Maintaining the Competitive Edge in California's Dairy Industry

Part II - Challenges and Opportunities

Sponsored by the University of California Agricultural Issues Center
Maintaining the Competitive Edge in California’s Dairy Industry

Part II — Challenges and Opportunities

L.J. (Bees) Butler
Department of Agricultural Economics
University of California, Davis

University of California
Agricultural Issues Center

1994
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PREFACE

This is Part II of a two-part report on California’s dairy industry. It is one of the Agricultural Issues Center’s continuing “Competitive Edge” series, examining the status and outlook for strategic agricultural industries in California.

Part I of this report, *Maintaining the Competitive Edge in California’s Dairy Industry—Organization and Structure*, was published in 1992. It provides a brief history of dairying in California, an overview of the industry and a detailed description of its complex regulatory structure, including Federal price supports, milk marketing orders, California’s milk pooling system, and the role of the Department of Food and Agriculture.

The author of this volume is L.J. (Bees) Butler, Cooperative Extension specialist in the Agricultural Economics Department at UC, Davis, who also was the author of Part I.

Butler was assisted by a study group sponsored by the Agricultural Issues Center. We appreciate the encouragement and comments of that group, whose members were:

Craig Alexander, Dairy Institute of California  
John C. Bruhn, Food Science and Technology, UC Davis  
Richard Cotta, San Joaquin Valley Dairymen, Inc.  
Ed DePeters, Animal Science Department, UC Davis  
David Ikari, Milk Stabilization Branch, CDFA  
Bennie Osburn, Veterinary Medicine, UC Davis  
Tom Shultz, UC dairy farm Advisor, Tulare County

Finally, this report would not have been possible without the editorial contributions of Carole Nuckton and Ray Coppock.

Harold O. Carter  
Director  
UC Agricultural Issues Center
This is one of a series of reports on the outlook for selected California agricultural industries.

Because of its resource advantages and efficient methods, the California dairy industry is in a good position to maintain its current economic advantage in milk production. However, a number of issues need to be dealt with—environmental regulations, more diverse consumers (this could be an opportunity), a mismatch between butterfat production and consumer preferences, relatively high processing costs, a shortage of processing capacity, and others. These issues are interconnected.

In 1994, California milk production has more than doubled since 1970, resulting from a 53 percent increase in the number of cows and a 54 percent increase in production per cow. The average California dairy herd has 480 cows, compared to the national average of 60. Average annual production per cow is about 20,000 pounds of milk; the national average is 15,500.

Processing capacity has increased to handle the greater milk production.

Highlights:

- Technology will be a powerful force in future dairy production, enabling dairymen to maintain or increase production in the face of regulatory and other constraints. Important advances are expected in biotechnology, information systems and robotics.

- A particular issue involving biotechnology is the recent approval of genetically engineered and commercially produced recombinant bovine somatotropin (rBST), which can increase feed efficiency by 5 to 15 percent and milk production by 10 to 15 percent. The controversy surrounding this development involves economic impacts on the industry structure, and consumer acceptance.

- In California, consumers are increasingly diverse in ethnic background, age and family structure. Marketing efforts designed for particular consumer groups are called for. The state's large Hispanic population, relatively heavy milk-drinkers, offers an
opportunity.

- Increased butterfat production along with less fat consumption by many consumers is a significant problem. However, high fat content is associated with quality in the minds of other consumers. Also, cheese consumption is up. Options for dealing with the problem of excess butterfat production are (1) to attempt to reduce average butterfat production per cow without reducing total production, an unlikely prospect, or (2) to develop new industrial uses for butterfat, or (3) a combination of both approaches.

- Processors have a role in marketing dairy products to diverse consumer groups, but developing new products is expensive and risky. Also, there is at least a temporary shortage of processing capacity in the state.

- California has high standards in milk production, but the possibility of microbial contamination and residues of antibiotics and pesticides must be continually dealt with.

- Dairy waste management, particularly as it affects water quality, is a significant problem. Regulatory restraints are likely to increase. Commercialization of manure processing and use is one promising option.

- In on-farm practice and in public activities, dairymen should be aware of the animal welfare issue.

- Federal government price-support programs are likely to be phased out during the next few years. However, California’s unique milk marketing order and stabilization plans provide flexibility for adjusting to these potential changes. California has significantly higher standards for fat and solids content in processed milk than the rest of the nation.

- There are opportunities to increase California’s international trade in dairy products, with Mexico in the short run and with Canada and the Pacific Rim in the longer run.

The report proposes a number of strategies for the California dairy industry, dealing with adoption of technology, marketing, waste management, the role of government and international trade.
INTRODUCTION

Milk production in California is among the most efficient anywhere. As a result, the state's consumers enjoy high quality dairy products at prices among the lowest in the nation. Because of California's favorable climate, cows need less shelter than in most other states; therefore, to expand production, farmers can simply add more cows with little capital cost. Another advantage we have over other production areas is an abundance of good quality alfalfa hay. Also, cost-effective by-products, such as cottonseed, sugar beet pulp, citrus pulp, and almond hulls, are available for feed. For all these reasons and others, the California dairy industry is well situated to maintain its economic advantage in milk production.

Another encouraging trend is remarkable growth in California's dairy production and sales. Between 1982 and 1992, cheese production went up by 222 percent. Butter increased by 62 percent. Yogurt sales in California were up 41 percent. In the late 1980s, entry of U.S. nonfat dry milk into international markets quadrupled California's sales of that product.

To maintain its competitive edge, however, the California dairy industry must deal with a number of problems. Although total dairy product sales are up in the state, higher-return Class I (fluid milk) has become a lower proportion of the total. There is a mismatch between milkfat production and consumer demand for lower fat products. Price supports were reduced during the 1980s while feed costs as a percentage of total milk production costs have been rising. Relatively higher wages and capital costs mean that California's processing costs exceed those in most of the rest of the country. Meanwhile, several features of the 1990 Farm Bill apparently have an anti-California bent. Also, new production and processing technologies could affect California's comparative advantage, depending on relative adoption rates among states.

To keep on top, California's dairy processors must target specific demographic groups in particular locales with appropriate
products. However, these targets are moving; the industry needs to keep abreast of consumer dynamics in order to take better aim.

As the state becomes more crowded, urban-farming conflicts, including the tug-of-war over water and land as well as environmental concerns, can be expected to intensify. Even today, stricter enforcement of environmental regulations is increasing costs of production and processing, and threatening California’s competitive advantage compared to other U.S. regions. Also, changes in government policy—new laws and regulations—are increasingly made in a global context.

*An interconnected system*

The issues facing the dairy industry today are inextricably intertwined. The use of commercially produced bovine somatotropin is one such multifaceted issue, raising questions about industry structure and price, government policy, consumer demand, food safety, animal welfare, and trade.

The California dairy industry can be thought of as an interconnected system composed of three components—an input sector (feed, labor, etc.), a farm-level production sector, and a processing-marketing-distribution sector. The industry’s ability to meet society’s goals—nutritious, healthful, high-quality products at reasonable prices and produced without negative environmental impacts—depends on effective coordination within this system.

Many of the trends that have created changes in the dairy system will continue and so can be predicted with a fair amount of accuracy. For example, population growth and demographic changes can be projected and industry responses can be carefully planned. Even technology, a potent force for change, is subject to physical limitations that allow for reasonably accurate predictions over a 10 to 20 year range. On the other hand, forces such as weather, pests, disease, war, government policy and inflation can bring about dramatic and often unexpected changes.

Thus, in this report considering future competitiveness of the California dairy industry, we are able to predict reasonably accurate scenarios based on historic trends and known patterns. In time, however, unforeseen forces, generally external to the industry, will cause any prediction to miss the mark to some degree. In this report, we discuss several issue areas, keeping in mind the difficulty of discussing any one in isolation from the others.
PRODUCTIVITY AND TECHNOLOGY

Since 1970, California's commercial milk production has more than doubled. The number of cows has increased 56 percent and production per cow, 57 percent. Meanwhile 2,000 farms have gone out of the dairy business (Table 1). Obviously, the remaining farms have, on average, increased their herd size and, with increasingly productive cows, have brought about a significant increase in production.

The average California herd size per dairy is now 480 cows, although the mode is closer to 750. The national average is about 60. Average production per cow is about 20,000 pounds, compared

<table>
<thead>
<tr>
<th>Year</th>
<th>Milk Production million pounds</th>
<th>Milk Cows 1000 head</th>
<th>Production/Cow pounds</th>
<th>Dairies number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>5,991 (34%)</td>
<td>777</td>
<td>7,710</td>
<td>19,428 (78%)</td>
</tr>
<tr>
<td>1960</td>
<td>8,075 (20%)</td>
<td>824</td>
<td>9,800</td>
<td>9,764 (59%)</td>
</tr>
<tr>
<td>1970</td>
<td>9,350 (9%)</td>
<td>755</td>
<td>12,384</td>
<td>4,473 (39%)</td>
</tr>
<tr>
<td>1975</td>
<td>10,853 (6%)</td>
<td>800</td>
<td>13,556</td>
<td>3,423 (30%)</td>
</tr>
<tr>
<td>1980</td>
<td>13,577 (4%)</td>
<td>896</td>
<td>15,153</td>
<td>2,873 (16%)</td>
</tr>
<tr>
<td>1985</td>
<td>16,762 (3.6%)</td>
<td>1,041</td>
<td>16,102</td>
<td>2,765 (14%)</td>
</tr>
<tr>
<td>1990</td>
<td>20,953 (2%)</td>
<td>1,135</td>
<td>18,461</td>
<td>2,402 (10%)</td>
</tr>
<tr>
<td>1993</td>
<td>22,921 (2%)</td>
<td>1,180</td>
<td>19,425</td>
<td>2,442 (8%)</td>
</tr>
</tbody>
</table>

* Numbers in parentheses indicate percentage of Grade B milk produced and percentage of Grade B dairies.

Source: California Dairy Information Bulletin, December Issues; California Dairy Industry Statistics, annual issues. Farm numbers are from California Department of Food and Agriculture, Milk and Dairy Foods Control.
to the national average of about 15,500 pounds. Only Washington’s and New Mexico’s cows have comparable averages.

Obviously, as California’s milk production has increased, so has processing capacity. However, the number of processing plants in California has decreased dramatically over the last two decades. In 1970, there were 322 fluid milk processing plants in the state. By 1980 the number had fallen to 94, and by 1992 to just 51.

Meanwhile, dairy product manufacturing capacity also has increased, as have the numbers of these plants, shown in Table 2.

### Table 2. Numbers of Dairy Product Manufacturing Plants in California

<table>
<thead>
<tr>
<th>Category</th>
<th>1985</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter/powder plants</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>Frozen product plants</td>
<td>26</td>
<td>65</td>
</tr>
<tr>
<td>Cheese plants</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>Cultured product and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>specialty plants</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

Source: Boynton, 1992

As these trends indicate, on the dairy farm and in the processing plant, economies of size have played an important role in the growth of the California dairy industry. One of the major driving forces enabling the capture of economies of size is technology. Three types of technological innovation could well accelerate productivity even more in the future: (1) biotechnology and genetic engineering, (2) computer information systems, and (3) automation and robotics.

**Biotechnology**

A wide range of biotechnological methods and products are currently being considered for development. Advancements in the field of animal reproduction, for example, are making it possible to improve herd quality more rapidly than with conventional methods. Traditional animal selection procedures are being superseded by the recent development of animal genetic mapping, which allows a producer to control the lineage of a dairy herd more precisely. Screening of semen, embryos and newborn animals can detect the presence or absence of a variety of inheritable traits such as growth rates, feed efficiencies, disease resistance and other
desirable (or undesirable) genetic conditions.

Researchers have increased their understanding of how eggs develop in the ovary, how to stimulate the release of numerous eggs at once, and how to achieve fertilization and development of eggs outside the cow. Embryos can be frozen for later use. Both embryos and sperm can be sexed. Multiple copies of an embryo can be created, each of which can be transplanted into a recipient cow. Although the technology is still in a formative stage, it is now even possible to create transgenic animals.

New biotechnology products are being developed to improve animal health, including vaccines and diagnostic kits, as well as compounds known as immunomodulators that enhance an animal’s ability to fight disease. Interleukins and interferons are immunomodulators currently used in human medicine.

Many new biotechnology products useful for the food processing industry are under development. During the next decade in cheese manufacturing, according to the U.S. Congress Office of Technology Assessment (OTA), a recently approved genetically engineered version of the enzyme rennet will replace the preparation normally extracted from the forestomachs of calves. Other enzymes, used to accelerate ripening or to make dairy products digestible by lactose-intolerant individuals, also will be produced more economically by engineered microorganisms.

Genetically engineered starter cultures will make the production of high-value dairy foods much more precise and economically feasible. Cloned genes responsible for ripening of aged cheeses will reduce storage costs by decreasing ripening time. Production of natural preservatives will ensure safety and extend the shelf life of fermented dairy products. Enzymes to reduce cholesterol or modify the degree of saturation of milkfat will improve the nutritional quality of dairy products. Genetically engineered products will facilitate turning whey, some of which is now wasted, into value-added products.

The rBST controversy

A significant current development in biotechnology is the marketing of bovine somatotropin (BST), a naturally-occurring hormone in cows. When BST is extracted from the pituitary gland of one cow and injected into another, it increases milk production. The function of BST in milk production has been known since the 1930s, but its commercial use has not been feasible due to the expense of extracting it.

However, DNA technology has allowed the commercial
production of recombinant bovine somatotropin, or rBST. Injecting rBST into cows increases feeding efficiency by 5 to 15 percent and milk production by 10 to 15 percent.

Commercial use of rBST was approved by the Federal Drug Administration (FDA) in November, 1993, after 10 years of controversy over its potential effects on the health of cows and quality of the resulting milk, and over socio-economic impacts on the dairy industry. Trials have demonstrated that rBST requires substantially increased nutritional management of cows, and may result in reduced pregnancy rates, increased risk of clinical and sub-clinical mastitis, and negative effects on general health. At the same time, the FDA has determined that the use of rBST on commercial cow herds is safe, both for the cow and the consumer. No available test is capable of distinguishing between rBST and the natural bovine somatotropin already in milk.

Nevertheless, the controversy continues. At issue for the dairy industry are (1) the aggregate effects of increased milk production and (2) the potential for reduced demand for milk.

Increases in aggregate milk production as small as two percent can have large impacts on the prices paid for milk and dairy commodities. Price supports keep prices from falling below the current $10.10 per hundredweight of milk. However, increases in Commodity Credit Corporation (CCC) purchases of butter, nonfat dry milk and cheese beyond 7 billion pounds milk equivalent (on a total solids basis) will result in an assessment on all dairy producers—whether they use rBST or not—designed to cover the additional government costs of purchase. (The dairy price support program is explained in Part I of this report.)

If aggregate milk production increases significantly due to the widespread adoption of rBST, it is likely that milk prices will eventually adjust to a point where producers are no better off financially than they were prior to the new technology. This process, the “treadmill effect,” is a notable characteristic of agricultural technology. Thus, for the dairy industry, the development of rBST may simply accelerate the trend toward fewer and larger dairy farms.

Information systems

More dairy farmers are using computers and software to do their own accounting, to fine-tune their management systems, and to determine optimal feeding strategies and least-cost feeding programs. According to a 1992 survey conducted by the author, about 50 percent of California dairy producers use computers. The
Dairy Herd Improvement Association has a computer program that allows producers to analyze their own records and compare them with average performance figures in their region. Recent advances in hardware and software have made possible the development of expert systems, knowledge-based systems, and decision-support systems on microcomputers and desktop personal computers.

Meanwhile, other new information technologies are revolutionizing dairy record-keeping. With new automatic metering devices, milk weights can be recorded every day instead of relying on once-a-month recording. These data can be tied to other information, such as measures of milk conductivity and temperature, to monitor individual cows for estrus. This, in turn, will increase reproductive efficiency while reducing labor requirements.

As the cost of computers continues to decline, as more dairy-specific software becomes available, and as more producers realize the power and usefulness of computer-aided management, computer use by dairy operators will become even more widespread.

Automation/robotics

Some dairy producers are already using automatic devices, described above, that measure the milk output of each cow at each milking and record it by computer. Some are also trying an automatic feeder that delivers a measured amount of supplements to each stall. Sophisticated versions of this technology identify each cow and deliver an individual feed ration, tailored to her stage of lactation, age, etc.

However, on-farm robotics is only in its testing stage. For example, while most dairymen milk twice a day and some three times, there is evidence that if cows were milked more often, their production could increase by 15 to 20 percent. With robotic systems, cows would be milked on demand by walking up to a machine where cups would be automatically placed, operated, and removed. Automatically-delivered supplemental feed would encourage the cows to use the apparatus. Of course, all feed intake and milk output would be recorded by computer.

So far, the required engineering is complex and expensive. However, robotics could well become standard operating procedure on California dairies within the next 15 to 20 years.

At the processing level, automation is even further along. Fluid milk plants are already highly automated, and some
cheese plants use only a few workers to turn out as much as one million pounds of cheese a day. Robotics also fits well into other processing functions, such as butter churning and nonfat dry milk manufacture.

**Sustainable agriculture**

At the other end of the technology spectrum is an increasing interest in low-input, or sustainable, agriculture. This philosophy advocates a broader-based systems approach to agriculture, focused on long-term perspectives concerned with stewardship of both natural and human resources.

Many current dairying practices can be considered sustainable. For example, the increasingly stringent food safety and environmental standards currently being met by dairy producers and processors could be described as sustainable.

On the other hand, the sustainable agricultural movement would, at times, appear to be at odds with today's dairy industry. Advocates of rotational grazing, for example, argue that confinement feeding is a source of surface and groundwater pollutants. While this may be true where adequate waste management facilities are lacking, properly managed waste systems are a potential source of recyclable nutrients and energy production—and are consistent with the principles of sustainable agriculture.

Some aspects of sustainable agriculture could be considered by the dairy industry in a more positive light. For example, some California dairy producers are becoming increasingly interested in producing organic milk. The University of California Sustainable Agriculture Research and Education Program (SAREP) in cooperation with the California Certification for Organic Farming (CCOF) program could help in defining standards and assisting the industry in moving in this direction. SAREP also might be useful in increasing research on technologies to help address environmental problems confronting dairy producers and processors.

The whole-farm planning approach, while certainly not new, is finding renewed support. Also, because the negative environmental impacts of most agricultural and industrial practices are confined to the associated watershed, the concept of managing resources within the watershed as the jurisdictional authority is becoming more widely accepted.

**Role of public-sector research and extension**

Science and technology, the engines of economic growth,
also provide the means to protect the environment—but all technologies have costs. Scientific development, as with rBST, must involve social, economic, and even ethical dimensions. Scientists need to meet with farmers, consumers and representatives of the general public. Without societal consensus for significant future developments, the California dairy industry could endanger its competitive edge.

In biotechnology and robotics as well as more conventional developments such as feed efficiency and dairy drainage systems, the role of publically-funded research and extension has been crucial to the California dairy industry. To a large extent, the state’s higher rates of increased dairy productivity result from educational programs by U.C. and other institutions (Cal Poly, San Luis Obispo; California State University-Fresno).

U.C.’s contributions have been made by many departments in the Division of Agriculture and Natural Resources—Animal Science, Agricultural Engineering, Agronomy and Range Science, Food Science and Technology, Agricultural Economics, the School of Veterinary Medicine, and others.

Unfortunately, both funding and scientist-years of effort for U.C. dairy research and extension have remained static or declined in recent years, with a significant downturn in the mid-1980s. Combined state and federal funding through the California Agricultural Experiment Station was less in 1989-91 than in 1968-70. Scientist-years in the two periods were approximately equal.
CONSUMER-DRIVEN MARKETS

California’s population, currently almost 30 million, is expected to climb to 38 million by the year 2000 and to 45 million by 2010 (Bouvier, 1991). To meet the demands of this increasing population, milk production will have to expand from 21.5 billion pounds in the early 1990s to about 29 billion pounds in the year 2000, and to about 36 billion pounds in 2010.

Much of the state’s current growth is from immigration, particularly from Mexico and Southeast Asia. As a result, California’s population diversity is increasing even faster than its growth. By the year 2005, the Hispanic population is expected to increase from its present 25 percent to almost 32 percent of the total, while Asians will increase from just under 10 percent to 12.3 percent (Kiplinger, 1991). California’s Anglo-white population will drop to less than half, while African-Americans will continue to represent about 7.5 percent. Sometime in the decade between 2020 and 2030, Hispanics are predicted to become the majority (Quinn, 1989).

The state’s newer residents come with different cultures and values, and have divergent food consumption patterns. Thus, the dairy industry needs to “unbundle” its products to better respond to differing segments of the total market. For example, Hispanics drink more milk than anglos and prefer whole milk, a counter-trend to the growing low-fat and nonfat preferences of many of the state’s current consumers. Hispanics represent an ideal market for extra-rich milk.

The increasing proportion of Asians also has important implications for dairy marketers. For example, the trend to Mexican food and pizza, with its heavy use of cheese, may have peaked and the newer ethnic cuisines such as Thai use no cheese. Other demographic trends and lifestyle changes also have important implications. While new immigrant groups are on average younger and tend to have larger families, the rest of California is aging and lives in smaller households. In these respects, California is following
national trends. Aging brings an increased interest in the relationship between diet and health, while smaller households have special food form and packaging needs.

Increasing numbers of California women will continue to enter the labor force. The result is a trend to convenience in retail products, such as microwavable; to away-from-home eating; and to take-out, including the increasingly important deli sections with their use of cheese.

The state’s changing income distribution patterns also require appropriate marketing responses. The food demands of new immigrant groups and the increasing numbers of unemployed workers and their families differ sharply from the demand of the more affluent for high-value, high-quality products.

The institutional food market also commands attention by food marketers because of increasing numbers of Californians being served in facilities ranging from nursing homes and prisons to schools and day care facilities.

The Butterfat Conundrum

Consumer concern about fat consumption is a crucial issue. In January, 1991, a Food Marketing Institute survey of about 1,000 shoppers asked: “What is it about the nutritional content of what you eat that concerns you and your family most?” Forty-four

Figure 1. U.S. Milk Consumption, pounds per person, 1970-1990

percent of the respondents pointed to the fat content, while 37 percent mentioned cholesterol levels. On the other hand, butter sales have increased during the past year or so. This is partly due to a dramatic reduction in price triggered by lower support prices, and partly due to increasing recognition by dietitians and the public that the type of fat in dairy products is more acceptable from a health standpoint than fat from certain other dietary sources.

U.S. per capita consumption trends in whole milk, nonfat and lowfat milk are shown in Figure 1. Trends in California are similar. Table 3 shows that butter and ice cream consumption declined slightly over the 1970s and 1980s, while yogurt consumption increased fivefold. Lowfat and nonfat frozen desserts, includ-

**Table 3. U.S. Consumption of Various Dairy Products, pounds per person, Selected Years**

<table>
<thead>
<tr>
<th>Date</th>
<th>Butter</th>
<th>Ice cream</th>
<th>Yogurt</th>
<th>Frozen desserts, including ice milk and frozen yogurt</th>
<th>Cheese</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>5.4</td>
<td>17.8</td>
<td>0.8</td>
<td>10.7</td>
<td>11.4</td>
</tr>
<tr>
<td>1975</td>
<td>4.7</td>
<td>18.6</td>
<td>2.1</td>
<td>10.1</td>
<td>14.3</td>
</tr>
<tr>
<td>1980</td>
<td>4.5</td>
<td>17.5</td>
<td>2.6</td>
<td>8.9</td>
<td>17.5</td>
</tr>
<tr>
<td>1985</td>
<td>4.9</td>
<td>18.1</td>
<td>4.1</td>
<td>9.7</td>
<td>22.5</td>
</tr>
<tr>
<td>1986</td>
<td>4.6</td>
<td>18.4</td>
<td>4.4</td>
<td>9.6</td>
<td>23.1</td>
</tr>
<tr>
<td>1987</td>
<td>4.7</td>
<td>18.3</td>
<td>4.4</td>
<td>9.8</td>
<td>24.1</td>
</tr>
<tr>
<td>1988</td>
<td>4.5</td>
<td>17.3</td>
<td>4.7</td>
<td>105</td>
<td>23.7</td>
</tr>
<tr>
<td>1989</td>
<td>4.4</td>
<td>16.1</td>
<td>4.3</td>
<td>127</td>
<td>23.8</td>
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<td>1990</td>
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<td>4.1</td>
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<td>4.2</td>
<td>16.4</td>
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<td>127</td>
<td>25.2</td>
</tr>
<tr>
<td>1992</td>
<td>4.1</td>
<td>16.8</td>
<td>4.2</td>
<td>133</td>
<td>25.8</td>
</tr>
</tbody>
</table>


ing ice milk, sherbet, and frozen yogurt also have increased, particularly since the mid-1980s.Nearly all of this increase is accounted for by frozen yogurt and other non standardized frozen dairy products which increased from less than a pound per person in 1985 to over 4 pounds in 1990. The trend is exemplified by McDonald's switch from 3.5 percent fat milkshakes to market testing of lighter versions. Other fast food restaurants are consider-
ing similar changes.

**More cheese consumption**

Consumption of cheese runs contrary to this trend toward lower-fat food. As shown in Table 3, U.S. cheese consumption more than doubled between 1970 and 1990. Possible reasons why Americans are eating more cheese include: (1) some substitution of cheese for red meat; (2) growth of the fast-food industry with its high use of cheese, particularly in Mexican foods and pizza; and (3) inclusion in the data of subsidized cheese consumption in school nutrition and food welfare programs. Also, many consumers may not be aware of the high fat content of cheese. The new FDA nutrition labeling requirements could threaten this aspect of dairy product marketing by making consumers more aware of the high fat content of traditional cheeses.

There is some effort to use more milkfat commercially. For example, among its many recommendations, a Stanford Research Institute report encouraged more production of “the more marketable high-fat products,” such as double cream Brie and cream cheese, at least in the short run.

Nutrition and technology research, including fractionation (separating milkfat components), may develop more useful, marketable ingredients from milkfat (O’Donnell, 1990). For example, some milkfat components have very desirable flavors, such as butyric acid with its pleasant “butter” flavor. A partnership between universities and industry has been suggested to hasten the development of valuable uses for milkfat components.

**Milk composition**

One response to consumer demand might be to change the composition of milk so that it contains less milk fat, but the barriers appear to be prohibitive. Because of the high correlation between milkfat content, protein content, and the quantity of milk produced (Table 4), producers currently have very little incentive to reduce the fat content of milk. Despite the lowering of butter

<table>
<thead>
<tr>
<th>Milk</th>
<th>1.0</th>
<th>.83</th>
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<tr>
<td>Protein</td>
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**Table 4. Phenotypic Correlation Among Milk Quantity and Its Fat and Protein Content**

Note: Similarly, the genotypic correlations are milk-fat, .81; fat-protein, .87; and milk-protein,.72.
support prices from $1.56 per pound in 1981 to $0.65 per pound in 1993, producers have done little to dramatically change the composition of milk.

Genetic change is a possibility but would take considerable time and effort, and the resulting reduction in milk fat could be only a small increment of the desired goal. Feeding and management programs offer some hope in the more immediate future. (It is possible to lower the fat content of milk about 2 percent by changing feeding practices.) High-grain diets, more finely chopped roughages, and the use of ionophores that selectively inhibit certain ruminant bacteria are three possible approaches. However, ionophores are not yet approved for use in lactating dairy cows. Again, the relative change in milk fat levels would likely be incremental, failing short of the desired goal. Future breakthroughs in biotechnology may hold the answer to controlling the component makeup of milk, but at the moment substantive control appears to be beyond the grasp of dairy farmers.

Challenges for Processors

Milk and dairy products have long held a healthful image in the minds of consumers, being one of the four basic food groups recommended for daily consumption. But in light of changing preferences about fat, the industry must continue to respond by producing more of what consumers want.

One challenge is to modify traditional products such as butter and cheese. The industry is attempting to produce reduced-cholesterol products, even though the debate over dietary cholesterol is still inconclusive. Richardson (1991) outlines the technical aspects of various processes to remove cholesterol from milkfat. Even though about 95 percent of it can be removed, research is still needed to meet FDA’s definitions of cholesterol-free or even cholesterol-reduced dairy products.

Another approach is to develop more and better products with little or no fat. Some of the fastest growing new products are in the fluid line. Extra-light (1%) milk was launched in California in 1990, targeted at consumers who want less fat, but who like the whole milk taste. Other new fluid milk products include flavored milks, calcium-fortified milk, and lactose-reduced and lactose-free milk. One new product, a mixture of yogurt and orange juice, is competing successfully with other juices on the market. Another is light eggnog which contains 2 percent milkfat instead of the traditional 6 percent. Milk-based soft drink competitors include flavored, carbonated, and acidophilus-cultured milk drinks. Al-
ready discussed (Table 2) is the sharp increase in new soft and hard-pack frozen yogurt products, causing ice cream consumption to slip.

An important market niche for new dairy products is snack food sales, including those to children and teens. Portable and convenient, even bite-size, snacks fit well into new American lifestyles. The dairy industry can offer healthier alternatives to chips and candy. An example is shrink-wrapped string cheese that now comes plain or flavored with jalapeno or pepperoni.

Cheese is available in more forms than ever in supermarkets and delis. Some of these products are designed for convenience and for smaller households—for example, microwavable packaging, single-serving sizes, and shredded cheese in resealable packages. New flavored cheeses are also appearing on the market. Particularly important are the reduced-fat cheeses which probably will be the most important growth category of milk products.

Whey products

Among the most significant developments are new uses for whey, once an enormous disposal problem for the industry. For every pound of cheese made, about nine pounds of liquid whey are produced and disposal costs can be substantial. Another promising recent use of WPC is in the manufacture of a fat substitute. Ethanol or isopropanol-butanol-ethanol (IBE), for blending with gasoline, can be produced from whey. (Although ethanol from corn is still cheaper, whey is plentiful.) Also, whey is being used as a soil acidifier and as liquid animal feed. Whey utilization promises a win-win-win situation—producers, consumers and the environment may all gain from using the valuable components of this former waste product.

Another technology with some promise is ultra-high-temperature (UHT) processing combined with extended-shelf-life (ESL) packaging. With UHT, products are treated at a high temperature until free of spoilage-causing bacteria. Subsequent processes take place in a bacteria-free environment, resulting in an ESL package. Consumers have a pure product that keeps a long time before opening. However, plastic containers, now used for over half of U.S. milk sales, are not suitable for UHT. Also, there is some question about consumer acceptance of UHT/ESL—apart from its relatively high cost, there could be some suspicion about “unnaturalness.” Furthermore, grocers are not enthused about ESL products, preferring consumers to drop in frequently to purchase milk. ESL has had more success in Europe where there is much less home
refrigeration than in the U.S. So far, only some UHT/ESL specialty dairy products (whipped cream, half and half, and flavored milk) have appeared in U.S. grocery dairy cases.

**Problems with new products**

Developing and marketing new products involve high costs and considerable risks. Dryer (February, 1990) estimates that the average expenditure per product—the costs of research and development, new packaging, testing with focus groups, other test-marketing, sales and marketing efforts and related activities—is at least $100,000. Because the success rate is only about 10 percent, the cost is at least $1 million for every product successfully launched.

Since the early 1980s, retailers have been charging fees to "slot" new products onto store shelves. These slotting allowances typically cost a dairy processor at least $5,000 per item into a warehouse, about $500 per item for an individual store's freezer space, or $100 for shelf space in a store. This money is lost if the product fails (Dryer, Aug. 1990). Even if it succeeds, there may be a "facing allowance" or a "staying fee." However, to compete in today's marketplace, the California dairy industry must keep abreast in the new product introduction game, despite the cost.

U.S. standards of identity for such items as ice cream, sour cream, cheese, and eggnog may cause problems for processors seeking to market low- or nonfat versions with new names. Also, recent FDA nutrition labeling regulations require manufacturers to list the amounts of saturated fat, fiber, cholesterol, and calories from fat. These regulations are proving costly to the industry, although the information will benefit consumers.

**Processing Capacity**

A particular problem facing California is a shortage of processing capacity. As milk production continues to grow, this constraint will tighten. According to the SRI report, wages at California plants, which are higher than in other parts of the United States, as well as energy and capital costs are high enough to drive the price of processed products to possibly uncompetitive levels. The key to success at the processing level is not more bulk capacity for butter and powder, but operations that add value to the milk—new products with consumer appeal. However, plants capable of the many processes needed for adding value are much more costly to build and to operate than bulk facilities.

The SRI also reports that a substantial share of the needed new processing capacity will have to be paid for by produc-
ers because the risk and cost of these ventures probably will deter proprietary investors.

SRI examined three alternatives to the current method of producer pricing/quota/pooling but did not find them preferable to the present system. However, the level of California’s manufacturing (make) allowance is now threatened in the policy arena. Other states, especially Wisconsin, have long felt that California’s larger make allowance gives an undue advantage to California cheese manufacturers. The 1990 farm bill requires that California bring its make allowance in line with the federal formula. So far this has not happened, but if and when it does processors will have to find new and innovative ways of covering their costs. Otherwise, there will be less incentive to develop and market new, value-added products.
FOOD SAFETY

Milk is produced and distributed with continuing attention to protection of its quality and wholesomeness. Because microbes cause milk to rapidly deteriorate, microbial standards set by state and local ordinances for both raw and processed milk are very strict. In California, milk is routinely tested to meet state standards for antibiotic residues. As a result, milk is among the safest and most wholesome foods that consumers can buy. However, microbial and chemical agents do, on occasion, find their way into animal products.

Microbial agents may come from animals, the environment, or other humans. Organisms such as Brucella, Listeria, and verocytotoxinc Escherichia coli can cause infection, disease, or food poisoning in humans.

Thus, microbiological quality is the key to product safety. In general, the dairy industry has excelled with sanitary practices and refrigeration. Its good image was briefly threatened with an outbreak of Listeria contamination of a specialty cheese in 1985. Frequent monitoring, strict enforcement of safety standards, and occasional product recalls have prevented further outbreaks. Also, there are occasional outbreaks of Listeriosis and Salmonellosis from consumption of raw (unpasteurized) milk. Meanwhile, surveys continue to show that consumers are apparently more concerned about pesticide residues and antibiotics in their food supply than they are with microbiological hazards.

Chemical residues of antibiotics, hormones, or pesticides can remain in an animal’s system for a time after being administered to treat disease, promote growth, enhance product quality, or control pests. Regulations specifying withdrawal periods and other careful management practices for lactating cows protect against drug residues in marketed milk and dairy products. When these regulations are followed, drug residues in food-producing animals are insignificant and of no risk to consumers.
The most likely source of chemical residues in dairy products is milk from cows treated for mastitis and returned to milking before the antibiotic has cleared from their bodies. Mastitis, a microbial infection that causes inflammation of the mammary gland, is the single most important and costly disease faced by U.S. dairy farmers.

The industry has been plagued by occasional false positive test results of antibiotic residues. In December, 1989, the Wall Street Journal reported unconfirmed results of test findings of veterinary drug residues in the milk supply. Soon after, another unconfirmed test with positive results was reported by the Center for Science in the Public Interest. In both cases it was discovered that the tests had been done incorrectly, and further tests confirmed that there were no drug residues in the milk.

Hormones are another potential food safety issue. The most controversial topic in the dairy industry today involves the genetically engineered hormone rBST, discussed in Chapter II. The issues appear to be primarily concerned with the economic effects on the industry and potential consumer acceptance, rather than food safety as such.

The presence of small quantities of pesticide residues (legal or illegal) in some animal products is not uncommon. Some of these occurrences result from pesticides used on the animals. Others come from residues in their feed, since in California many crop byproducts such as cottonseed, tomato pomace, citrus peels and almond hulls are fed to dairy animals. However, a dairy cow’s system will screen out most if not all of these residues before they reach a product consumed by humans. Still, the more the industry can do to assure that its products are entirely free of pesticide residues, the better.
WASTE MANAGEMENT AND OTHER ENVIRONMENTAL ISSUES

As public environmental awareness has developed, all forms of agriculture are being scrutinized. Given the urgency of many environmental issues and the increasing involvement of the public, it is not surprising that the highly visible dairy industry in the West has attracted attention.

Although California dairy producers have long enjoyed a cost advantage over their eastern and midwestern counterparts, increasingly stringent environmental regulations may significantly raise their costs of production. It is unlikely that the industry will receive any help with the increased costs of compliance from state or federal governments. Nor is it likely that the public will support any special dispensation to the industry to mitigate these increased costs. On the contrary, more environmental “strings” will probably be attached to federal and state dairy programs, requiring costly compliance by program beneficiaries.

In any case, the dairy industry has no choice but to deal with a host of environmental issues ranging from dairy waste management practices to packaging in recyclable containers and land-use conflicts at the urban fringe.

Water Quality Issues

Historically, dairy designs recommended that corrals slope away from the milk barn, preferably towards the nearest stream or ditch. In more recent decades, the environmental effects of improper wastewater disposal have been better understood—and increasingly regulated.

In 1970, California passed the Porter-Cologne Water Quality Control Act, which is stricter than, but served as a model for, the federal Clean Water Act of 1972. Today, the State Water Resources Control Board implements California’s water quality law, dividing the state into nine geographical regions, each with its
own governing board and basin plan.

**Regional patterns**

Waste disposal practices differ significantly among regions. For example, most dairies in the Northern Central Valley apply both liquid and solid wastes to their own land. Only a few (16 percent) sell manure off the farm. Liquid and solid waste disposal is essentially the same in the South Valley, but over half of the dairies there sell manure off the farm—about 40 percent of their total supply.

Bay Area dairies tend to have larger acreages—many over 1,000 acres, primarily pastureland. However, the area’s high rainfall and smaller proportion of land suitable for spreading manure poses more problems for dairy waste disposal. About 40 percent of Bay Area dairies sell some solid waste off the farm, accounting for about 16 percent of their total output.

Southern California’s Chino Valley, at the headwaters of the Santa Ana River, was the largest dairy region in the U.S. between 1965 and 1975. But largely due to nitrate contamination of the aquifer that supplies drinking water to Orange County, the regional Water Quality Control Board set regulations that prohibit any further disposal of animal wastes on land. Now, nearly all cattle manure must be transported out of the watershed. Many dairy farmers are moving their operations to the Central Valley. (See box.)

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**SOUTHLAND DAIRYING: A CLASSIC EXAMPLE**

Southern California dairying vividly illustrates rural/urban interface issues emerging in many areas of the country. Los Angeles has always been a major milkshed in California. In the 1930s, its dairy farms were located mainly in Los Angeles County. As the city expanded, many of these producers relocated to Orange County. In the 1960s, urban expansion in both Los Angeles and Orange counties forced many to the Chino Valley and the Hemet/San Jacinto areas of Riverside and San Bernardino counties. Once again in the 1980s, urban expansion and environmental degradation in the Santa Ana watershed (the Chino Valley) are forcing dairy producers to consider yet another relocation. Many are moving their operations to the southern San Joaquin Valley, while others will relocate in the northern San Joaquin and Sacramento Valleys and still others out of state.

Because urban expansion boosts land prices, many dairy farmers have realized significant capital gains when relocating. For example, development land in the Chino Valley can sell for $350,000 per acre. Some dairymen who sold at high prices were able to build massive new, modern dairies in the Central Valley.

Impacted counties such as Tulare, Kings, and Fresno are enacting new zoning rules and implementing other regulations to control dairy practices. For example, over the last 20 years Tulare County has imposed standards that govern the location and allowable size of dairies within the county and relative to each other.
The heaviest concentration of the state’s dairy industry is now in the South Central Valley, from San Joaquin County through Kern County. In this region, 533,000 mature dairy cattle are kept on some 1,400 operations. There is considerable concern about degradation of groundwater and the quality of surface water that drains into the San Joaquin River Delta. Currently, South Valley rules require that dairy producers own sufficient acreage to handle waste entirely on the dairy property at a rate of four animal units per acre.

**Point and non-point sources**

In the 1970s, under the Porter-Cologne Act, California became subject to point source pollution restrictions and controls. (A point source is a fixed location where waste material is stored or accumulated and may be conveyed into a receiving water.) In the early years of the law, the overextended regional boards tended to focus on chemical storage problems. But in the late 1980s, dairy farms and their waste management systems, clearly a potential point source of pollution, became a top priority.

Point source controls now affect the collection, storage, and disposal of dairy wastes. While enforcement varies by region, in general regulations require that all waste either be conveyed off the site or be contained on site in a manner that will not allow nutrients, minerals, or other substances to migrate to groundwater. All manured areas, including walkways, alleys, milk barns, feeding areas and corrals, are to be designed and managed to convey all waste material to a holding area. The waste in the holding area may be solid or, more often, liquid with mixed solids from flushing the concrete areas. The holding area must be properly constructed and of sufficient capacity to withstand the heaviest rain—for existing dairies, a 25-year, 24-hour rain; for new ones, a 100 year peak storm flow. Wells to monitor the holding areas may be required. Producers must report to the state the size and capacity of their waste management system.

Nonpoint source pollutants include various materials from storm runoff, excessive soil sediment, and nutrients/chemicals from agricultural lands. (“Nonpoint” means the source is not readily identifiable at a discrete location.)

The various water quality control regions have basin plans with nonpoint source pollution regulations, including controls on spreading dairy waste on farmland. Allowable rates of manure application are specified, depending on the conditions of the site. However, specific programs such as nutrient budgeting
and waste and soil nutrient monitoring have not yet been developed by any of the regional boards.

Dairy operations must have sufficient farmland relatively nearby to spread the manure or manure-water, either on their own pasture or on other farmers’ crops. The lack of sufficient area for spreading is one of the major problems in the Chino Valley as that area urbanizes. Even when there is sufficient area, application rates will continue to be scrutinized for potential and actual leaching to groundwater.

Other regulations

The federal Coastal Zone Management Act and Reauthorization Amendment, passed in 1990, aims to reduce nonpoint source pollution into estuaries, bays, and the ocean. The objectives of the act are translated by state agencies into specific regulations. Best management practices (BMPs) are recommended for a variety of land uses, including dairying. Research, education and demonstration projects have been instituted, but so far only voluntary compliance has been solicited. Eventually there could be profound implications for California’s dairies, since some state agencies argue that the boundary of control should be at the crest of the Sierra.

The oldest state water-protection policy is the Fish and Game Code 5650, to protect the state’s waterways and natural fishery resources. The regulation prohibits any discharge that would adversely affect fish and aquatic life. Historically, penalties have been low, but a recent amendment raised the fine from $2,000 to $25,000 and made the burden of proof easier to establish. Some dairy farms have been prosecuted under this law.

Making Use of Manure

Manure is an important source of nitrogen, phosphorus, potassium, and other minerals. Particularly in the San Joaquin Valley, commercial composting and bagging firms purchase tractor-stacked, dried manure which they compost, process (remove weed seeds and minerals; incorporate additives), bag, and sell as fertilizer or soil amendment. The economic feasibility of the enterprise depends very much on transportation costs and demand for the final product. In Southern California a problem is that the manure supply exceeds demand, while hauling distances are considerable. Instead of purchasing manure for processing, fertilizer companies there are paid to haul it away.

One option for easing the dairy waste disposal problem
is to expand the current composting/bagging industry. Promotion to local nurseries and the general public could help on the demand side. Such a program might be subsidized by assessments on an area's producers; or they could form a cooperative to run and manage a composting/bagging business.

Manure is also potentially an important energy source, depending on the relative costs of alternative sources. There are at least four methods of producing energy from dairy waste: anaerobic digestion, direct combustion of dried manure, gasification, and ethanol production. Manure can also be processed for a variety of uses, such as densification into logs, cubes or pellets to be used as fertilizer, fuel or even animal feeds.

Air Quality

Federal and state policies to protect air quality also have potential impact on dairying in the state. As with water quality, a board administers the state regulations—the Air Resources Board. Again, the state is divided into regions with their own governing boards, but the boundaries differ from the water quality regions, following air movement patterns and air basins. Main pollutants of concern for the dairy industry are airborne particulates (PM-10) and gaseous ammonia. Both are produced under conditions found at most dairy operations.

The San Joaquin Valley south of Stockton is considered the next major smog area in the state. Already having problems meeting EPA's air quality standards, this area also has the most dairy cattle, as shown in Table 5. Obviously, population growth and the aggregate effect of human activity in the confined air basin—particularly the production and use of fossil fuels—are the main causes of worsening air pollution in the Valley. However, the increasing number of very large-scale dairies in the area may be a cause for concern.

Environmental Concerns During Processing

Dairy processors also are called upon to comply with costly environmental standards. In the late 1970s, EPA began fining publicly-owned waste treatment facilities whose discharge didn’t meet the new standards. These agencies, in turn, forced processors to reduce effluent or pre-treat it. Severe penalties were imposed and, in some cases, processors who did not comply were shut down.

One problem is with biological oxygen demand (BOD), a measure of the organic matter found in wastewater. BOD levels are
a moving target, since the legal amount allowed in the effluent continues to drop. For dairy processors, most BOD is the result of spilled milk. Thus, loss of milk to wastewater costs processors the value of the milk plus the cost of removing it from the water. By reducing spills and leakage, thoroughly draining tanks and vats before cleaning, and reducing water use, plant operators can cut BOD levels significantly. The potential uses of whey, discussed before, also will help reduce BOD levels in effluent from cheese plants.

Environmental regulations also require processors to clean up total suspended solids (TSS) such as milkfat, dirt, and trace minerals from the wastewater. Future regulations may set threshold levels for other chemicals such as those found in cleaning products used at the plants.

Although dairy processors have never been targeted as significant air polluters, some plants are located in areas where sulfur dioxide levels already are high. They could be lumped with other polluters and penalized, if the area in aggregate exceeds the EPA standard.

Urban Competition for Land and Water

As California's urban population grows, more intense urban/rural conflicts will erupt. Dairy farms are particularly vulnerable because they tend to be located relatively close to urban markets. Both the human population and cow numbers are increasing fastest in the San Joaquin Valley—and so is regulatory pressure. (See box.)

The availability and use of land for dairying will continue to be a contentious issue because of the expanding population, the urban/rural interface, and competing uses for the land. Dairying in the urban fringe can be costly in terms of land-use zoning and taxes, as well as nuisance complaints from urban dwellers about odors, noise, dust, and flies. There also are many and varied environmental regulations that declare land unacceptable for dairy operations because of drainage problems or its unsuitability for waste management facilities.

Most regulations on dairies have to do with water quality, but water quantity is also an issue. Water demands of a rapidly increasing population threaten agriculture's historic claims. However, dairying per se is not a large water user. Shultz (1990) estimates that an average cow drinks about 25 gallons of water a day, but notes that milk is 90 percent water and that manure and urine
JUMPING THROUGH REGULATORY HOOPS
When Ray Veldhuis decided to expand his operation in Merced County, it took almost two years of necessary but frustrating hassle to get a permit to build a 2,000-cow dairy on 1,700 acres (Gehringer, 1991). The municipal advisory council wanted to know about odor, dust, and flies. The Regional Water Quality Control Board (RWQCB) outlined the water discharge requirements that must be met before construction could begin. These included standards for the dairy waste holding facility and sediment pond, how the waste handling unit should be built under the supervision of a registered engineer, how the manure and waste should be applied to the land, and how the required buffer zone between the dairy and the town should be cared for. The RWQCB wanted information on the water table, water quality, and water movement, so Veldhuis hired a geologist to evaluate soil type and determine depth of the water table. The county planning commission approved the plan, but the decision was appealed to the county board of supervisors—where an attorney for environmental interests argued that the waste-holding facility could be an attractive but deadly nuisance to birds. The supervisors turned down that appeal but stipulated that 421 acres be farmed without manure because they are located in a 100-year-flood plain.

The RWQCB required a more in-depth look at soil type and water quality, the movement of waste water, irrigation times and directions, and the approval of the Merced Irrigation District to cross a canal with the waste. Two wells were installed to monitor water table movements and quality. Surface water movements as well as nitrogen loading and use were examined. When the RWQCB issued an administrative permit, a 15-point negative declaration was accepted and a public hearing was held.


are usually recycled as fertilizer. While an average dairy will use 50 gallons per cow per day to clean the cow and sanitize the milking equipment, this water is used again to flush the barns and feeding areas and eventually ends up on farmland. Thus, the daily water use per cow is less than the 100 to 150 gallons that an adult living in Fresno, for example, uses for drinking, showering, cooking, watering the lawn, and other uses.

The chief water supply issue for dairying in California is the irrigation requirement for alfalfa. Dairy producers rely heavily on alfalfa grown in the state. Bringing alfalfa in from elsewhere, except for some from nearby western states, would be extremely costly. However, California dairy producers have available large quantities of certain crop byproducts, which are often substituted when alfalfa prices are high. Some of these byproducts—almond hulls and citrus pulp—are from crops that have first claim on agricultural water when it becomes scarce. While they are no substitute for the high quality alfalfa that California producers are accustomed to, these byproducts provide flexibility that may help dairying survive when water is in short supply.
Packaging Problems

According to a Wall Street Journal/NBC 1991 telephone poll, eight out of 10 Americans call themselves environmentalists. Many are concerned about the waste disposal problem, from disposable diapers to plastic milk containers. (Americans generate about four pounds of garbage per person per day.) In another study by the Food Marketing Institute, over three-fourths of those questioned in 313 U.S. shopping malls said they look for packaging to be recyclable, recycled, biodegradable, or crushable. Many even said they would pay more for a product in an “environmentally friendly” container.

It looked for a time as if plastic milk jugs, now containing over half the milk sold in the United States, would become a casualty of the environmental movement, but efforts to recycle these materials—high density polyethylene (HDPE) and polyethylene terephthalate (PET)—are beginning to take hold. At least 20 percent of PET and over 10 percent of HDPE are being recycled. A key to recycling success is to find good end uses for the material. Consumer education (rinse the bottles and remove the neck bands) also helps. Recycling polyethylene-lined paper milk cartons is only at the pilot program stage.

A promising milk-packaging approach is the collapsible pouch. Over three-fourths of the milk in Canada is sold in 1-1/3 liter pouches that can be recycled or reused by consumers—or at least take up only a fraction of the land-fill space used by other containers. Canadian packagers are beginning to target U.S. markets with the pouch. School milk served in half pint pouches could save considerable land-fill space.
ANIMAL WELFARE

Views about the relationship between humans and animals range between claims of almost unlimited human rights over animals to assigning animals the same rights as humans (Wunderlich, 1991).

Animal rights activists include, among others, vegetarians; those who object to the use of animals for research; critics of various food-animal production practices, such as milk-fed veal or cage-layers; and environmentalists who believe that food animals—mainly beef cattle—are destroying the ecological balance of nature, especially in riparian areas. Activities range from peaceful objections to the militancy of those who harass food-animal producers and sabotage research laboratories and livestock auction facilities.

Very few today defend the anthropocentric belief that humans hold all the rights. Most people fall somewhere in between—that is, nearly all are more or less concerned with animal welfare. However, the concept of welfare is not always clear. Wunderlich asks: Is confinement bad because it limits movement and freedom, or is it good because it provides a comfortable, secure environment for easier control of pests and disease? Is dehorning bad because it may be painful, or good because it prevents injury and death to other animals? For food animals, welfare might be defined as proper, even kind, care—including feeding, housing, reproduction, health, and humane research and slaughter practices.

Producers argue that treating their animals well is good business. Well cared for animals are more productive, so there are not only ethical but also financial motives for giving priority to animal welfare. Some tend to belittle animal activism as emotion-laden, with little or no scientific backing. However, emotion and feelings can be the basis of legislative decisions, particularly those made by legislators representing the nonagricultural population—now 98 percent of the total. Since large dairies are operating in ever closer proximity to urbanizing areas in California, their practices will be more noticeable.
THE ROLE OF GOVERNMENT

Like many major agricultural industries, dairying has been supported by government programs designed to increase rural incomes, stabilize prices and production, and provide a steady supply of relatively cheap and nutritious food to the American public.

Most of the government agricultural programs that are in place today got their start in the early 1930s. (A detailed description of the price support program and milk marketing orders is presented in Part I of this two-part series). Over the 60 years that the price support system and marketing orders have been in place, the programs have come under increasing public scrutiny and have been criticized as inefficient, unnecessary, and wasteful of resources. Public pressure to reduce the budget deficit has created interest by Congress in reducing farm support program expenditures. Also, as the number of people in farming has decreased to less than two percent of the population, agriculture has lost its special status in the public eye. Thus, agricultural programs are increasingly vulnerable to cuts.

Some policy makers are trying to shift program emphasis away from price intervention and toward less trade-distorting income maintenance programs. These are more consistent with current government aims of free trade.

It appears that the types of government farm support programs that have been in place for the last 60 years may well be phased out in the near future and replaced with others that promote agricultural conservation and environmental goals. Two approaches to agricultural conservation and environmental policy will likely receive greater consideration. The first would involve greater reliance on regulation, forcing producers to address the environmental consequences of farm activities. The second would redirect some or all of the payments under the current commodity programs to environmental stewardship payments.
In any case, future agricultural and environmental policies likely will be implemented on a whole-farm resource basis or a watershed-wide basis. While these changes in regulation and policy-making probably will not be devastating for the dairy industry, changes in the structure and organization of the industry will continue. Recent interest in a "self-help" program is likely to increase with less price intervention. Increased interest in cooperation and resource sharing may expand the dairy industry's already substantial investment in cooperatives. Most important, trends toward change in the structure and organization of the dairy industry of the last few decades will continue.

The pricing issue

As explained in Part I, California's unique milk marketing order and stabilization plans have allowed the industry the luxury of experimenting without having to coordinate its plans with neighboring states. The California dairy industry now has an opportunity to use its unique flexibility to take up the slack of reduced government support for dairying. However, recent attempts by the industry to create a pricing system that is more responsive to national price changes create an interesting dilemma.

As it currently stands, the classification and pricing system in California— instituted through minimum pricing formulas—provides for much more stable prices than exist in the federal system. That is, the formulas that are currently used tend to spread out the changes that occur in national markets, making the peaks lower and the troughs higher. Attempts to make the California price more responsive to national price changes tend to reduce the forces creating price stability, making the peaks higher and the troughs lower.

Would the California dairy industry be better off with less responsive and more stable prices or with more responsive and more volatile prices? There are no clear-cut answers. On the one hand, stable prices make planning easier and do not subject producers to extremes of price movements, thus reducing income risk at the farm level. On the other hand, increased responsiveness to price changes in national commodity markets means that producers may sometimes enjoy windfall gains associated with high prices. However, there is evidence to suggest that increased volatility of producer prices tends to increase the farm-retail price margin, thus driving prices at retail up and resulting in decreased consumer demand for milk and dairy products.

California standards

This state has long had standards for fat and solids
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<th>Product</th>
<th>Federal</th>
<th>California</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whole milk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milkfat</td>
<td>3.25%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Solids-not-fat</td>
<td>8.25%</td>
<td>8.70%</td>
</tr>
<tr>
<td>Protein</td>
<td>8 g</td>
<td>8 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>290 mg</td>
<td>310 mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>120 mg</td>
<td>130 mg</td>
</tr>
<tr>
<td>Calories</td>
<td>140 Kcal</td>
<td>150 Kcal</td>
</tr>
<tr>
<td><strong>Lowfat milk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milkfat</td>
<td>0.5-2%</td>
<td>2%</td>
</tr>
<tr>
<td>Solids-not-fat</td>
<td>8.25%</td>
<td>10%</td>
</tr>
<tr>
<td>Protein</td>
<td>8 g</td>
<td>10 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>290 mg</td>
<td>350 mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>120 mg</td>
<td>150 mg</td>
</tr>
<tr>
<td>Calories</td>
<td>120 Kcal</td>
<td>140 Kcal</td>
</tr>
<tr>
<td><strong>Extra-light milk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milkfat</td>
<td>0.5-2%</td>
<td>1%</td>
</tr>
<tr>
<td>Solids-not-fat</td>
<td>8.25%</td>
<td>11%</td>
</tr>
<tr>
<td>Protein</td>
<td>8 g</td>
<td>10 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>290 mg</td>
<td>320 mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>120 mg</td>
<td>160 mg</td>
</tr>
<tr>
<td>Calories</td>
<td>100 Kcal</td>
<td>120 Kcal</td>
</tr>
<tr>
<td><strong>Nonfat Milk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milkfat</td>
<td>&lt;0.5%</td>
<td>&lt;0.25%</td>
</tr>
<tr>
<td>Solids-not-fat</td>
<td>&gt;8.25%</td>
<td>&gt;9%</td>
</tr>
<tr>
<td>Protein</td>
<td>8 g</td>
<td>8 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>290 mg</td>
<td>320 mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>120 mg</td>
<td>130 mg</td>
</tr>
<tr>
<td>Calories</td>
<td>90 Kcal</td>
<td>80 Kcal</td>
</tr>
</tbody>
</table>


content in fluid dairy products that differ from the rest of the country. (See Table 5.) California standards require fluid milk to be fortified by replacing removed fat with solids-not-fat (powdered or condensed milk) so that total solids are at least 12 percent. As a result, California fluid milks are richer in taste than those of other states, and taste tests have shown that consumers prefer this richer product.

However, among the many provisions of the Nutrition Labeling and Education Act of 1990 is a requirement that standards of identity be uniform in all states. This, in effect, preempts California milk standards, no longer allowing them to differ from those
prescribed by the federal government.

Although it is not illegal for California to continue to produce the richer milk that consumers prefer, the preemption poses a competitive threat. Since federal standards will be cheaper to meet, adjacent states could market cheaper milk in California in competition with the state's own product. Consumer confusion would likely ensue, and California processors might be forced to opt for producing cheaper milk with less solids.

Many in the industry believe that the higher, somewhat more nutritious California standards should become the national standard. However, many processors in other states oppose the idea because of added economic costs and processing changes, and the issue is not resolved. Congress has expressed some interest in adopting the California standards nationally, recognizing that this would increase the use of nonfat solids now having to be purchased by the government.
TRADE ISSUES

Because of the perishability of fluid milk, it seldom enters international trade channels, except within the European Community (EC). In fact, because of California's relative geographic isolation, the state has always produced nearly all the fluid milk needs for its population. California interstate and international trade have been restricted to processed, manufactured products.

The SRI report provides details of world trade in dairy products. Two-thirds of the world's milk production occurs in the former Soviet Union, the EC, and the United States. The EC and the United States are both major exporters of dairy products, but most of the volume has been associated with disposing of surplus commodities (butter and nonfat dry milk) at subsidized prices. Because New Zealand and Australia, low-cost producers with minimal subsidization, produce more than their relatively small populations need, they also are important exporters.

Importers fall into three categories. First, the former USSR and other countries of the former Eastern Bloc import butter at below world market prices. Second, high-income but milk-deficit countries like Japan and Saudi Arabia import commercial dairy products. Japan gets most of its dairy products from New Zealand, Australia, and the EC, but does buy dried whey and lactose from the United States. Japan, like most developed countries, has trade barriers against dairy imports. (Dairy products were not a part of the Japanese diet until well into the 20th Century. Consumption there has increased substantially, to just under one-third of U.S. levels.)

Third, the developing world imports mostly nonfat dried milk from the EC and United States. Mexico is by far our biggest customer. The Mexican government reconstitutes imported nonfat dry milk and butteroil and sells it to low income families through milk stores in poor urban and rural areas (McClain and Harris, 1991).
Very high stock levels in both the EC and United States kept world market prices low in the early 1980s. Policy shifts during the 1980s decreased stocks and partly closed the gap between U.S. and EC milk prices and world prices. Beginning in 1984, the EC took a production-control approach—which continues today—by imposing producer quotas and charging a "superlevy" of 100 percent of the target price on any over-quota milk. They also placed limits on growth of government agricultural spending. Meanwhile, except for the whole-herd dairy buyout in 1986/87, U.S. policy took a more market-oriented approach.

Besides its domestic welfare distribution programs to unload surplus, the U.S. has used several export enhancement strategies (Dobson, 1991). The Export Guarantee Program helps finance imports by high-risk foreign purchasers. The Export Incentive Program (DEIP), initiated with the 1985 farm bill and extended through 1995 by the 1990 farm bill, offers exporters generic certificates for CCC commodities that can be turned into cash. The idea is to make U.S. butter, butteroil, nonfat dry milk, whole milk powder, and cheddar cheese competitive with EC exports. Finally, there were direct sales of CCC stocks, mainly of nonfat dry milk to Mexico and other developing countries.

In the late 1980s, as stocks were substantially diminished and U.S. support prices came down, world prices rose. In fact, U.S. nonfat dry milk supplies were so tight that the CCC bought none from June 1988 through 1989, and exports were on a "commercial" basis during that time. While markets have stabilized considerably since, price fluctuations and other uncertainties in world markets continue to create considerable price volatility in domestic markets.

According to SRI, the greatest opportunities for U.S. dairy product exports are for nonfat dry milk, wholermilk powder, whey products, and lactose. However, besides these bulk commodities, there is also considerable value-added dairy product marketing abroad (Dobson, 1991). Such exporters range from large U.S. companies like Borden to small niche marketers like Well's Dairy in LeMars, Iowa, which sells premium ice cream in Japan through Mitsui Foods.

Meanwhile, the successful outcome of trade negotiations over GATT (The General Agreement on Tariffs and Trade) and NAFTA (The North American Free Trade Agreement) promises a continuing trend toward more open markets.

Prospects in Mexico

For California particularly, Mexico offers a promising market.
Mexico's population is growing rapidly and almost half of its people are under 19 years old. With recent economic growth and more prosperous times, the middle class is expanding.

The NAFTA accord will have two favorable effects on dairy exports. It will: (1) reduce prices as tariffs and nontariff barriers are lowered or eliminated and (2) stimulate the Mexican economy, speeding up income growth. Demand for dairy products (except nonfat dry milk) is most likely income elastic, so as incomes go up consumption will increase even more.

Mexico does produce milk, but not enough for its burgeoning population. Combining 1985 data from Rodriguez and 1989 data from the U.S. attaché, both cited by McClain and Harris in their NAFTA report, we can get an idea about dairy production there, as shown in Table 6.

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>number of operations</th>
<th>average herd size</th>
<th>production/cow</th>
<th>percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized dairies</td>
<td>1,850</td>
<td>230</td>
<td>5,000</td>
<td>54%</td>
</tr>
<tr>
<td>(confined systems)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-confined</td>
<td>NA*</td>
<td>40</td>
<td>3,200</td>
<td>18%</td>
</tr>
<tr>
<td>Family</td>
<td>100,000</td>
<td>5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Dual purpose, i.e., beef</td>
<td>120,000</td>
<td>20</td>
<td>645</td>
<td>28%</td>
</tr>
</tbody>
</table>

*NA=Not Available


Only about one-third of Mexican dairy operations have milking machines and cooling tanks. The industry depends on replacement heifers, equipment, semen, and veterinary supplies from the United States. Some of the specialized operations are drylot dairies similar to those in California; most of the pasteurized milk marketed in the cities comes from these larger dairies. It is noteworthy that rBST has been approved and is being used in Mexico, which may help increase production.
Of the 2,800 Mexican processing plants in 1988, all but 250 were very small cheese and butter manufacturers. There were only 50 pasteurization plants. Consequently, raw milk is the largest sales category in the nation, followed by government sales of reconstituted nonfat dry milk and butteroil imports. Next is pasteurized milk, cheese, powder, and evaporated and condensed milk. Until Mexican milk quality standards are increased, there is potential for Mexican consumers with higher incomes to prefer higher-quality, higher-priced U.S. milk and dairy products.

Table 7 compares U.S. and Mexican per capita consumption of several dairy products. It also may provide an indication of the future potential of this market for California.

Table 7. U.S. and Mexican Per Capita Consumption of Dairy Products, 1991

<table>
<thead>
<tr>
<th></th>
<th>fluid milk</th>
<th>butter</th>
<th>nonfat dry milk</th>
<th>cheese</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>100.7</td>
<td>0.9</td>
<td>11.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Mexico</td>
<td>47.2</td>
<td>2.6</td>
<td>4.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

STRATEGIES FOR THE DAIRY INDUSTRY

Some of the forces that will shape the future of the California dairy industry are largely external—for example, consumer preferences and international trade policies. Others, such as technology adoption and marketing programs, are to a large extent within the control of individuals or groups within the industry. In either case, the industry needs well-considered strategies to deal with probable future trends and developments.

Some recommended strategies can be put into effect by individual decision. Others will require organization and coordination inside the industry and, if possible, outside.

Productivity and technology
Technology has been largely responsible for California's huge dairy productivity increases of the past. Future advances in technology will be required to maintain the industry's competitiveness, particularly in such areas as information systems and robotics. However, there is now widespread recognition that some new technologies, such as rBST, while leading to increased productivity and efficiency, also can affect the income distribution and structure of the industry.

In addition, new technologies will be increasingly aimed at resource conservation and environmental protection. While productivity and efficiency will continue to increase, the search for solutions to environmental and food safety problems may well change the nature of the productivity-increasing technological development of the past. Certain new technologies may not necessarily increase the individual profits derived from dairying, but their adoption will benefit the individual producer, the dairy industry and the community.

Proposed strategy:
Encourage development and adoption of technologies that maintain or increase efficiency while meeting broader environ-
mental goals. UC departmental researchers need to work more closely with the dairy industry and with Cooperative Extension to ensure that appropriate technologies are transferred in a timely and concerned fashion.

In all this, allocation of increasingly limited UC resources is a crucial issue. The industry should be prepared to not only continue its support for research and extension programs, but possibly to increase industry support in relation to public funding.

*Consumer-driven markets*

Two fundamental trends among U.S. and California consumers can be expected to influence milk marketing: (1) ethnic and age-related diversity in consumer preference and (2) public concern about health and related consumption patterns—particularly consumption of fat and cholesterol.

California’s population diversity may prove to be an advantage for milk marketing, but the issues are complex. The growing proportion of Hispanic population indicates an increase in milk demand. However, as the average age increases, there is more concern with health and less interest in milk and milk products. Meanwhile, as income distribution changes there are opportunities to service markets that demand high-value/high-quality products as well as those that cater to lower income groups. And as the average household size and makeup changes, there are opportunities to differentiate products in ways that appeal to these different consumers.

There appear to be too many uncertainties associated with the cholesterol issue to declare it a major issue at the moment. Health concerns about fat, however, will continue to be an issue for the dairy industry, since many people are opting for low-fat diets.

However, the eating habits of US consumers are complex. High-quality dairy products are often associated with high fat content, and there is still a large segment of the population for whom fat is not an issue. Thus, many high-fat products are still in high demand. Nevertheless, at current production rates there will be an increasing surplus of milk fat.

This leaves two possibilities for dealing with the surplus: reduce the fat content of milk, or find alternative, industrial uses for milkfat. In the past, producer and processor response to changes in consumer demand in California has been relatively swift and effective—an important characteristic of the industry. But there are high costs and considerable risk in developing and successfully
marketing new products. Another problem is that California needs to develop more processing capacity, but it has become almost prohibitively expensive to do so.

Proposed strategies:
Specifically target relevant population-oriented markets for dairy products.
Since milkfat production at the producer level is closely tied to overall production, it would appear to be to the industry's advantage to find alternative uses for milkfat rather than trying to reduce fat production.
Processors and producers need to work together to develop more processing capacity, and to offset the cost and risk of developing and marketing new products.

Food safety
Food safety is an issue for the entire U.S. dairy industry, not just California. Although there is already a high level of safety in milk and milk products, public attention to food safety issues can be expected to continue and possibly intensify. Microbial contamination, antibiotic residues and pesticide residues are matters of concern. (The rBST issue probably is more relevant to economic impact and consumer demand.)

A crucial consideration is the fact that California's food safety standards already are higher than those of most other states. One potential problem is that dairy products produced more cheaply under lower standards elsewhere could be imported into California.

Proposed strategies:
Maintain California's higher standards, and influence other states to adopt them.
Search for and embrace new technologies that improve food safety and environmental standards.

Waste management and other environmental issues
In an increasingly urbanized state, this may be the most significant issue area shaping the future of dairying in California. There are both challenges and opportunities.

Dairy waste management appears to be the biggest challenge. Large dairies concentrate cows and manure production. Environmental regulations, especially those involving water quality, are increasingly constraining dairy producers. This trend is potentially threatening to the existence of dairy farms in some areas.
Water supply also is a potential constraint, particularly irrigation water for alfalfa production. The South Valley (San Joaquin Valley) is particularly vulnerable to drought and other water limitations.

A third problem is land-use conflicts, particularly at the rural/urban fringe.

Proposed strategies:
Establish local/regional and state-level dairy waste coordination committees.
Establish proactive programs to provide increased economic incentives to conserve resources and protect the environment.
More emphasis on commercialization of dairy waste.
Support programs that develop and disseminate information on environmental impacts of animal agriculture, in order to reduce the need for regulation.

*Animal welfare*

Proposed strategy:
Further educate dairy producers on the issues, encourage participation in local animal welfare activities, and inform the public about agriculture’s needs.

*The role of government*

Since at least the 1960s, agriculture has been losing its special societal and legislative status. Price supports and other taxpayer-funded and trade-distorting programs to support agriculture are being phased out, and agriculture will be merged into the general economy—probably within a few years.

California’s unique dairy pricing system could provide an opportunity for this state to use its flexibility to take up the slack of reduced government support. California’s quality standards, generally higher than the rest of the nation, provide another potential advantage. It appears that California could withstand a reduction in government dairy price supports without major economic dislocation.

On the other hand, California has been a major contributor to CCC purchases.

Proposed strategy:
Actively plan for reduced government intervention in
dairy marketing, including a probable phaseout of support programs over a period of years. Plan for an industry that is both (1) more competitive on an open market and (2) more cooperative in developing programs to help itself.

**International trade**

The trade world is becoming smaller, and with reduced government support the California dairy industry needs to develop its own marketing strategies. Mexico, with growing population and a viable middle class, provides the most immediate promise for international market development. The California dairy industry’s experience with the state’s own large Hispanic population provides a competitive edge.

In the long run, the largest international market opportunities probably will exist in Canada and the Pacific Rim, including Southeast Asia and other Asian markets.

**Proposed strategies:**

Focus on market expansion of dairy products to the countries of Central and South America, particularly Mexico.

Research market potential for dairy products in Pacific Rim countries, including Asia and Russia. Develop products such as UHT for these markets.

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**Conclusion**

Dairying in California in the 1990s and beyond is a complex and challenging venture. The issues considered in this report are intertwined and often multifaceted so that it is almost impossible to deal with one without raising others. Clearly, there are promising and important opportunities for the industry to enhance its competitive edge. Similarly, there are obvious challenges, such as increasing environmental constraints and consumer/marketing issues, that must be dealt with even to maintain the California dairy industry’s current competitive advantages.
References


