. Thus, it is likely that supply will fall faster than demand, increasing the local milk

\(^{12}\) In the short run, the exchange rate is the main force affecting U.S. fluid milk exports. Large movements in the exchange rate can make U.S. milk very competitive, or drive it out of the market in a matter of days.

<table>
<thead>
<tr>
<th>Net Revenue Per Cow When Selling to Arizona (in $ per cow per year)</th>
<th>% Change in Milk Price</th>
<th>Transportation Cost $1/cwt</th>
<th>Transportation Cost $1.50/cwt</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10%</td>
<td>321.99</td>
<td>224.99</td>
<td></td>
</tr>
<tr>
<td>+5%</td>
<td>211.31</td>
<td>114.31</td>
<td></td>
</tr>
<tr>
<td>Basic scenario</td>
<td>100.63</td>
<td>3.63</td>
<td></td>
</tr>
<tr>
<td>-5%</td>
<td>-10.04</td>
<td>-107.04</td>
<td></td>
</tr>
<tr>
<td>-10%</td>
<td>-120.72</td>
<td>-217.72</td>
<td></td>
</tr>
</tbody>
</table>
deficit.

Delays at the border increase transportation costs, reducing net returns to dairymen. Delays of up to three hours are not uncommon, which would make the 20 mile journey from Holtville almost as long as a trip to the Chino Valley. The basic scenario was constructed using the current cost of hauling from Holtville to Mexicali with Mexican trucks ($0.91/cwt). This is a very high cost and could be reduced in several ways—controls at the border become more efficient, the volume of milk shipped increases or the farmer uses his own trucks. Two lower transportation costs were used to construct alternative scenarios ($0.60/cwt and $0.30/cwt).

The price received by dairymen in the Imperial Valley will depend on (1) the volume of the milk deficit in Mexicali, (2) the exchange rate and (3) the price that dairymen can obtain for fluid milk in California. In general, this last value is the lowest price that processors in Mexicali can pay for American milk since California dairymen would have no incentive to sell to Mexicali for a lower price than in San Diego.

Another consideration in deciding whether to sell to Mexicali is the stability of the plant’s demand. If an American dairy becomes a steady supplier of Mexican plants, it might not have other markets available on short notice. Even though in the long run the lowest price an American dairy will accept is the overbase price minus transportation costs, in the short run it may be forced to accept a lower price until alternative purchasers are found.

Table 9 shows net revenues per cow for different transportation costs and price levels when the milk is shipped to Mexicali.

<table>
<thead>
<tr>
<th>% Change in Price</th>
<th>$0.30/cwt</th>
<th>$0.60/cwt</th>
<th>$0.91/cwt</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10%</td>
<td>336.15</td>
<td>277.95</td>
<td>217.81</td>
</tr>
<tr>
<td>-3%</td>
<td>231</td>
<td>172.8</td>
<td>112.66</td>
</tr>
<tr>
<td>Basic scenario</td>
<td>125.85</td>
<td>67.65</td>
<td>7.51</td>
</tr>
<tr>
<td>-5%</td>
<td>20.7</td>
<td>-37.5</td>
<td>-97.64</td>
</tr>
<tr>
<td>-10%</td>
<td>-84.44</td>
<td>-142.64</td>
<td>-202.78</td>
</tr>
</tbody>
</table>

Table 9
Net Revenue Per Cow When Selling to Mexicali (in $ per cow per year)

These transportation costs are similar to those considered in Table 7 which showed the economic results of selling milk to Los Angeles. In both cases, if cheap transportation is available, net returns are positive but still smaller than those obtained by shipping to San Diego.

The likelihood of obtaining cheap rates to Los Angeles and/or Mexicali differs because of specific institutional forces. The 30 cent rate to Chino depends on the availability of transportation allowances, which are granted through an administrative process. The 30 cent rate to Mexicali depends on the efficiency of the controls at the border, availability of trucks, and the volume and frequency of shipments.

Although the closeness of Holtville to the border gives dairies there
a location advantage in the Mexicali market, any economic advantage over San Diego may be lost because of high transportation costs due to delays in crossing the border. However, this location advantage could give dairies in the Imperial Valley some margin to negotiate higher prices in Mexicali. In effect, Mexican processors could give to dairies in the Imperial Valley part of the transportation cost they save when using milk produced in the valley to replace milk imported from further away.
CHAPTER V

Summary and Conclusions

This study defines the feasibility of a dairy industry in the Imperial Valley in terms of two criteria: net revenues per cow should be (1) positive and (2) at least as large as those that can be obtained in the South Valley. The first condition states that no firm can survive if it consistently loses money; the second, that dairying in the Imperial Valley has to be at least as profitable as the closest alternative production site, i.e., Tulare County. The analysis in the previous chapter shows that, with proper technology and management, dairying in the Imperial Valley is feasible according to both criteria.

In summary, the Imperial Valley has advantages and disadvantages for milk production compared to the South Valley. These stem from climatic conditions, location and institutional arrangements.

The importance of proper management cannot be overlooked. (Chapter IV analyzed changes in net revenues per cow caused by different management efficiency levels.) In these scenarios, the effect of management efficiency on revenues was assumed to be of the same magnitude in both locations, even though the problems faced by dairies differ in important ways. Producing milk in the desert requires different feeding techniques, herd management practices and use of the appropriate cooling equipment. On the positive side, cows arrive cleaner to the milking barn and have less mastitis problems because of the drier climate.

The main advantages of the Imperial Valley over the South Valley are a larger availability of feedstuffs and lower alfalfa prices. In Chapter III it was shown that the difference in feed prices can compensate for the costs of installing and operating cow cooling equipment. The result is that production costs in both locations are roughly equivalent.

The main economic advantage of Tulare County over the Imperial Valley is the existence of transportation allowances and a local market for milk. These were granted to dairies in the South Valley to induce them to ship their milk to deficit areas like Los Angeles instead of selling to local milk processing plants. Because of the allowance, Tulare County dairies pay only a local hauling cost regardless of where they sell their milk. Without the allowance dairies in the Imperial Valley
would pay according to the length of the trip. Several factors influence milk transportation costs; for example, existence of backhauls, volume of milk to be transported and continuity of shipments. Dairies in the Imperial Valley might compensate for their higher transportation cost by: (1) choosing the right market, (2) owning quota or (3) a combination of both. These alternatives were analyzed in Chapter IV.

Four markets are close enough to the Imperial Valley to be considered potential outlets for fluid milk: San Diego, the Los Angeles-Chino Valley area, Mexico and Arizona. Quota ownership affects the prices received only in the first two markets.

Because of its proximity, San Diego is the best option available — unless transportation allowances are granted to Imperial Valley producers. In that case, there would be no difference between selling to San Diego or Los Angeles, regardless of the amount of quota owned.

Without transportation allowances, however, the feasibility of Southern California markets depends on (1) the particular hauling rate that each Imperial Valley dairyman can obtain and (2) quota ownership. If the Imperial Valley dairy owns no quota and pays full hauling rates, Tulare County producers have an economic edge in both the San Diego and Los Angeles markets. If the dairyman owns quota, it is preferable to produce in the Imperial Valley, except when selling to the Los Angeles at full hauling cost. (These results assume that producers in the Imperial Valley pay the current Southern California RQA of $0.00 per cwt).

The Mexican market has two clearly differentiated segments: the local market in Mexicali which imports fluid milk, and the national market which buys processed products from the U.S. The local market for fluid milk is the most promising for dairies in the Imperial Valley, since Mexicali has a chronic deficit of fluid milk that, so far, has been covered by imports from the U.S. and other Mexican states. The Imperial Valley could use its location advantage to negotiate prices that would be at least as profitable as those in the closest American destination. The main problem that dairies face when selling in this market is the crossing of the border that can take several hours.

The Mexican market for processed products is supplied mainly from federal stocks managed by the CCC. Therefore, the Imperial Valley would have no advantage over other production areas.

Arizona appears as the least potentially profitable market of all. Only when transportation costs are low to Phoenix and high to San Diego is this market preferable. In all scenarios, any fall in the milk price below the base would make net revenues negative, regardless of transportation costs. Thus, the Arizona market is particularly risky.
Conclusions

The central and most important finding of this study is that milk can be produced on a dairy farm in the Imperial Valley at least as efficiently and cheaply as in the southern San Joaquin Valley. The important difference between the two regions is the relatively higher temperatures and humidity in the Imperial Valley, necessitating the use of expensive cow-cooling technologies. However, this expense is offset by the abundance and relative cheapness of available feeds, particularly high-quality alfalfa hay, in the Imperial Valley.

The economic feasibility of dairying in the Imperial Valley, however, is importantly determined by profitability which, in turn, is largely influenced by transportation costs. The current differential in transportation costs to appropriate markets between the Imperial Valley and the South Valley can be largely offset by quota ownership. Thus, at least in the short term, ownership of quota, although expensive, will be necessary for profitable dairying in the Imperial Valley.

The future success in establishing a viable dairy industry in the Imperial Valley will depend on the size of the herd that is located there, the establishment of milk processing plants, and the regulatory environment that surrounds it. More importantly, cultural and other factors may influence the attractiveness of the region, but these factors defy economic analyses.
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APPENDICES
APPENDIX 1
Dairying in Southern California

Historically, milk production in Southern California evolved in response to technological improvements and demand changes. The state's relative isolation and a booming population generated a steady demand for dairy products. Expansion of the larger cities, however, forced dairies away from the metropolitan zones. Better transportation and cooling techniques allowed farms to relocate to faraway areas.

As a consequence of these changes, an extremely dynamic structure of farms and processing plants evolved in which the relative importance of the different production areas varied over time.

In the early decades of the century, demand for dairy products in Los Angeles and surrounding cities boomed as population soared. The industry responded and in 1925 Los Angeles county became the state's largest producer. In 1930 almost the entire fluid milk supply came from producers within 60 miles from the city. More than 1,400 dairies with 80,000 cows were approved to supply milk to the county, and 69 per cent of the approved dairies and cows were located in the county itself. Twenty country plants shipped market cream to Los Angeles; 16 of the 20 were in the San Joaquin Valley (115 miles away) and one in the Imperial Valley. Still, most of the supply for the area was produced in the southern portion of Los Angeles county and in Pomona, El Monte, Chino and Ontario (Fletcher and McCorkle, 1962). This was a classic example of the specialization of supply zones around an urban area. The closer farms supplied the most perishable and bulky products; cream and manufactured dairy products were obtained from plants in the outlying region.

Figure 1-1 shows the number of milk cows in the three most important production areas of southern California after the mid-1940's.

Figure 1-1  Milk Cows in Production

![Milk Cows in Production Chart]

Source: CDFA.

The number of cows in Los Angeles and Orange counties peaked in 1946 and remained relatively constant until the early '60s when urbanization pressures forced most farms to relocate. By the early '70s, dairies had almost disappeared from Los Angeles and Orange counties. Today, the region produces less than 1 percent of California's milk production.

In 1930 the Chino Valley district contained 7,600 cows and by 1950, that number had doubled. In the next decade, cow numbers rose to 48,810 cows as dairy producers relocated to Chino from Los Angeles county (Fletcher and McCorkle, 1962). Between 1965 and 1975, the Chino Valley was the largest dairy region in the U.S. Steady expansion of the dairy cow population continued until 1991 when 312,000 cows
were reported. Since that time cow numbers have been decreasing with 286,210 reported in 1993 (CDFA). Today, the Chino Valley supplies about 24 percent (5.42 billion pounds) of the state's annual milk production.

The number of dairy farms and cows in the Chino Valley will continue to decrease as environmental degradation and urbanization pressure force dairy producers to relocate. Land for development can sell in the range of $100,000 - $150,000 per acre. By selling their farms, dairy farmers can realize substantial capital gains and build new and modern facilities in alternative locations.

Dairies in the South Coast area (San Diego County) are relatively large, with over 800 cows per farm. The total number of cows in the region has halved in recent years and the trend appears to be continuing. Traditionally, this region has been a fluid milk deficit area. In 1993, local output was less than 1 percent of the state's total production. Due to its proximity, it is a potential market for milk produced in the Imperial Valley.

Southern San Joaquin Valley

The Southern San Joaquin Valley (commonly called the South Valley) is now the most important dairy area in the state. It includes the counties of Fresno, Kings, Kern, and Tulare. In 1993, the South Valley produced 8 billion pounds of whole milk (34.9 percent of the state total). Farms located in the South Valley ship most of their milk to local plants, but may ship milk to plants located as far away as Los Angeles and San Francisco.

The average farm in the South Valley has over 800 milk cows, all housed in corrals. Nearly all dry cows and 75% of heifers are also in corrals. There is a growing trend to keep herd replacement stock in feedlots separate from the dairy (Shultz, 1994).

In 1944 about 150,000 cows were in production in the South Valley; by 1993 the herd had increased to more than 400,000. The rise in cow numbers was caused by a combination of larger operations and more farms. Applications for dairy construction in Tulare County increased in 1994 for the first time since 1990. As of mid-September, twenty-seven permits requests had been filed, with 14 all-new dairies. The average dairy size on permit applications was 8,074 cows on 629 acres. The two largest farms had 10,800 milk cows (16,484 total animals) and 7,200 cows (The Dairyman, 1994).

The combination of potential pollution and scarce land could impose serious restrictions to future expansion of the local industry. Even though land is still easily available, large parcels are becoming scarce. Most of the expansion is coming from local dairy producers, rather than from producers who are relocating from other areas (The Dairyman, 1994). Even though expansion of the milking herds has already created environmental problems that forced counties in the area to restrict the location and size of dairies, people familiar with dairying in the region feel that there is still a considerable potential for further expansion.1

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1Personal communications from John Grimaius (The Ranch Company, Visalia), and Tom Shultz, Cooperative Extension, UC.
APPENDIX 2
Milk Marketing and Consumption Trends

This section analyzes the evolution of different dairy product markets in California with the objective of assessing the magnitude of the demand for milk produced in the Imperial Valley. Particular attention is devoted to the market for fluid milk in the southern portion of the state, where the Imperial Valley may have a comparative advantage due to transportation costs.

Industry Output and Marketing Trends

Commercial production of milk in California has increased considerably in the last two decades. Since the output of milk grew faster than the demand for fluid milk, most of the additional supply went to manufactured products, mainly cheese, butter, and nonfat dry milk. These three products are traded in national markets because they can be stored. They are also the main instruments of the federal support program. Fluid milk, on the other hand, is mostly consumed in-state. Occasionally, small volumes are sold to neighboring states and Mexico.

In 1973, total commercial production of milk in California amounted to 10.2 billion pounds, with about 55 percent of the total classified as Class 1 (5.72 billion pounds). By 1993, commercial milk production had risen to 22.8 billion pounds of which only 30 percent was classified as Class 1. The availability of milk for manufacturing use jumped from 4.5 billion pounds in 1973 to 15.2 billion in 1993 (CDFA). In the last twenty years total Class 1 usage increased only 18 percent, while the output of market milk for manufacturing use rose 305 percent. Meanwhile, the state’s population grew about 51 percent.

Southern California is the state’s most important market for milk products. About 55 percent of the state’s population live in the area; however, they purchase about 63 percent of total milk sales. Sales of fluid milk products are influenced by regional demographic variations and particular tastes of different ethnic and age groups. Southern California has a higher proportion of Hispanics, while Caucasians and Asians are more prevalent in the north. Hispanics have larger families and are younger on average; additionally, they prefer whole milk over lowfat milk.

Butter production in California grew from 192 million pounds in 1984 to 333 million pounds in 1993 (78 percent). In 1993 about 61 percent of all butter was consumed in-state while close to 34 percent was sold to the CCC. The remaining 5 percent was sold to other U.S. markets. Given the volume of purchases, the activity of the CCC has been crucial in stabilizing this market.

Cheese production surged in the late 80’s and has continued growing at a slower pace. Overall output growth in the last decade was 220 percent (from 305 million pounds to 905.5 million pounds). In spite of this expansion, California is a cheese deficit state. About 80 percent of all cheese produced in California in 1990 was consumed in state and the rest was sold in other U.S. markets. In the same year, close to half of California’s cheese consumption was met with imports from other countries and U.S. states.

Production of nonfat dry milk increased from 267 million pounds in 1983 to 413 million pounds in 1993. The strongest rate of increase occurred in the last five years.

Trends in Consumption

Changes in total consumption of fluid milk in Southern California will determine the evolution of the size of the demand for milk originated in the Imperial Valley. This evolution is the result of independent changes in per capita consumption and total population. Even though per capita consumption fell through the years, population increased at a slightly higher rate. As a result, total consumption increased slightly in the last decade.

Per capita consumption of fluid milk products in the U.S. changed dramatically in the last three decades. National per capita consumption of whole milk declined from 80 percent of total fluid milk consumption in 1970 to about 40 percent in the early 80’s. Per capita consumption of low-fat and skim milk, on the other hand, increased from about 20 percent of the total in 1970 to 80 percent in 1990.

Even though per capita consumption of fluid milk products in California showed similar trends, Californians consume a higher than U.S. average quantity of whole milk and lower quantities of low-fat...
and skim milk. Per capita consumption of whole and lowfat milk\(^1\) in California declined by 24 percent in the last decade alone while consumption of skim milk increased by 26.1 percent. Overall, Californians consume 3 to 4 percent more Class 1 dairy products per capita than the national average. As was mentioned, these differences in consumption patterns can be partially explained by different age and ethnic group consumption patterns and preferences. For example, Hispanics consume more milk than whites. Further, Hispanics and blacks favor whole milk, and whites prefer low-fat or skim milk. Consumption of whole milk is larger in younger populations (SRI, 1990).

Per capita consumption of natural cheese registered the largest increase among all dairy products in the U.S. It jumped from about 12 pounds (excluding processed) in 1971 to about 24 pounds in 1990. Cheese consumption in California followed a similar pattern. Per capita consumption in the state is about 3 to 4 pounds per capita higher than the national average. A study by the Stanford Research Institute projected California per capita cheese consumption to grow to 29.5 pounds in 1995 and 30.8 pounds in 2000. Table 2-1 shows per capita production (and in-state consumption) of selected dairy products.

<table>
<thead>
<tr>
<th>Year</th>
<th>Whole and Lowfat Milk (gals)</th>
<th>Skim Milk (gals)</th>
<th>Half &amp; Half (gals)</th>
<th>Yogurt (lbs)</th>
<th>Butter (lbs)</th>
<th>Cheese (lbs)</th>
<th>Cottage Cheese (lbs)</th>
<th>Nonfat Dry Milk (lbs)</th>
<th>Ice Cream and Iced Products (gals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>25.39</td>
<td>1.85</td>
<td>0.44</td>
<td>0.68</td>
<td>7.52</td>
<td>11.9</td>
<td>5.51</td>
<td>10.69</td>
<td>3.55</td>
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<td>1985</td>
<td>24.91</td>
<td>2.01</td>
<td>0.45</td>
<td>0.73</td>
<td>8.68</td>
<td>14.2</td>
<td>5.33</td>
<td>12.61</td>
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<tr>
<td>1986</td>
<td>24.27</td>
<td>2.09</td>
<td>0.44</td>
<td>0.74</td>
<td>8.01</td>
<td>16.5</td>
<td>5.36</td>
<td>10.31</td>
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<td>23.81</td>
<td>2.16</td>
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<td>17.8</td>
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<tr>
<td>1988</td>
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<td>0.77</td>
<td>8.09</td>
<td>19.3</td>
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<td>1989</td>
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<td>2.75</td>
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<td>0.71</td>
<td>8.76</td>
<td>21.2</td>
<td>3.96</td>
<td>9.75</td>
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<tr>
<td>1990</td>
<td>21.11</td>
<td>4.44</td>
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<td>0.71</td>
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<td>23.4</td>
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<td>1991</td>
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<td>24.3</td>
<td>3.43</td>
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<td>25.7</td>
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<td>1993</td>
<td>19.02</td>
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<td>0.83</td>
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<td>28.4</td>
<td>2.85</td>
<td>13.11</td>
<td>4.72</td>
</tr>
</tbody>
</table>

Overview of the Southern California Processing Industry

Los Angeles is the largest market in the state and is a net importer of fluid milk. When the dairies move out of the Chino Valley, fluid plants located in the Los Angeles area will have to increase their purchases of raw milk from outside the area. In 1998, 142 plants handled fluid milk in California; 63 of them were located in Southern California, 16 in the South Valley and 2 in San Diego county. The number of fluid processors in a region depends on the size of the local market (mainly determined by population and income) and not on the local milk supply.

The number of fluid milk processors operating in Southern California decreased dramatically in the last 20 years. In 1970, approximately 322 fluid processing plants reported sales in California; in 1993 there was a total of 58. The decline in the number of processors was caused by new technologies exhibiting substantial economies of size.

The number of firms in each region is clearly not related to the amount of milk produced locally. For example, the proportion of fluid milk plants in Los Angeles and surrounding counties is larger than the share of cows in the region, whereas, the South Valley has a larger proportion of cows than plants. Because of the different location of producers and processors, fluid milk has to be shipped long distances to the plants.

The number of fluid processing plants has declined dramatically since 1983. In the last decade, 25

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\(^1\)No data are directly collected in California on consumption of dairy products. For some products, though, the quantities produced are a good approximation to the quantities consumed in the state. These are products which are not imported or exported in significant amounts and that can only be stored for short periods. In this report, the products with these characteristics considered are: whole and lowfat milk, skim milk, half and half and yogurt.
percent of the plants ended their operations in the southern region while the decrease for all of California was 46.6 percent. Of the nine counties in the region, only Kern, Kings and San Diego counties evidenced a substantial permanent loss of plants. Between 1983 and 1985 the number of plants in the counties of Los Angeles, Orange, San Bernardino and Riverside fell by only 15 percent.

The Milk Market of Southern California

The San Diego market for fluid milk is the most promising market for dairies located in the Imperial Valley. There are two processing plants in San Diego county, both producing fluid milk. One belongs to Lucky Stores Inc. and has a capacity of 100,000 gallons per day; the second, which belongs to Hollandia Dairy Inc., processes 50,000 gallons per day.

If processors were to deal directly with individual dairies, they would have to bargain with each of them, maintain individual accounts and increase the number of people in charge of the negotiations. In order to simplify the bargaining process and reduce costs, both plants buy their milk exclusively from cooperatives.

Lucky Stores purchases its milk from Dairyman's Cooperative Creamery Association (DCCA) and Security Milk. Traditionally, DCCA (in conjunction with California Milk Producers (CMP)) supplied about 75 percent of the input processed; in the last years, however, their share has declined. Due to a lack of local supply, they have been shipping milk from as far as Tulare. DCCA has closed its membership and is not expected to open it in the near future. Consequently, any new processors willing to sell to Lucky Stores in San Diego will have to do it through Security Milk. This cooperative can also provide cheap transportation because it is involved in interstate milk shipments; the shipping cost from the Imperial Valley to San Diego estimated by the cooperative manager is $.75 per mile for a load of 55,000 pounds of milk.

The smaller plant owns several dairies in the area and also buys milk from CMP. The managers of both plants recognize that their local milk suppliers will eventually move further away; they believe, however, that the plants will remain in their current locations. This would open a market niche for a dairy industry in the Imperial Valley. However, in order to sell their milk to these plants, the Imperial Valley processors would probably have to operate through a cooperative.

Apart from San Diego, the closest plants to the Imperial Valley in the U.S. are located in the Chino Valley and Los Angeles county, at an approximate distance of 170 miles. Even though the market there is larger than the one in San Diego, it can be supplied from the South Valley at competitive prices. It is not clear whether the South Valley could eventually increase its production enough to compensate for the closure of the dairies in the Chino Valley.

Migration of dairies now located in the Chino Valley will force neighboring plants to reorganize their supply sources and production strategies. Three of the most important factors determining the optimal location for a milk plant are: 1) type of output produced, 2) distance to milk producers, and 3) distance to the market. For fluid milk plants, it is more efficient to be close to the market; in this way, they reduce hauling costs. Consequently, if fluid plants are to remain in the Los Angeles area, new sources of supply will be needed to replace the dairies that move out of the Chino Valley.

For a cheese plant it is important to be as close as possible to the dairies because the quality of milk for cheese production falls rapidly with the time spent between milking and the beginning of processing. It is also cheaper to move cheese than fluid milk. When dairies move out of the Chino Valley, cheese makers will have to either find alternative sources of supply or move closer to the dairies. If they choose to move, it is more likely that they will move to the South Valley because of the milder climate and cheaper milk. The optimal location to make other products depends on the nature of the manufacturing process.

Per capita consumption of fluid milk in California in 1985 was estimated at 24 gallons (200 pounds) per year (CDFA). Total population in the five counties that comprise Southern California in the same year was estimated at 17.5 million. Regional total consumption of fluid milk was, then, approximately

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2Personal communication from Gerry Gilman, DCCA. He expects their share to decline even further.
3Personal communication from Gerry Gilman, DCCA. He expects their share to decline even further.
4Personal communication from Karen Brooks, manager of Security Milk.
5Personal communications from Don Shaw, Hollandia Dairy Inc. and Bill Williams, Lucky Stores Inc.
6Personal communication from John Siebert, California Gold Dairy Products.
7Personal communication from Moshe Rosenberg, Dept. of Food Science, UC Davis.
3.49 billion pounds of milk.
The Chino Valley and Los Angeles county produced 5.42 billion pounds of milk in 1993. If 3.49 billion pounds were used for fluid milk, 1.93 billion pounds remained for manufactured products. Additionally, it is estimated that 1.26 billion were shipped into the area from the South Valley. Both demands (for fluid milk or manufacture) in the coastal cities are different in nature. The demand for fluid milk will remain in the area after the dairies move; the demand for manufactured milk, however, could decrease as some plants move closer to the milk production areas.

Arizona's Milk Market
Between 1977 and 1993, milk production in Arizona increased by 105 percent (Perez, 1994). In 1993, there were 107 dairy operations with a total of 108,000 cows. They supply the majority of Arizona’s fresh milk and dairy product needs including most of the hard cheese, butter, and some cultured dairy products. Ninety percent of the dairies are located within a radius of 50 miles from Phoenix in the Salt River Valley.

Holsteins make up 91 percent of the state dairy cattle; 8 percent are registered purebreds. There are 51,000 cows enrolled in the official DHIA programs, with an additional 10,000 cows in unofficial test. Arizona DHIA ranks fourth in the nation in production per cow with a rolling 12-month average of 20,177 lb. of milk and 735 lb. of fat for January, 1994. For all cows in Arizona, production per cow averages 18,402 lb. of milk per year.

Ninety-nine percent of Arizona’s dairy producers are members of the United Dairymen of Arizona. This cooperative operates a supply quota program which encourages members to adjust production to market needs. A supply management plant enables the co-op to hold reserve milk to meet day-to-day fluctuations in the processors’ demand. The market is cleared of excess milk by converting it into cheese, butter or milk powder. A new cheese plant was built in 1984, expanded in 1990-91, and will be expanded again in 1995. Cheese whey is processed into milk sugar and sold to companies that manufacture baby food and other specialty foods. A plant manufacturing coffee creamers is located in Arizona and is supplied by the co-op. In the past, there have been temporary deficits in supply which were covered with milk from California and Mexico. 9

All the milk produced in Arizona is regulated by Federal Marketing Order 131. USDA supervised “hearing” or bargaining procedures are arranged between dairymen and milk handlers. The prime objective is to establish minimum classified prices which handlers must pay dairy producers to encourage an adequate supply of milk.

Class I utilization averaged 52 percent in 1993; it is expected to fall to 35 percent in 1995. Because of this use, any additional milk shipped to Phoenix from the Imperial Valley would receive the manufacture price. The average price for Class III milk is 11.40 $/cwt. The Imperial Valley is about 230 miles away from Phoenix; full transportation costs for such a distance should vary between $1 and $1.50 per hundredweight. Consequently, the net price received by producers in the Imperial Valley should be close to $10.4 per hundredweight. 10 Transportation fares, though, depend on a variety of factors such as volume, frequency of shipments and existence of backhauls. It could be possible, in consequence, to find cheaper transportation to Phoenix.

Federal regulations require that farmers sell their milk at one price even if they sell in more than one marketing order. This means that if a dairy producer sells his milk both in Arizona and California, the plant in California would have to pay the Arizona price. 11

Presently there are some milk shipments from California to Arizona and vice versa. The volumes involved are not significant when compared with the total production in each state. These shipments, however, are important for prospective producers in the Imperial Valley because they offer the opportunity of large reductions in the transportation costs by using backhauls.

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8 Most of the data for this section were provided by Dennis Armstrong, Cooperative Extension, University of Arizona
9 Personal communication from the administration of the Federal Milk Marketing Order
10 Personal communication from Robert Gerad, executive director of United Dairymen of Arizona.
11 Personal communication from the administration of the Federal Milk Marketing Order.
The Mexican Market

Mexico offers two potential markets to milk produced in the Imperial Valley: the local market in Mexicali and the national market. Demanding mainly fluid milk, the local (Mexicali) market presents better opportunities for producers in the Imperial Valley than the national (Mexican) market. The potential of these markets depends on the success of the Mexican stabilization plan and stabilization of the exchange rate.

Naturally protected from other producers in the United States by transportation costs, dairy producers in the Imperial Valley have the potential to produce at lower prices than their Mexican competitors. In effect, Mexican dairies in northern Mexico depend on imports from the U.S. for certain inputs (concentrates and replacement cows). They also face much higher capital costs which prevent them from expanding their farms to take full advantage of economies of scale. Long delays at the border, however, substantially increase transportation costs and erode most of the location advantage of the Imperial Valley.

The national market demands processed products (mainly, dry milk and butter) and, so far, has been mainly supplied from federal government stocks. Although it is larger than the market of northern Mexico, it also has more sources of supply. This market could affect the Imperial Valley indirectly through its influence on the U.S. stock of stored dairy products and federal support policies.

Regional Trade Patterns

Given the available information, it is not possible to estimate the net effect of NAFTA on regional trade patterns. Before NAFTA, U.S. exports of fluid milk paid a tariff of 10 percent, which is being phased out over 10 years. The lower duty on fluid milk, however, will be partially compensated by cheaper imported feed. In other words, production costs for Mexican dairies should fall with the price of imported inputs. At this stage, it is not possible to determine whether production costs will fall more than the price of imported milk.

In the next few years, however, the impact of NAFTA should be small compared with the consequences of macroeconomic and exchange rate instability, higher interest rates and economic risk. In less than two months, the Mexican currency lost about 50 percent of its value in U.S. dollars. Due to the economic crisis affecting Mexico, interest rates recently reached levels of up to 40 percent annually. The increased instability makes investing in physical assets more risky and depresses investment. Under these conditions, dairymen find it harder to adopt improved technologies that reduce production costs.

The 1 percent annual reduction in tariffs is relatively small compared with jumps of 50 percent in macroeconomic variables in just two months. The effective exchange rate\(^\text{12}\) between the U.S. dollar and the Mexican peso is of great importance in determining the price that Mexican plants can pay for imported milk. If the Mexican peso increases in value (as before the devaluation), all prices in Mexico increase when measured in U.S. dollars. Mexican incomes and the price of local milk rise in dollars, or conversely, the price of American milk becomes relatively cheaper in Mexican pesos. In this case, American dairymen can negotiate higher prices with the plants in Mexico.

Conversely, when the Mexican peso falls in value with respect to the dollar, American milk becomes more expensive in pesos. The Mexican plants will try to reduce the cost of imported milk by paying a lower price. The lowest price that American dairymen will accept is the payment they can obtain in the U.S. net of transportation cost from their dairy to the plant. This value depends on the quantity of quota owned; if the dairy producer owns no quota, the relevant price is the overbase price.

In the long run, the most likely outcome of the crisis will be a smaller volume of U.S. exports to Mexico compared with the pre-devaluation situation. To tackle the crisis in the currency markets, the Mexican government will have to reduce its spending and induce a recession. The magnitude of the slowdown will depend on the success of the adjustment package. If the adjustment package fails, the increased instability will trigger higher inflation and newer devaluations; the prospect in this case is even lower imports. If it succeeds, investment and growth in Mexico will resume. However, because imports will remain relatively expensive, U.S. exports of all goods will increase at a lower rate than in the absence of the devaluation. The final outcome will depend on the final loss of value of the peso.

\(^{12}\) The effective exchange rate for a particular product is defined as the nominal exchange rate net of tariffs and subsidies.
The Local Market in Mexicali

Presently there are three fluid milk plants in Mexicali, supplied by approximately 9,000 cows on the Mexican side of the border. The biggest dairies have about 700 cows in production; most, however, milk about 200 cows. Taking advantage of lower prices during the winter months, some dairy producers buy improved animals from Minnesota and Wisconsin. These farmers have invested in milking equipment and depend heavily on purchased feed. Some input prices are higher than in the U.S., particularly interest rates and the price of concentrates.

The largest and more advanced processing plant has a capacity of 30,000 gallons a day of fluid milk. This plant supplies milk mainly to the local market and occasionally to other states in Mexico. Before the devaluation in January, 1995, it bought milk from Mexicali, the Imperial Valley, and the Chino Valley. After the devaluation, competition from packaged fluid milk imported from the U.S. fell and the demand for local milk surged. As nearby producers could not expand their output in the short run, the plant increased its purchases of American milk. In January, 1995, the plant was importing approximately 40 percent of its raw milk consumption. The continued instability of the exchange rate outpaced the price of American milk in the Mexican market. By March, 1995, exports of fluid milk to Mexicali were completely ended.

Prior to the devaluation in January, 1995, the owner of this plant expected a 5 percent annual increase in the demand for his milk; he also expected a slow relocation of the dairy herds from Tijuana to Mexicali and an expansion of his sales into the Tijuana market. The plant management is planning to increase its processing capacity by 50 percent in the next year; they are also trying to set up a program to help their Mexican suppliers to upgrade their dairies. However, due to higher capital costs and the increased instability of the Mexican economy, it is unlikely that they will be able to reduce their costs to the American levels in the short term.

The smaller plants process local milk and also buy milk in Tijuana and the U.S.

Apparently, there are substantial institutional and market barriers that prevent American fluid milk from entering the market in Tijuana. The future of these barriers will depend on the bargaining strength of local dairy producers and their ability to reduce efficiency differences with respect to dairies in Southern California.

In the short run, the only Mexican outlet for fluid milk produced in the Imperial Valley will be Mexicali. Because of their proximity to the border and relatively low production costs, producers in the Imperial Valley could enjoy a comparative advantage over their Mexican competitors and dairymen from other regions in the U.S. Crossing the border, though, is a major administrative hurdle that can erode the cost advantage of dairying in the Imperial Valley.

Crossing of the border increases substantially the cost of shipping milk to Mexicali. Passing the customs inspection can take several hours, making a 20 mile trip as long as a journey to the Chino Valley. Drivers’ wages being an important part of hauling costs, long delays increase the latter even if the truck is not moving. In spite of the very short distance separating Holtville from Mexicali, the cost of moving the milk is relatively high. A Mexican truck company estimated that, when its own tanks are used, the price would be as high as $0.31/cwt. The cost falls 40 percent if the dairy producer owns the tank.

The closeness of Holtville to the border gives it a location advantage over other regions in the U.S.; the Mexicali market however, loses its economic advantage over San Diego for dairies in the Imperial Valley because of delays in crossing the border.

The National Market in Mexico

U.S. dairy exports have been a small percentage (2-5 percent) of total domestic supply. However, they are a much larger proportion of the excess supply (i.e., supply minus commercial demand). Cox (1994) estimated that exports represent 34, 121 and 116 percent of fat, protein and lactose excess supply respectively. While NAFTA could have an important impact in U.S.-Mexico dairy trade and a large impact on the aggregate U.S. supply-demand balance in milk components, it will likely have only

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13 Personal communication from Francisco Fuentes Teran, Lecheria Imperial, Mexicali.
14 Personal communication from Karen Brooks, Security Milk.
15 Personal communication from Jose Garcia Guerero, veterinary doctor in Mexicali.
16 Personal communication from procurement department, Lecheria Imperial, Mexicali.
a small influence on the U.S. dairy sector.

Imports of dairy products from Mexico have been negligible for several reasons, among which are: a) a substantial Mexican deficit in milk production, b) before the devaluation, Mexican milk was more expensive than U.S. milk, and, c) sanitary conditions in Mexico do not comply with U.S. regulations. It is unlikely that the situation will be reversed in the near future.

As U.S. wholesale dairy prices have generally been above world market prices due to the support policies, most of these exports required subsidies of some sort. Nonfat dry milk and butter have traditionally dominated U.S. dairy exports (on a milk equivalent basis); these two products also account for approximately 80 percent of total Mexican imports (Cox, 1994). In regard to U.S. dairy exports to Mexico, fluid milk ranks third.

Table 2-2 summarizes total U.S. exports of eight dairy products and the average Mexican share in their total exports in the period 1990-93.

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<tr>
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<td>28</td>
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<td>3</td>
<td>4</td>
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a 000's of liters
b 000's of metric tons
APPENDIX 3
Milk Prices In California

The dairy industry in California is regulated by a set of rules determined at both the federal and state levels. As some of the regulations affect milk prices, they are a major factor affecting the economic viability of a dairy industry in the Imperial Valley. This section briefly analyzes those regulations that affect the prices received by dairies in different parts of California. A much more detailed explanation of the California pricing system is presented in Butler (1992).

The most important objective of price regulations is to ensure a steady supply of milk to the market. Milk marketing orders and federal price supports are the main instruments used to set minimum prices for the raw milk that processors must pay producers.

The federal price support program sets a floor to fluctuating prices so that supply in excess of demand will clear the market at the set level. The operator of the program is the Commodity Credit Corporation (CCC) which purchases nonfat dry milk, butter and cheese on behalf of the government.

Milk marketing orders were established to ensure that local markets had an adequate supply of high quality Grade A milk for fluid use. In addition, they were designed to increase dairy farmers' incomes, to stabilize fluid milk markets, and to maintain reasonable prices for consumers.

Milk marketing orders have two major characteristics: classified pricing according to use, and pooling of all revenue from the sale of milk in the area covered by the order. Both of these features are different in California than in the federal milk marketing orders. California operates three separate marketing orders (Northern California, South Valley and Southern California) with only slight differences among them.

Classified Pricing
Classified pricing establishes classes of Grade A milk based on its actual use. In California, five classes are established. Class 1 includes fluid products, yogurt (in-state), sterilized or UHT milks (in-state), and lactose-reduced milks. Class 2 includes fluid creams, sour cream, cottage cheese, buttermilk, sterilized creams, yogurt (out-of-state), and UHT milk (out-of-state). Class 3 includes all frozen products such as ice cream and frozen yogurt. Class 4a includes butter and dried milk, while class 4b includes cheese other than cottage cheese.

In California, minimums for Class 4a and 4b prices are established by formulas based on the national markets for each product (butter, powder or cheese). Minimum Class 2 and Class 3 prices are established by differentials which are added to Class 4 prices. Minimum Class 1 prices are established by a formula that reflects the supply and demand conditions for fluid milk based on dairy commodity prices on national markets.

Pooling
In California, market milk producers receive a blend price based on market wide utilization of milk by class. The main characteristic of California's program is the existence of a closed quota system. The blend price a producer receives depends on how much quota he holds and how much milk he sells relative to the quota holding.

Quota may be freely traded among producers. A fairly active market for quota exists and the Milk Pooling Branch monitors all transactions. Producers who do not own quota receive the overbase price. Butler (1992) estimated that about 14 percent of all market milk producers, representing about 8 percent of all market milk produced, have no quota.

Milk prices change seasonally and also between years. Seasonal changes can be predicted with some certainty and, consequently, do not pose a significant economic risk to dairies. Since producers can balance their income throughout the year, the relevant value to determine the profitability and riskiness of dairying is the annual average price.

Class 4 prices for the years 1990-94 in California averaged $10.72 per cwt. The standard deviation was $.26, about 2.4 percent of the average. The annual price variability is relatively small; assuming that prices are distributed as a normal variable, the probability that prices will fall more than 52 cents (about 5 percent) over a year is less than 4 percent.

Seasonal patterns in milk prices were analyzed by calculating monthly averages for Class 1 and
Class 4 milk and obtaining the difference of these with respect to the annual average. In the last 15 years, Class 4 prices presented a clear seasonal pattern while Class 1 prices were remarkably stable. Class 4 prices reach a minimum in July and August and peak in January and April. The difference between maximum and minimum prices is approximately 5 percent. The annual variation of Class 1 prices was slightly over 1 percent.
APPENDIX 4
Environmental Concerns and Regulations

The South Valley has been the preferred area of relocation for dairies leaving the Chino Valley. However, environmental concerns, scarcity of large parcels of land in the San Joaquin Valley and its increasing price cast doubt on the expansion potential of the local dairy industry. Because of its abundant land and feed, the Imperial Valley is viewed by some as a possible alternative site.

Establishment of a dairy industry in the Imperial Valley raises two types of environmental concerns: a) whether it is possible to produce milk during the hot summer months and b) the economic impact on dairies of investments and management practices required to comply with regulations protecting the environment. This section discusses briefly both concerns.

Heat Stress

"Heat stress occurs when any combination of environmental conditions cause the effective temperature of the environment to be higher than the animal's thermoneutral (comfort) zone" (Armstrong, 1994a). Four environmental variables influence effective temperature: a) air temperature, b) relative humidity, c) air movement and d) solar radiation. The cow’s responses to heat stress are: a) reduced feed or dry matter intake; b) elevate respiration rate; c) increased water intake; d) reduced gut motility, rumination and rate of passage, and e) increased body temperature.

Heat stress can affect negatively the economic results of dairies; without some form of cooling, losses of 30 percent in milk and 50 percent in reproductive efficiency are common. Eliminating the negative effects of heat stress requires adequate nutritional management of the herd and physical modification of the environment. The two most important environmental modifications are shades and cooling (Armstrong, 1994a and 1994b). In the last five years newly designed facilities have been used with excellent results in hot climates. When evaporative coolers were used over the cow resting areas in combination with spray lines over the feed area on days with temperature exceeding 110°F, the inside temperature was below 85°F. This design allowed achievement of a herd average exceeding 27,000 lb. of milk sold per cow per year with breeding efficiency of 35-40 percent (Armstrong, 1994a).

Environmental Regulations

In spite of the small dairy cow population in the Imperial Valley, dairies there are also subject to stringent environmental regulations. Minimum compliance standards are determined at the state and federal levels; in addition, each region sets its own standards which have to be at least as strict as those determined by state and federal officials.

Dairies willing to operate in the Imperial Valley must obtain a number of permits which include: building, conditional use, pesticide (annual), tank monitoring, weights and measures, zone change, authority to construct, two permits to operate1 (initial), permit to operate (annual), dairy inspections, monitoring wells and surface water permit.

The process of obtaining the required permits is quite long and can take a substantial amount of time and effort. In the South Valley the whole process takes about six months; it is not known how long it takes in the Imperial Valley. Only one dairy was opened there recently and the owner worked for about two years to obtain the required permits. County authorities say they have substantially simplified the process but their claim has not yet been tested.

Issuing of an authority to construct permit takes about 40 days. "The application must include a written plan designed to effectively control dust. This plan should include dust control measures for pen maintenance, alley ways, haul roads, and the entrance to the facility. The application should also include a list of any devices (grinders, feed mills, emergency generator, air pollution control equipment, etc.) used in the operation of the facility that emits or controls air pollutants".2 Dust control in the Valley may be a major issue because dairying involves a large number of animals walking the premises at least twice a day.

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1Out for dairy and one for milk, the emphasis on dust control.
2Memo from Gaspar Torres, Deputy Air Pollution Control Officer.
Dairies are allowed in A-3 zones (heavy agriculture) without additional land use permits; they can also be located in A-2-R zones (general agriculture - rural) subject to some specific limitations. In 1991, 143,000 acres of A-3 land had already been zoned for dairies.

Water quality regulations have a major impact on investment and dairy management. The Regional Water Quality Control Board (RWQCB) regulating farming in Imperial County is currently reviewing those regulations. Until they are formally approved, the rules affecting new dairies cannot be evaluated. Consequently, this section will discuss only those regulations in each region that will remain unchanged and affect the operation of dairy farms.

The first rules affecting discharges from dairy farms were enacted in 1970. As public concern about the environment increased, regulations impacting farm operations became more stringent. It is likely that this trend in strengthening waste management controls will continue in the future. Complying with stricter environmental regulations may increase dairy production costs and erode the advantage that California dairy producers enjoy over their counterparts in other parts of the country.

Today, “while enforcement varies by region, regulations require that all waste either be conveyed off the site or be conveyed in the site in a manner that will not allow nutrients, minerals, or other substances to migrate to groundwater. All manured areas, walkways, alleys, milk barns, feeding areas, and corrals are to be designed and managed to convey all waste material to a holding area” (Butler and Bennett, 1994)

Both in the South Valley and the Imperial Valley, dairy producers are not required to own sufficient acreage to handle waste entirely on the dairy property. The only requirement is that they present a plan to handle waste in an appropriate way. In particular, the plan can contemplate a variety of options such as buying or leasing the land required to dispose of waste, agreement with another farmer to receive the waste or hauling it off the dairy.

In both locations there are active markets for manure. In the South Valley manure is used by the composting industry, directly by farmers, or by the dairy to fertilize feed crops. In the Imperial Valley, in addition to these uses manure can also be sold to the Mesquite Lake Resource Recovery plant near El Centro where it is burned to produce electricity. This plant burns 900 tons of manure with 40 percent water content every day; it is estimated that it can handle the manure of 250,000 cows.3

Fertilization with manure is not a widespread practice in the Imperial Valley because of salinity problems. When manure is used as fertilizer, additional irrigation is required to leach the soil. Manure, however, has the advantage of adding organic matter to the soil. Considering its limited present use, there appears to be a high potential for additional manure usage in the Imperial Valley.

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3Personal communication from Michael O’Leary, Mesquite Lake Resource Recovery plant.