Impacts of Farm Policy and Technological Change on U.S. and California Agriculture

The Dairy Sector

A reprint from the proceedings of the June 1986 symposium sponsored by the University of California Agricultural Issues Center
This is a selection from the complete proceedings of a symposium sponsored by the University of California Agricultural Issues Center in June, 1986. This excerpt has been printed for the convenience of those who are particularly interested in the sector— one of the three agricultural major industries discussed in depth at the symposium.

The complete volume is available from the Agricultural Issues Center, University of California, Davis, California 95616. (Price: $20) It is titled, *Impacts of Farm Policy and Technological Change on U.S. and California Agriculture*. It covers these topics:

- **Section I** — A Look Ahead at U.S. and World Agriculture
- **Section II** — Modeling Policy Scenarios
- **Section III** — Responding to Changes in the Political, Economic and Technological Environment: Three Major California Commodity Groups
- **Section IV** — Interrelations of Government Programs and California Agriculture
- **Section V** — Institutional Response to Changes in Agriculture

In addition, a summary report of the symposium is available without charge from the Agricultural Issues Center at the University of California, Davis.
INTRODUCTION

Harold O. Carter

In the past 15 years, U.S. agriculture has experienced unparalleled highs and catastrophic lows. In the early 1970s, as a result of the worldwide vagaries of weather and economic policies, the "food crisis" emerged to replace the "farm problem"; some said the change was permanent. The emphasis of U.S. agricultural policy shifted from supply management to the encouragement of all-out production to meet rapidly expanding export markets. Agricultural prices surged in 1973 and 1974 to new highs, further reinforcing the belief that the "golden years" for farmers had returned. Indeed, aside from some occasional dips, export markets and general farm prices continued strong throughout the decade of the 1970s.

The "ride" crested in the early 1980s as a world recession hit. Export markets seemed to dissolve almost overnight. Farm prices and incomes, as well as land values, tumbled downward precipitously. Unfortunately, the 1981 farm bill was enacted on the presumptions that the previous decade of excess demand would continue and that inflation was the only major culprit to hedge against. Target prices were set at unrealistically high levels, giving growers strong incentives to produce more, even as markets were dwindling. Support prices were ratcheted up year by year to offset anticipated inflation growth that didn't materialize.

Entering the second half of the 1980s, agriculture continues to grapple with excess productive capacity, shrinking overseas markets, and a serious financial credit crisis.

The purpose of the Agricultural Issues Center's first major symposium, which is in part presented here, was to analyze and discuss the long-term impacts on U.S. and California agriculture of all these economic and structural changes—considered within the policy environment of the recently enacted 1985 Food Security Act and Farm Credit amendment acts. The major participants at the symposium were drawn from government, universities, and agribusiness.
PARTIAL LIST OF
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A faculty member at UC Davis since 1958, Dr. Carter was chair of the department from 1970 to 1976. He has been visiting professor at the Agricultural College of Sweden, the University of Naples, and the University of Sydney, and Senior Scholar at the International Institute of Applied Systems Analysis, Austria. He was elected Fellow of the American Agricultural Economics Association. He has served as chair of the UC World Food Taskforce, as senior staff economist of the President's Council of Economic Advisers, and as co-director of the Economics project of the UC-Egypt program. His B.S. and M.S. are from Michigan State University; his Ph.D. is from Iowa State University.

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Mr. Barcellos has operated a dairy farm for 25 years. He also serves on the Board of Directors of the San Joaquin Valley Dairyman's Milk Cooperative, the Federal Land Bank of Merced, the Western United Dairymen, the Los Banos Resource Conservation District, and the National Milk Producers. In 1985-86 he was manager and dairy lobbyist for the Western Dairymen Association.
ROBERT D. BOYNTON, Executive Director, Dairy Institute of California, Sacramento.

Since 1984, Dr. Boynton has served as executive director of the Dairy Institute, a trade association representing California fluid and byproduct processors in the legislative and regulatory arenas. Before returning to California, Dr. Boynton was a professor in research and extension, working on milk marketing and dairy policy at Purdue University. His B.S. is in animal science and his M.S. in agricultural economics at the University of California, Davis; his Ph.D. is from Michigan State University.

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Dr. Gruebele was born and raised on a North Dakota farm. He received his B.S. in agriculture from North Dakota State University and then taught vocational agriculture in Minnesota. After he received his M.S. in agricultural economics at Iowa State University, he was employed as a milk marketing specialist for the Great Basin Milk Marketing Order, Salt Lake City. His Ph.D. is from the University of Minnesota in agricultural economics after which he had a teaching-research-extension appointment at the University of Illinois, with a focus on milk marketing. In 1977 he came to California as an economist for the Dairyman’s Cooperative Creamery, becoming its CEO in 1984.

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After getting his Ph.D. in biochemistry at the University of Wisconsin, Dr. Richardson did postdoctoral study at the Department of Food Science and Technology at UC Davis. Then he served on the faculty in food science at the University of Wisconsin for 23 years. He recently returned to Davis as Peter J. Shields Professor, an endowed chair funded by the California Milk Advisory Board and the California Manufacturing Milk Advisory Board.

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Mr. Sawyer is a fifth generation California farmer. After graduation from UC Davis in animal science, he went into partnership on the family’s dairy farm. He has been very active in the dairy industry, serving as president of the California Holstein Association and of the California Milk Producers’ Federation. Currently, he is a member of the National Dairy Board, a group of 36 dairy producers from across the country appointed by the Secretary of Agriculture.
THE DAIRY SECTOR

Robert D. Boynton

Abstract

The dairy title of the 1985 Food Security Act plowed substantial new ground in federal dairy policy. The most significant new provision of this act is the milk production termination program under which dairy farmers bid to be bought out of production by the federal government for a period of at least five years. This program moves the dairy sector one step closer to a permanent, mandatory supply control program in the United States. While almost 11 percent of California’s 1985 milk marketings will be “bought out” under the milk production termination program, it is expected that the state’s total milk production will rebound quickly, perhaps by the end of 1987.

The dairy title of the 1985 Food Security Act contains conflicting economic signals, but despite this, it appears to contain the tools necessary to move supply and demand back into balance. To accomplish this, however, it may be necessary to invoke the discretionary authority given to the Secretary of Agriculture under the act to bring back a partial diversion program or yet another herd buyout program in the 1988-90 period. The potential efficacy of the act’s dairy provisions may be moot because it is becoming increasingly clear that many of the major dairy farm organizations, especially in the Midwest, will seek a permanent, mandatory supply control program for the dairy sector before the act expires. A national quota program could adversely affect the growth and viability of the California dairy industry: the state’s dairy industry must closely monitor any federal action on a national supply management program. But Gramm-Rudman-Hollings is a wildcard in the dairy policy game at this time.

The biggest technological change likely to impact the dairy sector nationwide in the next decade is bovine growth hormone. If this technology lives up to its advance billing, it will throw the industry out of any supply-demand balance it may have achieved. Other technological changes on farms and in plants will
hasten the marketing of milk's components and trigger changes in milk pricing, identity standards, sanitation standards, and component testing methodologies.

Introduction

This paper will discuss the following topics with special, but not exclusive, reference to California: (1) provisions of the 1985 Food Security Act relating to the dairy sector, (2) impacts of those provisions in the short and long run on the dairy sector, (3) related policy issues facing the dairy sector in the balance of this decade and beyond, and (4) trends, structural changes, and technological factors expected to shape the future of the dairy sector.

Dairy Provisions of the Food Security Act

The 1985 Food Security Act (hereafter referred to as the act) plowed substantial new ground in federal dairy policy. The most striking feature of the legislation is the whole herd buyout program (WHBP) or its more correct name, the Milk Production Termination Program. Under the WHBP, dairy farmers submitted bids to be "bought out" of production by the federal government for a period of five years.

For the first time, in this act, Congress mandated specific provisions for the federal milk marketing order system, including minimum Class I prices and pool payments to firms providing services of market-wide benefit. Although not a new concept in dairy legislation, the act provided automatic supply-demand triggers to adjust support prices beginning in 1988. Along with the temporary whole herd buyout program, this support price flexibility is seen as a way to move the dairy sector back toward market economy. Time will tell if the architects of the 1985 Food Security Act were successful in this important regard.

Support Price Determination

The maximum possible price support reduction over the five-year life of the act is $2.00 per hundredweight (cwt.) or just over 17 percent from the pre-act level. The support price was held at the pre-act level through the end of calendar 1986 (11.60 per cwt. for milk of 3.67% fat). On January 1, 1987 the support price will be reduced to $11.35. and again on October 1, 1987 the support price will be reduced another 25-cents to $11.10.

Beginning in calendar 1988 and continuing through 1990, there is flexibility built into the setting of the support price. If government purchases of storable dairy products are estimated by the Secretary of Agriculture (ex ante) to be in excess of 5 billion pounds, milk-equivalent (approximately 3 percent of U.S. production) in any of these three years, the support price must be reduced by
50-cents per cwt. Conversely, if purchases should be projected to be less than 2.5 billion pounds, milk-equivalent, the secretary would be required by the act to raise the support price by a like amount (U.S. Congress, 1985).

Whole Herd Buyout Program

Under provisions of this program, 13,988 U.S. dairy farmers will go out of business by September 30, 1987, most by late summer 1986. In California, 325 farms, or 11.7 percent of the state’s dairy farmers, had bids accepted by the U.S. Department of Agriculture (USDA, 1986; California Crop & Livestock Reporting Service (CCLRS), 1986). Compared to 1985 milk marketings, the WHBP will reduce annual national production by 8.70 percent or 12.28 billion pounds and California output by 10.67 percent or 1.78 billion pounds.

In California, the average bid accepted by USDA was $15.58 per cwt. payable on a historical annual production base, resulting in an average payment to participating California dairy farmers of $852,637 (compared to a national average per participant of $130,601). The total cost of the buyout program nationally is estimated to be $1.83 billion, about 38 percent of which will be financed by dairy farmer assessments (USDA, 1986).

As a condition of participation in the WHBP dairy farmers must slaughter or export all female dairy cattle. Nationally, this will reduce the dairy cow herd by almost a million cows and almost 600,000 heifers and calves. In California, the corresponding numbers are approximately 115,000 cows and almost 69,000 heifers and calves (USDA, 1986). Due to concern expressed by the livestock industry during debate on the dairy provisions of the act, increased government purchases of beef were required by the act. During the 18-months of the WHBP, the secretary must buy an additional 400 million pounds of red meat, half for domestic distribution and half for international programs, including military bases abroad. Despite this provision, the livestock industry filed suit in April to block dairy cattle slaughter under the WHBP until USDA adopted a slaughter schedule less likely to demoralize livestock prices. Recent court action on this suit required USDA to adopt a less disruptive slaughter plan by June 1, 1986.

California’s participation rate and the relatively low average bid in the state has been the subject of much discussion since program results were announced. Most analysts expected relatively low participation in California and the Pacific region in general (Motes, 1985). Three reasons for the state’s high participation level seem plausible, although none have been scientifically tested to date. First, to generate a total cash payment under the WHBP California’s large and productive herds could make a lower hundredweight bid than the typical midwestern or northeastern dairy farmer. Second, alternative agricultural and nonagricultural enterprises for whole herd bidders may have been better in California than elsewhere. Finally, with so few dairy farmers in California compared to many other major dairy states, the decision to participate by only a few producers, nevertheless resulted in large volumes of milk (and livestock) being removed from the market.
What has largely gone unnoticed in the excitement over the WHBP is a provision in the act which authorizes the secretary to establish and carry out a milk diversion program (payments to producers for partial cutbacks in output for a specified period) or another WHBP during the 1988-90 period if needed to "...avoid the creation of burdensome excess supplies of milk or milk products" (U.S. Congress, 1985, p. H12253). With this provision and secretarial authority to lower support prices if government purchases exceed prescribed levels, the dairy title could survive the full five-year term of the act without amendment.

One additional component of the act deserves mention here—the feed grains programs. With reduced loan rates for feed grains immediately (and soybeans beginning in 1988), barring a major crop failure here or elsewhere, dairy feed prices are expected to move even lower. Novakovic (1986, p. 12) observes that "...the feed grains program, which is intended to stimulate exports of feed grains while protecting the incomes of grain producers, will tend to make it more difficult to rein in milk production."

**Impacts of 1985 Act Provisions**

*Contradictions in the Dairy Title*

The dairy title of the act represented a grand compromise among competing interests (dairy processors vs. producers, midwestern producers vs. southern producers, dairy vs. livestock, and the like) and as is often the case with political compromise, the result is an equally grand set of confused economic signals. Consider these varying signals:

1. Assessments and proposed support priced cuts will lower effective prices received by all producers.

2. The WHBP will shrink supplies by providing dairy farmers who cannot or will not produce at the expected lower prices a more financially secure means to exit the sector.

3. By buying out large shares of production in the southeastern states, the WHBP will cause shortages there later this year, necessitating significant shipments of raw milk from the upper Midwest. When this happens, supplies will tighten further and the upper Midwest, increasing competition for milk among butter, powder, and cheese plants and driving the Minnesota-Wisconsin price upward, probably near the support price target. This will have the direct effect of raising producer prices in all federal milk marketing orders covering about 80 percent of all grade milk produced in the United States.

4. Class 1 price increases were mandated in 35 of 44 federal order areas by the act. These increases ranged from $.08 per cwt. in the upper Midwest to $1.03 per cwt. in Florida (Novakovic, 1986).

5. Assessments were required by the act to help finance the WHBP. In addition, March 1, 1986 budget reductions dictated by Gramm-Rudman-Hollings
(GRH) were achieved under the dairy price support program by the imposition of another assessment of $0.12 per cwt. from April 1 - September 30, 1986. While these assessments lower the producer's effective price, they do nothing to reduce manufacturers' incentive to buy milk to make butter, powder, and cheese. Consequently, plants still actively compete for milk and in many cases, bid the price of milk up to keep their facilities operating at an efficient capacity level.

The conflicting economic signals created by the dairy title of the act do not exist to nearly as strong a degree in California as elsewhere, because of the state marketing order system which differs substantially from federal milk marketing orders. California does not escape the inconsistencies entirely, however. By maintaining the existing price support level through 1986, the act maintains an incentive for California manufacturers, cooperatives and proprietary firms alike, to continue to turn milk into storable products. This incentive translates into a continued willingness on the part of these firms to encourage expansion by their dairy farmer suppliers and spurs competition for milk supplies. In addition, since the Bureau of Milk Stabilization, California Department of Food and Agriculture, considers nonrefundable assessments to be production costs, this newest round of assessments is captured in the bureau's cost of production surveys. As a consequence, Class 1 prices are increased because production costs represent a 43 percent share of the economic formula which moves Class 1 prices.

Short-Run Impacts
National. I expect the following national impacts from the act in the next 18-24 months:

1. shortages of milk in the Southeast in the fall of 1986 as a result of the WHBP, leading to: (a) movement of bulk milk from the upper Midwest to the Southeast, (b) increased competition for milk supplies in the upper Midwest by manufacturing plants, and (c) increases in the Minnesota-Wisconsin price undergirding all federal order prices;

2. continued downward pressure on effective farm level milk prices through 1987 despite some upward pressure in late 1986;

3. maintenance of a reasonably favorable milk/feed price ratio despite falling milk prices because of low feed grain prices;

4. recovery of production volume lost to the WHBP at a reasonably rapid rate nationally with only the Southeast lagging behind;

5. little if any reduction in real wholesale and retail dairy product prices for much of the reduction in effective prices to dairy farmers through 1987 is achieved via assessments (plus the fact that the WHBP will put upward pressure on prices in late 1986); and

6. strengthening replacement-heifer prices as many are slaughtered under the WHBP.

Cooperatives, which do the majority of the supply balancing, will have considerable economic pressure put on their plant facilities from the WHBP.
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As supplies tighten later this year, cooperatives with manufacturing plants will have less milk available to put through these facilities. Per unit costs will rise dramatically leading these farmer-owned organizations to either encourage their members to increase production or actively engage in merger/affiliation discussions with other cooperatives. It should not be overlooked that the closing of a significant share of the nation’s manufacturing capacity is inevitable as supply and commercial demand move back into long run balance over the next several years. This prospect is a serious concern to cooperatives who have invested heavily in manufacturing capacity since the late 1970s to handle surplus production and enhance their bargaining position.

California. With almost 11 percent of California’s 1985 marketings slated to be eliminated by the program, participation by this state’s farmers exceeded that of any of the nation’s 10 leading dairy states except Michigan, Texas, and Missouri (USDA, 1986). Short-run impacts of the WHBP in California will be felt late this summer and early fall as production drops seasonally, school demand restarts, and the first buyout period ends with 72 percent of total cow slaughter completed. The adverse impacts of this tightening of supply will be mitigated by expected production increases by California dairy farmers not participating in the WHBP and the shifting of milk supplies from manufacturing facilities to fluid and soft product uses (largely) in fulfillment of full supply contracts between cooperatives and milk processors. Most expert observers expect production gains by remaining producers to quickly compensate for WHBP participation in California.

Some other short-run effects of the act can be expected in California. To a certain extent here, as well as nationwide, the WHBP has eliminated less efficient dairymen and cows. The result should be a stronger, more progressive, more efficient dairy production industry, capable of picking up new production-enhancing technologies. A more subtle, but nonetheless significant, effect of the weeding out process, is that the price and market expectations of remaining producers have been enhanced by the large sign-up under the WHBP. This fact too will give a boost to production by encouraging expansion and investment in efficiency-generating equipment and technology.

The California quota market might also soften with WHBP participants unloading this valuable asset in the next few months. Potentially acting in opposition to this might be especially strong demand for additional quota from remaining producers who foresee better times ahead.

Significant Longer-Run Impacts

Under the conflicting set of economic signals described earlier, lower expected feed prices, an adequate supply of replacement heifers, and new technologies expected to boost output per cow dramatically by the end of the decade, it seems almost certain that the 1985 Food Security Act with its initial WHBP will be unable to wrestle supply and demand back into proximity on a long-term basis. A reprise of the WHBP or a paid diversion program may
be necessary to rein in supply again even before the act expires. Alternatively, a permanent national quota system could be proposed to solve the chronic supply-demand imbalance. This alternative is receiving increased attention from industry leaders nationwide, as evidenced in recent reports of the annual meetings of two of the largest dairy farmer cooperatives in the United States—Associated Milk Producers, Inc. and Mid-American Dairymen. As reported in *Hoard's Dairyman* (1986, p. 416), Associated Milk Producers' delegates passed a resolution calling for the cooperative to work with National Milk Producers Federation and others to "...develop and enact legislation establishing an effective permanent [emphasis added] national supply management program or two-price system." Although less specific, Mid-America's delegates approved a similar resolution on a voice vote: *Hoard's Dairyman* (1986, p. 433) estimated that 80-90 percent of the delegates voted in favor of the resolution.

The major long-run significance of this act is to move the sector one large step closer to the adoption of a nationwide, permanent supply control program such as that existing in Canada and Europe. In my view, if ever the U.S. dairy industry adopts a quota plan, it will do so in several steps. The 1984-85 paid diversion program was the first step and the WHBP is the second. If a supply-demand imbalance persists beyond the 1986-87 WHBP, quota proponents will have both ammunition and a closer target to shoot for to reach their goal.

While it is possible that recent experiences with a largely unsuccessful paid diversion program and now the WHBP (which I expect to be unsuccessful in the long run) might brand supply control schemes as ineffective, I believe proponents will effectively argue that these experiences only point up the inadequacy of temporary measures.

The impacts of a permanent national supply management system on California's dairy sector could be profoundly negative depending upon the system's design. Growth and innovation could be discouraged if California's state order pricing and pooling systems are supplanted. Clearly, California dairy sector interests will resist adverse changes: but midwestern producers hold many of the political trump cards, and they have been known to support federal proposals at variance with California interests. California's large congressional delegation and Representative Coelho's position as chairman of the Dairy, Poultry, and Livestock subcommittee of the House Agriculture Committee are pluses for the California industry in resisting any federal plan discriminatory to the state.

Other long-run impacts of the act will be visited primarily on the federal order markets. By taking action to directly dictate key provisions of federal milk marketing orders, Congress established a dangerous precedent and in my judgment injured the long-run viability of that federal program. The strength of federal (and state) orders is that they are designed and amended through the melding of the collective experience and knowledge of all segments of the dairy sector. This has made this institution flexible and, to a large extent, responsive to the broad dairy sector, if not the public, interest. By directly
dictating prices and mandating market-wide service payments (the latter in clean-up legislation to the 1985 Food Security Act enacted in February 1986). Congress left little room for the collective wisdom and compromise of industry participants to design a marketing system which serves producers, processors, and consumers.

One last longer-run impact of the 1985 Food Security Act and its "clean up partner" may well be to push some proprietary processors in federal order markets into supplying balancing in order to capture the market order payments for these services mandated by Congress. Beginning in the mid-1960s and continuing through the 1970s, proprietary handlers moved away from these activities in favor or cooperatives. It is possible that this trend could be reversed by this latest round of federal legislation.

**Related Policy Issues**

In my judgment, the biggest policy issue left unresolved by the 1985 Food Security Act is the long-run level of government involvement in the dairy sector economy. The act straddled the fence, even while it broke new ground in dairy supply management. Whether this legislation will help usher in a return to a market-oriented dairy sector or pave the way for a permanent quota-type supply management system has yet to be determined. What is apparent at this juncture is that producer leadership has lost confidence in price as a resource allocation signal. It became increasingly common during the debate on the dairy title of the act to hear producer leaders state in effect, that the long-run milk production supply curve slopes downward or that price was too harsh a disciplinarian. Having lived with government dairy product prices which continuously "supported" the market throughout the 1980s, there is perhaps a natural fear of change. It seems quite easy to forget that government prices need not "be the market" but if operating properly, should be significantly under the market most of the time.

The real wild card in the dairy policy game is Gramm-Rudman-Hollings (GRH). Producer leadership through National Milk Producers Federation successfully held off a March 1, 1986 GRH cut in the prices of government-supported dairy products by pushing for new legislation authorizing a special dairy farmer assessment instead. Thus, government costs were not cut the mandated 4.3 percent, but rather government revenues were raised by a corresponding amount. This action saved the nation's dairy farmers millions of dollars because the assessment is much cheaper on a hundredweight basis than a corresponding reduction in the prices of supported products.

The next GRH trigger point is October 1, 1986, with major legal, executive branch, and congressional GRH activities slated to occur in advance of that date. Preliminary estimates are that deep expenditure cuts may be required—
perhaps resulting in a support price cut of $2.00 per cwt. or more for milk. This will surely meet strong resistance from producer leadership. While this might be a larger drop than necessary to bring supply and demand back into reasonable balance, the market should rectify any downside over-reaction promptly. I see GRH (or if declared unconstitutional, budget realities in general) keeping continued pressure on Commodity Credit Corporation costs throughout the balance of this decade. The potential responses are limited and include the following:

(1) Lower support prices significantly to reduce costs. This is unacceptable to dairy farm leaders.

(2) Increase producer assessments to increase USDA revenue. This will eventually be rejected by producers as "too much."

(3) Institute a mandatory, nationwide, permanent supply management program which will transfer program costs from consumers and taxpayers to consumers and new milk production entrants.

What must be recognized throughout this debate is that many producer leaders have mixed feelings about reining in milk production. On the one hand they recognize that the government cannot be a long-term market for dairy products, while on the other these same leaders have been party to large investments in new or expanded manufacturing plant capacity to handle the increased milk production of the 1980s which they need to keep at or near maximum efficient capacity. Perhaps it is no wonder that federal dairy policy appears ambivalent.

There are a host of other policy issues facing the industry in the next 5-15 years, but one of the most interesting and important is adapting the pricing and product standards systems to accommodate the marketing of milk components rather than milk with various components—a subtle but crucial distinction. I believe that more and more processors, manufacturers, and distributors will be engaged in marketing what is in milk rather than milk itself. We are already seeing the beginnings of this with ultra-filtration and reverse osmosis of milk to concentrate valuable constituents and remove water.

Response to this changing market place will need to take several forms. Pricing systems will have to adapt. Current butterfat and skim milk pricing systems which are used almost everywhere except California will have to change to allow handlers to pay for key milk components. Even California's innovative multiple component pricing system will have to be adapted to allow the marketing of ultra-filtered milk off farms. Sanitation standards, testing methodologies, and product identity standards will also need to keep pace.

Another related response to the marketing of milk components is product standards for fluid milk products nationwide. California has the highest fat and solids-not-fat standards in the nation for fluid milk products. The biggest distinction occurs for lowfat milk where California allows only one lowfat milk product (1.9-2.1 percent milkfat and at least 10 percent solids-not-fat)
while in most states and in interstate commerce, lowfat milk can have 0.5-2.0 percent milkfat and need only have 8.25 percent solids-not-fat. Producers continue to push for adoption of fluid milk solids standards on a statewide and national basis which closely match those in California. A necessary prerequisite or concurrent change in dairy marketing institutions, however, is adoption of a multiple component pricing system so that processors have more nearly equal raw product costs when standards are raised.

Trends, Structural Changes, and Technological Factors
Shaping the Dairy Sector

Production

Increased On-Farm Efficiency. By far the greatest force shaping the production segment of the sector will be unprecedented gains in output per cow during the 1990s. I believe these gains will come primarily from the widespread use of bovine growth hormone (bGH). This naturally-occurring hormone produced in the pituitary gland of dairy cattle has recently been synthetically produced by bacteria using recombinant-DNA technology. This biotechnological breakthrough means that bGH can now be economically manufactured in commercial quantities. If approved by the Food and Drug Administration for commercial use (and most observers believe it will be by 1990), several companies are ready to move into commercial production and distribution. In laboratory tests with dairy cows, production gains of 15-40 percent in milk output were achieved with a daily injection of bGH. The hormone appears to stimulate equal percentage production increases in cows of different initial production levels. Moreover, the hormone can be used effectively over the last 200-220 days of lactation with no apparent loss in reproductive efficiency, cow health, or longevity. It is clear, however, from early university trials, that nutrition and feeding management are critical in achieving large production gains (Katler, 1985).

Although the impact of bGH will likely be dramatic, I expect commercial production gains will be less than half the gains seen in early laboratory experiments. Most expert observers expect adoption of bGH technology to be rapid and widespread, with the nonadopters not surviving in the longer run (Kalter, 1985). While not a capital-intensive new technology, bGH is a management-intensive technology, and as such is not expected to be size neutral. California, with its large, progressive, and specialized dairy farmers, should adopt this technology quickly and relatively effectively, thereby increasing their dominant role in the U.S. dairy sector.

Other production-enhancing technologies are on the horizon. Embryo transfer technology is here now. Embryo sexing will enhance the economic viability of embryo transfer. Utilizing recombinant-DNA technology, manip-
ulation of the cow's genetic code to produce novel dairy products is a possibility in the late 1990s.

**Other On-Farm Changes.** As mentioned previously, I expect to see a shift toward the marketing of milk components and away from the marketing of milk. Dairy farmers will participate in this revolution through on-farm application of milk concentration and separation technologies such as reverse osmosis and ultra-filtration. Thermalization of freshly produced milk will also be used to enhance its keeping quality, allowing less frequent farm pickup and further contributing to transportation cost savings.

**Production Shift Northward in California.** I expect the shift of production out of southern California into the southern San Joaquin Valley to continue, reflecting high land prices in southern California, environmental pressures south of the Tehachapi Mountains, and a lower per unit cost of milk production in the southern San Joaquin Valley (SJV). Continuing a long trend, between 1980 and 1985, southern California's share of state milk production fell from 32.1 to 30.4 percent, while southern San Joaquin Valley's share rose from 26.4 percent in 1980 to 27.7 percent in 1985 (CCLRS, selected years). Based upon cost of production data collected and summarized by the Milk Stabilization Branch of California Department of Food and Agriculture (CDFA), the southern SJV has enjoyed an average $.72 per cwt. lower production cost than southern California during the 1976-85 period (CDFA, selected periods). There seems to be no clear trend in this cost differential; in 1979 and 1980, southern SJV held a $1.07-$1.08 per cwt. advantage over southern California but in 1981 and 1982, this shrank to $.46, only to increase again in 1984 and 1985 to near $1 per cwt.

**Processing and Distribution**

**Product Safety.** The dairy processing and distribution industry will pay increasing attention to product safety in the next several years. Recent contamination incidents in the Midwest (Hillfarm plant/salmonella) and California (Jalisco and Rodeo Cheese companies/listeria) point out clearly how important plant sanitation, engineering, and inspection are to ensuring that consumers get a safe, high quality product. These unfortunate incidents demonstrate the need for constant and improved surveillance of plant operations as well as research on the particular microbiological properties of new dairy products. In the case of soft, Hispanic-type cheeses, it now appears that their acidity, the temperature in storage and distribution, and the removal of competing micro-organisms may be creating an ideal environment for the growth of listeria monocytogenes.

Beyond a concern for plant sanitation and safety engineering, processors will be paying increasing attention to crisis management planning and product recall procedures. Recent cases of criminal product tampering in the dairy industry, including attempts to extort money from dairies under the threat of product tampering, have made the industry acutely aware of the need for
increased plant security and tamper-evident packaging. These steps, along with the skyrocketing cost of liability insurance, will mean increased consumer costs for milk and dairy products.

A final effect of the increased concern for product safety will be stricter process controls in all milk and dairy product plants. In California, this has manifested itself in more frequent inspection and product testing in soft cheese plants and in legislation requiring pasteurization in the plant where a dairy product is packaged (currently, a plant can receive pasteurized milk and further process and package it without repasteurization). With limited exceptions, this practice will no longer be allowed; plants, especially small cheese plants and those packaging eggnog, will have to install a pasteurizing unit. This requirement will increase the cost to small operators and discourage the production of dairy products as a “cottage industry.” The time has come when the entire industry must take steps to protect itself and the integrity of its products, even if it comes at the expense of the small operator.

*Growth of the Cheese Industry in California.* California imported over 70 percent of its total cheese consumption in 1981, including processed and natural cheeses and cream cheese, according to a Stanford Research Institute (SRI) study (1983).

California imported all its processed cheese and about 80 percent of the natural American cheese consumed in the state. SRI projected cheese consumption to rise 3.1 percent annually through 1995, reaching 29 pounds per capita by the mid-1990s. California manufacturers sold cheddar cheese to the Commodity Credit Corporation in sufficient quantities in 1985 to represent well over 10 percent of total annual consumption of all cheeses in the state. This cheese moves to the government for several reasons—the state lacks cut-and-wrap and processed cheese facilities, the government market remains attractive, and long-established buying arrangements exist with midwestern suppliers (Boynton, 1985). But the structure of the California cheese industry is rapidly changing.

In 1972, only 2 percent of the state’s milk was used to manufacture hard cheese. By 1983, this percentage had risen to 17 percent compared to 29 percent in the balance of the United States (Boynton, 1985). With the opening of the new, 80-million-pound per year cheese plant in Corona in October 1985, and the development of several modern, moderately-sized cheese plants in California, this state’s cheese industry is growing rapidly. California Manufacturing Milk Advisory Board’s “Real California Cheese” campaign has helped establish a consumer identity for California cheese. If this identity strengthens within and outside of California as the state’s ability to produce, cut-and-wrap, and process high quality cheese grows, this segment of the sector should prosper. The development of a California cheese industry is helped by the state’s geographical isolation, its huge, cheese-hungry market, and a favorable raw product price for milk made into cheese.
Increased Out-of-State Sales of Yogurt and Ice Cream. In 1984, about 21 percent of California’s yogurt production was sold out-of-state. This has been a growing market for the state’s yogurt manufacturers and promises continued expansion, especially if California yogurt standards can be rewritten to more closely match federal standards, thereby facilitating interstate commerce (Boynton, 1985). Although little frozen product moves into or out of California, I expect this state to become a modest net exporter in the next several years as more large ice cream companies come to California and existing companies expand their facilities and distribution area.

Marketing

There is at work in the dairy industry a new emphasis on marketing which is badly needed and exciting. It manifests itself in several ways: product innovation by existing dairy companies; entrance of new companies into dairy product processing and distribution usually with new products (or products at least new to the U.S. market); increased monies spent by proprietary dairy companies on advertising, promotion, and product development; and, greatly expanded producer funding of generic advertising, promotion, and product development. In the case of ice cream, the National Promotion and Research Board (responsible for producer monies contributed to national advertising and promotion) and proprietary processors collaborated in 1985 on promotion and advertising as part of the “Ice Cream for America” program. This represents a landmark in cooperation among producer and processor interests in this area.

More cooperation among producer and processor interests needs to occur, especially in the area of new product development. While producers are getting directly involved in new product development through California Milk Advisory Board, California Manufacturing Milk Advisory Board, and now the National Promotion and Research Board, it is difficult for producers to generate new product ideas for processors; both groups have to work together closely and from start to finish on a new product idea.

Producers have often felt the proprietary firms did not move fast enough on new product development. While admittedly true in some situations, there are sound reasons for the relatively slow growth in new dairy products. These include low profit margins in fluid milk processing; a desire to keep plant and distribution systems as simple (read: efficient) as possible which means taking a hard look at new products with low market share potential; the fungibility of milk; and the high cost of research and new product development. Producers’ most vital role in the process of new product development is in supporting basic research which most individual companies cannot afford to do on their own. Other producer efforts in the new product area, in my view, must be carefully coordinated with processors if their impact is to be maximized.
Consumption

Increasingly, consumers want healthful and convenient food. They also want a degree of luxury in their diet. These concerns, along with demographic changes, are important forces of change in the dairy industry.

In the main, growing consumer health consciousness has worked to the detriment of dairy product consumption. Although per capita consumption of lowfat products has increased, the decline in per capita consumption of traditional whole milk or full-fat products has been greater. Nevertheless, the negative effects of health and diet factors are expected to abate in the next several years. The worst may well be over, and better times may be ahead. People will continue to discriminate against saturated animal fats in their diets. The cholesterol/arteriosclerosis debate will probably continue to ebb and flow, generally inhibiting consumption of high fat dairy products, but the controversy will probably be no more strident than in the recent past.

There are several items on the plus side. Recent medical research indicates that present minimum daily requirements for calcium are too low to guarantee adequate bone health in older Americans, especially post-menopausal women. The dairy industry is rushing to exploit this situation with generic promotion as well as specific new fluid milk products fortified with additional calcium. Potentially even more important (although at present, less definite) is a suggested link between increased calcium intake and reduced hypertension. If firmly established, this circumstance could substantially increase lowfat dairy product sales.

Lately, consumers have shown considerable interest in foods that offer a hint of luxury, even when priced well above more common counterparts. This has been particularly true for super-premium frozen desserts and chocolate milk but is also evidenced in sales of fancy yogurt and European-style cheeses. Although the total volume of these products is low, their sales are expected to grow substantially.

As this century ends, the population will become steadily older, more concentrated in urban and suburban areas, and relatively more nonwhite. Thus, more people will belong to groups with relatively low demand for milk and dairy products. Such factors imply reduced per capita consumption, although they may be offset somewhat by mitigating factors on the health side, for example, increased calcium intake by middle-aged and older adults (Boynton, Novakovic, and Aplin, 1985). General demographic trends over the next 10-15 years indicate that the western and sunbelt states will continue to grow and that the population there will be generally younger. This has some bearing on the market for California’s milk.
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PRODUCTION ADJUSTMENT ISSUES

Tom H. Sawyer

Abstract

In response to Dr. Boynton’s address, several comments were made:

—While the provision in the 1985 Food Security Act for lowering the support price is a good thing, producers will fight fiercely for any other course of action.

—The whole herd buyout program has attracted worldwide attention, but a similar program in Germany did not work. Also, it seems a tragedy that the gene pool of the U.S. dairy herd has been dealt such as severe blow. And it is very likely that we will see production soar again anyway given that there are no restraints on remaining producers, the prospects are for continued low feed prices, and biotechnological enhancements are available.

—A positive note for bringing supply and demand into balance is the success of various promotion efforts and the associated increase in consumption of dairy products. It would also help for the nation to adopt California’s standards and component pricing and for raw milk quality standards to be enforced nationwide.

—If we still have a burdensome under-utilization upon the expiration of the act, we’ll likely initiate a national base program. This probably would not be of benefit to California’s industry which is the envy of the world.

—Perhaps the fruits of increased advertising, a greatly expanded national research program, better consumer education, and constructive planning by the nation’s farmer cooperatives may together solve the industry’s problems.

Comments

As a producer, I see a few good things as well as several problems with the dairy section of the 1985 Food Security Act. One good thing, in my opinion, is the provision for lowering the support price by a maximum of $2.00 per hundredweight over the five-year life of the act, with supply-demand triggers causing the change. The concern I have is that if we use the past as
a guide as to what might actually happen, we see that producers inevitably will fight fiercely for any other course of action. We worked for it, we bought and paid for it, and we don’t want it adjusted unless it’s upward! This attitude on the part of producers has been constant and unchanging during the past 30 years at least, and has been a major, though not the only factor in developing the sea of milk we find ourselves in at present. A person can become very unpopular for suggesting that prices be lowered, but I strongly feel that if we do not at some point become willing to allow the support price to fall to a level where it is a supply balancing device rather than a supply building device, the entire system is in jeopardy.

A further condition of the act requires the Secretary of Agriculture to increase the support price if purchases are projected to be less than 2.5 billion pounds milk equivalent. All this does, in my opinion, is to guarantee that the government will always buy 2.5 billion pounds of milk from us. I thought we were trying to get away from that. If we get the support price at the proper level, the forces of supply and demand should provide price increases when needed.

The whole herd buyout program has attracted worldwide attention and was, in my thinking, a novel and unique attempt to get our supply down to a manageable level quickly. However, in visiting with industry people from Germany, I find that it is neither novel or unique, nor do they expect it to be of any lasting benefit because a similar scheme in their country failed. Furthermore, they were astounded that we were so indiscriminate in our selection of the cattle slaughtered, saying that they at least used their program to rid the cattle population of undesirables such as leucosis carriers and genetically inferior females. It does seem a tragedy that the gene pool of the U.S. dairy herd, superior in performance to most of the world’s cattle, has been dealt a severe blow by slaughtering such a large number of our most desirable females. A black day in the history of cattle breeding, in my opinion. A further concern is that unless the industry makes the proper response now, all of this anguish will have been for nothing and may even have to be repeated. With no restraints on remaining producers, the continued outlook for low feed prices and the biotechnological enhancements to efficiency available to us now and on the horizon, it is very likely that we are going to see production soar again. Indeed, it appears that this is already occurring in California and is probably occurring in other areas as well. Because the act provides no disincentive for manufacturers to purchase milk to make butter, powder, or cheese, production is actually being encouraged by plants in some areas for precisely that purpose. These points suggest to me that in spite of good intentions by all parties involved, there are more reasons to expect failure of the dairy provisions of the act to get supply in line than there are to expect success. We perhaps have a little time to prepare for the big trouble that lies ahead because continued lower feed prices will make our “net” about as good as it is at present, in spite of lowering prices paid to producers.
THE DAIRY SECTOR

What then might be done to keep the remaining producers from destroying themselves? One simplistic idea is to either produce less or consume more. We’re not doing well at all on the “produce less” element of that idea but progress is being made on the “consume more” part. The California Milk Advisory Board (CMAB), for years held up as an example of a highly successful commodity promotion program, and the California Dairy Council (CDC) with its nationally acclaimed nutrition education programs have each been responsible for a considerable portion of the high levels of dairy products Californians consume. Both of these organizations are industry financed with producers picking up the tab for CMAB and producers and processors sharing equally the costs of CDC. Of course, the most conspicuous commodity promotion effort the world has ever seen occurred with the formation just two years ago of the National Dairy Promotion and Research Board. For the first time in history all producers of milk in the country are supporting with their dollars a promotion, research, and education program. It is already apparent that the work of this board is starting to pay dividends. The years 1984 and 1985 brought the biggest back-to-back gains in consumption in 30 years. With fluid milk up 2.5 percent, cheese up 13 percent, and believe it or not, butter up 8 percent. While the largest part of the National Dairy Board’s budget is spent for advertising, its heavy commitment to funding basic product and nutrition research as well as education programs should not be overlooked. These programs will soon yield benefits which could affect the consumption at least as much as does advertising.

What else can we do to stay alive? As has often been suggested, good strategy is to become more efficient and, of course, this year’s big efficiency gimmick is bovine growth hormone. Although there may be a great deal of interest in trying this in the beginning I do not think it will stand the test of time. The thought of working around 500 dairy cows who are stink each day with a 14 ga. needle and injected with a substance as thick as Karo syrup does not appeal to me. Even if the injection problem is solved I still believe it won’t last because my gut feeling is that in the real dairy world a well managed herd of cows milked three times a day will do about as well as a herd receiving bovine growth hormone, and with a lot less upset and cost. So, if you absolutely must increase your production per cow to survive, take another look at milking three times a day. However, don’t forget that most of us milking two times daily can find many areas to improve efficiency before we should consider three times.

What else could help ease our supply-demand imbalance? Adoption of California’s standards along with component pricing nationally will help. We have been working on this for years and gradually the resistance to it is breaking down. Someday it will happen. How about making on-farm raw milk quality more important? You can become about as popular talking about this subject as you can by talking about price cuts. Nevertheless, it has been said that if quality standards presently in place were strictly enforced across
the nation, we would not have a milk surplus now. The exciting thing about this idea is that the methods of dramatically improving our average raw milk quality have already been developed, tested and proven effective. All that remains is to motivate producers to employ them. Happily, we are seeing progress in this area. We now have several major milk processors paying producer bonuses for milk meeting higher standards. The benefits obtained from better tasting products with longer shelf life should eventually allow this cost to be passed on to the consumer.

What happens if we do all of these things and still have burdensome under-utilization at the end of five years when this act expires? I think we'll have a national base program, and very quickly. Two years ago when I first joined the National Dairy Board you could not start a conversation about that subject with anyone. Today it is being discussed in groups all over the country, and in fact two of the largest cooperatives in the United States are committed to bringing this about. While this may be inevitable I can not help but wish that something else had been tried first. The press release I imagine would read something like this: "The managers of the nation's two largest dairy co-ops stated today in a joint release that their producer boards had instructed them to enlist the support of all dairy co-ops for a new plan to process and market dairy products. The new plan, considered radical by many, directs the managers to devote maximum effort to price enhancement on products for which there is a sale to the private sector, and allows for running plants at something less than capacity when the only sale for said products is the Commodity Credit Corporation."

Does that sound radical? Well, it will probably never happen, but the point I'd like to make is that the nation's milk supply is largely in the hands of farmer-owned co-ops. Maybe it's time for those farmer/directors to start to lead the nation rather than just the co-op they own. Sure you have a big investment in a plant and you need to use it at maximum capacity to pay it off quickly. How does the plant investment compare to all the members' investments in land, cattle, and blood, sweat, and tears? It is within the power of co-ops to provide real leadership if they can but see beyond the walls of their own plants. I'd like to see something like this tried before we rush headlong into a national base program.

I have some real doubts about how California's industry will fare with the adoption of a base program. Certainly our creativity and growth, which has been the envy of the world, will be inhibited. Also, because we import so much of the cheese we consume, we may find ourselves in the political battle of the century simply trying to protect a portion of what we have now. These and other reasons make me want to work hard to solve our problems by increasing utilization and consumption. Let's see if the fruits of increased advertising, a greatly expanded national research program, and better consumer education taken collectively along with a little cooperation and constructive planning on the part of farmer co-ops won't work. It think it will.
INDUSTRY ADJUSTMENT ISSUES

James W. Gruebele

Abstract

The next few years will be critical to future policy in the dairy industry. The political power exerted by our nation’s milk producers has been substantial, but, apparently, the gains are more short- than long-term. There is little question the government’s role as purchaser of dairy products will be greatly diminished. As a result, manufacturing firms, whether proprietary or cooperative, will have to pay increased attention to marketing their dairy products. There will be mergers and joint ventures and, perhaps, more emphasis on promotion and merchandising. The good news is consumption of milk and dairy products, in all probability, will continue to increase, thereby helping to balance supply and demand. Technological developments in the production sector could have a significant influence on productivity, resulting in reduced cow numbers, fewer producers, lower costs of production, and lower consumer prices.

California will significantly increase cheese production. There is also a strong likelihood of substantial increases in cheese yields by removing some water from milk through evaporation, fortification of fat and solids-not-fat, and changing cheese cultures, but not by ultrafiltration of milk.

The federal order and the California state stabilization plan will probably survive and continue to play an important role in pricing and pooling of revenues for producers, but price levels are likely to be established at price stabilizing rather than at price enhancing levels. In my opinion, there will be efforts to incorporate a mandatory supply management program, though these efforts will more than likely fail politically.

Plants will be fewer but larger. Obsolete plant capacity will be replaced in California as well as in other states. The large food chains will continue to be involved in processing fluid milk products, and dairy cooperatives will continue to supply bulk fluid to these operations on a full supply contract basis. California cooperatives are likely to be involved in fluid milk processing within the next 10 years. There will continue to be opportunities to market
both branded and unbranded dairy products; however, there is likely to be a shakeout in the proliferation of branded yogurts in California and perhaps also in ice cream.

Introduction

The next few years will be critical to future policy in the dairy industry. The political power exerted by our nation's milk producers has been substantial, but apparently the gains are more short- than long-term. The paid diversion program, which paid producers who voluntarily reduced production below a base, started on January 1, 1984, and ended on March 31, 1985. While in effect the program served to reduce milk output, government purchases, and government expenditures. But milk production started to increase again at the conclusion of the program.

The dairy industry next supported a Whole Herd Buyout Program (WHBP) including an assessment to partially defray the cost of that program. The new program is in its infancy and some producer leaders are already advocating other programs. It is extremely important to give this program a chance to work. The dairy industry has approached Congress twice in three years. I believe Congress would question the credibility of our dairy leadership if we again approached the legislators to change the program in one way or another. The WHBP has a better chance of success because resources are being removed from the dairy industry and because of the pricing provisions included in the Food Security Act of 1985. The program requires the slaughter or export of cows, heifers, and calves from participant dairies. Participants are not allowed to use the facilities for dairy purposes for a term of 5 years. The 1985 Food Security Act provides a 40-cent assessment effective April through December, 1986; and, combined with a 25-cent price cut, a 25-cent assessment effective during the first three quarters of 1987. By October 1987, the price will be cut by a total of 50-cents per hundredweight and the assessment will end. On January 1, of calendar years 1988, 1989, and 1990, the Secretary of Agriculture will adjust the support price level depending upon the level of government purchases. Because of the combination of the removal of resources plus the price adjustments. I think the act has a reasonable chance of success.

The dairy price support program undergirds all prices received for dairy products. Except for isolated periods, from 1950-1978, the program was more of a price-stabilizing than a price-enhancing policy (Gruebele, 1978). The reason the program worked reasonably well is due to the agriculture secretaries' having the necessary discretion to lower prices when surpluses occurred to raise support prices when milk supplies tightened relative to demand. However, because of the political influence of this nation's dairy industry, this discretion was eliminated. While producers gained from higher prices and increased
income in the short run, unneeded resources were attracted to the dairy industry; and, in turn, government purchases became larger and larger. In response to this problem, the industry’s leadership recommended band-aid approaches which were short-term solutions to long-term problems. This was particularly evident with the voluntary paid diversion program. The proper action would have been the inclusion of a provision granting the Secretary of Agriculture adequate pricing discretion to achieve a balance in the supply of and demand for milk.

Unfortunately, there are industry factions that currently support a mandatory supply management approach to achieve a balance between supply and demand. In my opinion, such an approach would be a major mistake for the following reasons:

—First, once such a program is implemented, it is difficult to remove.
—Second, the principal beneficiaries of a base program are those who happen to be supplying milk when the program is implemented. In many cases, in a tightly closed base plan, practically all, if not all, of the benefits derived from base ownership are capitalized into the value of the base. Potential producers are worse off because the barriers to entry have become larger. The benefits of a supply management program accrue only to the first generation of producers. There are also differences among members of this first generation. Some may be ready to retire when the program is implemented. This group stands to benefit because of increased asset value. Some may just have started in business. The benefits for this group are considerably less because they will have to acquire additional base to expand their business.

—Third, a national program for supply management increases producer costs of production. Dairy farmers who wish to expand their dairies and those who wish to enter the industry would have to purchase base. The price of base becomes an investment cost.
—Fourth, consumers have to pay more for milk and dairy products under a program for supply management. Consumer prices will be higher and consumption will be lower.
—Fifth, smaller inefficient producers tend to remain in the dairy industry when they would otherwise be forced to exit, so the overall efficiency is likely to be lower.
—Sixth, the use of a national base program could, and probably would, discourage the adoption of cost-reducing technology. Additional base would have to be purchased if new technology were adopted as new technology not only reduces cost—it also increases output.
—Finally, production tends to be frozen regionally as well as nationally. The law of comparative advantage is not allowed to be fully operative under this kind of program. Since 1960. milk production has, for economic reasons, shifted to the West and Southwest. Such responses could be greatly impaired by a mandatory Supply Management Program.

On the other hand, a price approach would mean that the most efficient
resources would remain in business, the law of comparative advantage would be permitted to operate, and milk output would decrease in some areas and increase in others. Dairy operators would be free to increase their units to an efficient size and they would be free to adopt new cost-reducing technology. Such an approach would permit California dairy farmers to compete with other enterprises for land, capital, and management resources.

Dairy policy in the future will have a significant impact on resource allocation, on consumption trends, on government expenditures, and on overall efficiency of milk output. It is my hope the political influence of the dairy industry will be used to develop policies that will be of long-term benefit not only to producers but to consumers as well.

**California Industry Adjustments to a Changing Economic Environment**

There have been vivid changes in the California dairy industry in the past decades. California was once primarily a fluid milk state, but now only about 43 percent of the state’s milk is used for that purpose. The primary reason is the marked expansion of milk output because of California’s comparative advantage in milk production.

In a recent issue of *The Dairy Situation*, Betts (1986) compared the costs of producing milk for 1975-84. The analysis showed that (1) the Pacific region had the lowest economic costs every year during that time. (2) its economic costs showed the smaller increases than any other region, and it maintained the highest residual return to management and risk for nine of ten years. These data provide a reason why milk output has continued to shift toward this region.

California’s milk output increased by over 107 percent from 1960 to 1985 (Table 1a). By contrast, milk output in the rest of the country increased by only 8.8 percent (Table 1b). Cow numbers increased by 23 percent in California from 1960 to 1985, while cow numbers declined by over 41 percent in the remainder of the country (Table 2).

Had a supply management program been introduced in 1961, and it was considered at the time under the Kennedy administration, I think it is entirely clear that California’s share of total U.S. milk output would be much smaller than it is today. Milk output would have increased but not by more than in the rest of the country. The average size dairy herd would be much smaller, costs of production would be higher, producer returns would be lower, and consumers would be paying more for milk.

What About the Future?

Assuming a pricing approach is used, California’s share of total milk output should increase from 12 to 16 percent of total U.S. output by 1995. Production of milk in California should increase to at least 24 billion pounds.
Table 1a. Milk Production in California and the United States

<table>
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<td>1970</td>
<td>9.35</td>
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<td>10.76</td>
<td>115.4</td>
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<td>1980</td>
<td>13.52</td>
<td>128.2</td>
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<td>16.72</td>
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Table 1b. Percentage change in Production

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<td>1960-85</td>
<td>107.4</td>
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### Table 2a. Milk Cow Numbers in California and the United States

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<td>1965</td>
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Percentage change: 23.1% -38.2% -41.2%

### Table 2b. Percentage change in Cow Numbers

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1960-85: 23.1% -41.2%


by 1995. Production on a national basis should decrease for a time as a balance between supply and demand is achieved. But, by 1995, milk output should be larger than it was in 1985 due to increases in total milk consumption in the United States.

There have been substantial changes in the manufacturing sector of California because of increased milk output. The manufacturing capacity for the production of butter, nonfat dry milk powder, and cheese have increased significantly in the past decade. California remains a net exporter of butter and nonfat dry milk powder but a significant importer of cheese. Cheese has great potential in California. Consumption of cheese is higher on a per capita basis than for the country as a whole and it is anticipated there will be significant increases in consumption on a per capita, and even more so on a total basis.

Not only will California firms manufacture significantly more cheese, but in all probability, the California manufacturing firms will become increasingly involved in further processing cheese in the form of cut-and-wrap plants as well as in the manufacture of process cheese, cheese foods and cheese spreads. Because of the large increase in milk output in the past and the continued increase in milk supply in the future, it makes economic sense that the California cheese market will increasingly be supplied from California milk sources. There is also a significant market potential to California processors for specialty cheeses.

On the matter of manufacturing technology—there have been tremendous improvements in labor and energy efficiencies in the manufacturing sector. i.e., MVR evaporators, new energy-efficient dryers, and new technology will permit the drying of many different products including whey skim milk and high fat items. There will be vast improvements in cheese yields from the use of protein in cheese cultures, from the fortification of milk, and from concentrated milk. The concentration will probably be from evaporation rather than ultrafiltration. The Food and Drug Administration states ultrafiltrated milk produces inferior quality cheese. The current standards of identity will not permit manufacture of cheese from ultrafiltrated milk. In the next 10 years, I do not expect ultrafiltration units to be used at the farm level for use in cheese manufacturing.

There will be further involvement between California cheese manufacturing plants with national marketing firms that have traditionally marketed cheese in the western United States. With increased milk supplies, it makes sense that more of the cheese marketed in California will come from California milk supplies rather than from the Midwest or from the mountain states. There is likely to be increased activity in joint ventures among dairy cooperatives in California and California’s cooperatives with national proprietary firms. Some of these exist already; but, there will be more.

California plants will continue to process butter, nonfat dry milk powder and frozen desserts, as well as by-products. There will be changes—obsolete
and smaller plants will be closed. Consumption levels are projected to increase, so there will be fewer plants but volumes will probably be larger. There will probably be opportunities for California processors to enter joint ventures with national marketing firms in by-products as well as in frozen desserts.

An interesting change in recent years has been the intensified consumer interest in high quality and sometimes expensive, branded products. This trend has been particularly evident in premium ice creams, but it has also been true in yogurt. Consumers appear willing to pay premium prices. This trend could be associated with more women working outside the home. Nevertheless, a number of firms have capitalized on this national consumption trend. I would expect the continuation of these opportunities both for branded and nonbranded products. However, there is also likely to be a shakeout in the proliferation of branded yogurts in California and this could also happen for ice cream.

Other Changes of Importance.

There is little question the government’s role as a milk product purchaser will be greatly diminished. As a result, manufacturing firms, whether proprietary or cooperative, will have to pay increased attention to the marketing of dairy products. There will be mergers, joint ventures, marketing arrangements and increased emphasis in promotion and merchandising.

Much of the new brick and mortar construction for the manufacturing and processing of fluid milk as well as manufactured dairy products will fall into the hands of dairy cooperatives. A recent report (U.S. Department of Agriculture, 1984) indicates cooperatives’ share of total cheese production rose from 18 to 35 percent between 1957 and 1980. Cooperatives’ share of fluid milk processing volume rose from 12 to 16 percent between 1964 and 1980. The supermarket chains’ share of fluid milk processing on a national basis rose from 3 percent in 1964 to 18 percent in 1980 (Ibid.).

The returns on investment capital in manufacturing basic dairy products has become too small to be of interest to stockholders of major corporations. To ensure a market for producer members, the cooperatives will invest in manufacturing facilities and sell the products to the national marketing firms. Cooperatives will fill the gaps because their major responsibility is to provide a market for producer members’ milk. These large corporate entities find they can show greater returns on investment by providing marketing functions for dairy products, and by diversifying into food and nonfood areas. There are numerous examples including Borden, Dart Kraft and other proprietary firms. The food chains have been processing their own milk and in some cases by-products too. I think there is a possibility that some of the food chains not only will look to cooperatives for bulk milk, on a full supply basis, but also will look vertically to the cooperative as a source of bottled milk.

There will probably be significant technological developments in the production sector specifically involving the growth hormone, egg flushing the embryo transplant, and perhaps an increased emphasis on three-time-a-day
THE DAIRY SECTOR

milking. If, and when, these developments occur, the net result on a national basis will mean fewer cows, fewer producers, lower costs of production, and lower consumer prices than otherwise would be the case. California dairymen are likely to be among the first to adopt the technology.

The federal order and California state stabilization plan will probably survive and continue to play an important role in the pricing and pooling of revenue for producers. The quota plan in California will probably survive because there are more quota holders than nonquota holders. Once these programs are established, they usually remain because of the asset value of the capitalized quota.

The average sized southern metropolitan producer has about 800 cows per dairy herd. In the southern San Joaquin Valley, the average herd size is about 600 cows. I would not be surprised if these averages doubled in ten years.

The good news in California as well as nationally, is that the consumption of dairy products has been increasing by significant amounts in recent years. In fact, these increases in consumption will greatly assist the government and the dairy industry in achieving a balance between supply and demand. Consumption increases are attributable to continued population increases, higher per capita income, decreases in the real price of milk and dairy products, and the promotion, merchandising, and research support by the National Dairy Board. Research work in the areas of calcium, hypertension, and the importance of milk for bone health could play a significant role in increasing the demand for milk and dairy products.

I am very optimistic about the dairy sector in California. Unless it is hampered by mandatory supply management, the output, sales and manufacturing will continue to progress.

Finally, to provide industry stability, I would continue to endorse the concept of a price support program, even with the inclusion of a producer-assessment to defray the costs of its administration. Properly utilized, such a price support program can provide for total industry stability which can be of benefit not only to producers, but to consumers as well. Milk has some unique characteristics and government involvement, as a stabilizing force, can overcome certain market deficiencies created by characteristics.

References


TECHNOLOGY AND RESEARCH ISSUES

Thomas Richardson

Abstract

Several research topics relating to the dairy industry were discussed: the ultrafiltration of milk or cheese manufacture, increased utilization of whey, bovine growth hormone, genetic engineering of lactic starter cultures, genetic engineering of dairy cows coupled with embryo transplant technology, and the dairy food safety issue in the wake of recent outbreaks of foodborne listeriosis.

Introduction

I have been charged with discussing some of the research and technology issues in the dairy sector. A number of these have been mentioned by previous speakers. I would like to discuss, as time permits, (1) ultrafiltration of milk for cheese manufacture, (2) whey utilization, (3) bovine growth hormone, (4) the genetic engineering of lactic starter cultures, (5) the genetic engineering of dairy cows coupled with embryo transplant technology, and (6) dairy food safety.

Ultrafiltration (UF) of Milk

In the UF of milk for cheese manufacture, milk is filtered in a membrane system yielding a retentate where proteins and other high molecular weight constituents are retained in the milk, and a permeate, containing the lactose, milk salts, and other low molecular weight components. There has been, of course, experimentation in California on ultrafiltration on the farm where milk is concentrated about 2:1 with the retentate hauled to a cheese plant for cheesemaking and the permeate fed back to the dairy herd. This procedure has been
used to reduce hauling costs, and the milk, at a concentration of about 1½:1 is suitable for cheese-making using conventional vat procedures. Now the economics for this type of UF are better for larger farms such as are found in California, than for smaller farms in most of the rest of the country.

There is research being done on UF of milk within the dairy plant, say, for the manufacture of cheddar cheese, which requires a 6:1 concentrate. The research is looking into the use of special techniques and equipment, the pre-acidification of the milk, ultrafiltration, and diafiltration—a washing procedure. The objective of this special UF process is to adjust the minerals-to-casein ratio in order to get the basic cheese structure on the cheese-making process. Acidified milk is used to overcome the buffering capacity of the milk proteins and to obtain a desired calcium-to-casein ratio in the retentate.

Whey Utilization

In the cheese-making process, roughly from 100 pounds of milk, about 10 pounds of cheese curd and about 90 pounds of fluid whey are obtained. There is currently a big problem about what do to with the whey and whey permeate that results from the cheesemaking process. A portion of the whey may be ultrafiltered to recover nutritious whey proteins, leaving a dilute solution of lactose and milk salts in the permeate. There are about 5 billion pounds of cheese manufactured annually in the United States, which yields about 45 billion pounds of fluid whey. At 5 percent lactose, this yields about 2.25 billion pounds of lactose, only about half of which is currently being used. This poses a large research and economic problem for the cheese industry. And as California moves toward utilizing more milk for cheese-making, there is going to be more attention paid to the utilization of whey. Some attempts to utilize the lactose from whey and UF permeate include fermentation to provide ethanol for fuel and potable uses and methane for fuel. preparation of polyols for the manufacture of polyurethane foams, and lactose derivatives for adhesives in particle board.

Bovine Growth Hormone

Much has been said and written about the use of bovine growth hormone to increase milk yields. The intramuscular injection into dairy cows can increase milk production up to 41 percent, depending on the dosage. However, under practical conditions, a more general 25 percent increase in milk yield can be expected. Bovine growth hormone is produced by genetic engineering using recombinant DNA technology, and if it is successful, it will have unprecedented implications for farm management practices, milk markets and prices, and farm structure. In short, it will have a large impact on the dairy industry.
Genetic Engineering - Lactic Starters

Currently, there is considerable research on genetic engineering of lactic acid bacteria. The lactic acid culture and associated industries are worth about $25 billion annually. Lactic acid bacteria are used in fermented dairy products to develop acid and flavor, such as in cheese and in yogurt. There is a great deal of research in progress on trying to genetically engineer the lactic acid bacteria to stabilize ordinarily unstable functions such as the breakdown of proteins, or the metabolism of lactose by microorganisms. Genetic engineering may also help improve existing functions such as control of acid development, control of proteolysis, and control of bacteriophage resistance, i.e., the resistance of bacteria to virus attack. And there is research into the expression by lactic acid bacteria of what is called heterologous proteins, that is, proteins normally not expressed in the microorganisms, such as the protein thaumatin in S. lactis. Thaumatin is 100,000 times sweeter than sucrose, so if one could get expression of this protein in lactic acid bacteria, a naturally-occurring sweetening agent might be generated by genetic engineering. Of course, there is the continuing problem, as with many recombinant DNA products, of getting Food and Drug Administration (FDA) approval for the release of engineered organisms into the environment.

Genetic Engineering - Dairy Cows

Let’s take a look at the present genetic engineering of dairy cows and embryo transplant technology. Embryo transplant technology which, of course, favors the production of high-producing cows, can result in serious dislocations in milk marketing. However, it also makes it possible, I think, to genetically engineer not only the quantity, but the quality of milk proteins, and to possibly delete certain components, such as lactose, from the milk system. For example, in the shorter term, if the DNA that governs the expression of bovine milk proteins is cloned, it is possible to get biosynthesis of the milk proteins by microorganisms. Structure-function analysis of the proteins can then be performed using site-directed mutagenesis. With these techniques, it is actually possible to develop novel, more useful proteins that are elaborated by the microorganism. So, genetically, it is possible to modify the quality of the milk proteins and possibly manipulate the nutritional quality of the milk protein or the function of the milk protein in the food.

It is unlikely that novel commodity proteins would be produced by microorganisms for use by the food industry in the near future, because the scale of production would be insufficient and the economics would be unfavorable. However, these basic studies would set the stage for engineering the dairy cow. In the longer term, maybe 15 to 20 years in the future, one can isolate the so-called structural genes from bovine genomic libraries and
micro-inject these into embryos so that the resultant cows overproduce selected milk proteins. This may allow the tailoring of milk for specific end uses.

Again, by using bovine embryo transplant technology, one might be able to manipulate the structural genes in the embryo employing a technique called insertional mutagenesis where DNA fragments are inserted into the genes to inactivate them. Thus, it might be possible to inactivate the lactose synthetase system to get a low- or no-lactose milk. So research in this area is advancing fairly rapidly and I think within the next 15 or 20 years we are going to be seeing some real changes in the type of milk dairy cows will be producing.

**Dairy Food Safety**

Recent outbreaks of foodborne listeriosis, with mortality rates of 30 percent, have focused attention on *Listeria monocytogenes* in milk and milk products as a human health problem of considerable magnitude. Therefore, of course, was the 1983 outbreak in Massachusetts involving pasteurized milk, and the 1985 outbreak in California involving Mexican-style cheeses, and there have been two other incidents of contaminated soft cheeses, such as Liederkranz and Camembert.

In a FDA survey, in three widely separated areas of the United States, *L. monocytogenes* was isolated from 4.2 percent of farm bulk tanks. It is important to remember that this organism is also ubiquitous in the environment, e.g., it occurs in vegetables, soil, etc. Certain people are particularly prone to develop listeriosis: persons under stress, those with malignancies or renal transplants, pregnant women, alcoholics, and those receiving immunosuppressive drugs. And some humans can act as carriers.

In terms of research issues in listeriosis, a rapid test for the microorganisms is needed. At the University of California, Davis, Dwight Hirsh is working on DNA hybridization techniques employing biotechnology to develop such a test—one that can rapidly differentiate these organisms from other species of *Listeria*. Also needed is knowledge about whether avirulent strains of *L. monocytogenes* exist in nature, and if so, about the specific factors that determine its virulence characteristics.

Another research issue on food safety relating to *Listeria* is whether it can survive pasteurization. To date, results show that this organism, whether present within a leukocyte in the milk or not, does not survive. So basically, pasteurization kills the microorganisms. But are there thermostolerant strains? Current evidence on milkborne outbreaks suggests that they probably relate to improper processing or postpasteurization contamination.

Further research issues include: (1) Can *Listeria* organisms present in contaminated food be "injured"? Do they require resuscitation before selective enrichment techniques are employed in enumeration? Can species of *Listeria*
other than \textit{L. monocytogenes} cause human disease?

Among the economic factors of foodborne disease is litigation. Lawsuits totalling about $700 million in damages have been filed in the 1985 California soft, Mexican-style cheese outbreak of \textit{Listeriosis}. And there are the chronic costs of food processing firms such as food spoilage losses, food handler illnesses, sampling or control costs, and the utilization of more costly processing techniques.

Finally, potential costs to food processing firms from contamination outbreaks include product recall, reduced consumer demand, investigation costs, cleanup costs and plant closing, liability suits and food handler illnesses. There is a whole array of issues arising from foodborne disease problems that affect the industry.