KANSAS
DEPARTMENT of COMMERCE
Agriculture Marketing Division

Value-Added Dairy Processing Feasibility Report

"A Catalyst for Thought"

Ray Hammarlund, Cooperative Development Specialist
rhammarlund@kansascommerce.com

July 2003

Purpose

Within the dairy industry in Kansas, there has been a rising interest in the area of value-added dairy processing. Whether it is fluid milk or manufactured milk products, individual or group, many producers perceive an opportunity in adding value to their product by further processing or alternative marketing.

In response to this rising interest, the Agriculture Marketing Division of the Kansas Department of Commerce has engaged in a study of the opportunities and challenges of value-added processing. This report is the result of this study. Included in this study are an overview of the dairy industry in Kansas, the current trends, and the entire process of dairy processing. Further, fundamental issues of Federal Milk Marketing Orders, seasonality of production and demand are also addressed.

Finally, a survey of consumer demands for fluid milk products, in particular organic milk, is included in this study. It is a study of retail demand in Johnson County, Kansas, in the summer of 2001. A summary of that study is included in this document. The entire document is also available on the Kansas Department of Commerce website, entitled, "A Study of Marketing Issues with Organic Milk."

Insights Regarding the Study

The conclusions of this study are contained in the section entitled, "Executive Summary." These are the consensus conclusions of the staff at the Kansas Department of Commerce and those investigators contracted for work on the project. Any user of this information should be mindful of the following caveats:

- This study is not meant to be an all-inclusive template for a business start-up venture. It is a general overview of the marketplace for dairy products and the production and processing mechanics for a value-added venture. Any person or group pursuing such a venture should do additional market research on their own, with the assistance of competent experts in the field with solid, verifiable track records.
- The financial information regarding production and processing is based on a series of assumptions that may not be true to each individual business plan, marketing plan, equipment need and level of capitalization. Persons pursuing value-added ventures in dairy need to do additional work in the financial area of their feasibility and business planning.
- All value-added ventures in agriculture include a considerable amount of risk. This level of risk is additionally intense for value-added dairy ventures. Value-added dairy ventures tend to be capital intensive and require large investments of equity on the part of the principals to establish. Further, dairy products, by their very nature, are perishable and require solid and consistent quality control procedures, which require considerable investments in time, money, research and effort on the part of the business owners.
- The dairy industry in the United States is one of the most regulated industries in agriculture, and for good reason. Again, dairy products, by their very nature, require a marketplace with considerable government oversight to guarantee orderly marketing, balancing seasonal supply and demand, and to assure the quality and consistency of the product on behalf of the consumer. It is imperative that any start-up venture in dairy be well versed in both state and federal regulations in the areas of health, safety, and marketing.
- Finally, no value-added venture in agriculture, be it dairy or otherwise, can hope to succeed without a thorough understanding of the consumer, marketplace and marketing channels, adequate equity investment on the part of the principals, solid legal foundation, and finally, a firm commitment by a team of individuals willing and able to work hard towards a common goal.

Thank You

The Agriculture Marketing Division of the Kansas Department of Commerce would like to thank the United States Department of Agriculture, Rural Development/Cooperatives Services for their support in this endeavor.

We would also like to thank Dr. Mike Boland and the entire staff of the Arthur Capper Cooperative Center at Kansas State University for their invaluable assistance with this project.

In addition, thanks go to the team at Advanced Market Concepts of Manhattan, Kansas, who are responsible for a great deal of the work in this feasibility report.

Finally, we would like to thank all those individuals within the Kansas Department of Commerce who contributed their expertise in proofreading, formatting and website management for their contributions to this project.

TABLE OF CONTENTS

INTRODUCTION

The economic factors that influence the feasibility of small-scale milk processing in Kansas have changed dramatically over the past several decades. Many of these changes have been brought on by changes in U.S. population demographics, milk production demographics, and significant increases in economies of scale brought on by technology and improved production efficiency.

This study examines the changes that have occurred in milk processing and examines the economic feasibility of adding small-scale production capacity in Kansas. Milk processing from fluid milk (bottled milk) to cheese and milk powder are examined in this study. An outline of the numerous product opportunities is detailed, along with many of the steps in the processing. In addition, an evaluation of the marketing opportunities is assessed, along with an examination of the profit opportunities that may be available.

Despite the massive changes in milk production and processing that have occurred in the last fifty years, one fact has not changed. Raw milk is a perishable product and it is an expensive product to ship long distances. This fact provides the economic forces that have attempted to keep milk production near major population centers. Environmental concerns, the cost of feed, and the infusion of a large amount of capital to build large commercial dairies has enabled milk production to move away from these population centers and still service these areas with fluid milk.

This movement in milk production to different areas of the U.S. has also prompted discussion regarding new opportunities in milk processing and organic milk production in Kansas. This study examines those opportunities and points out the key components in developing a successful (profitable) milk processing operation in Kansas.

EXECUTIVE SUMMARY

(Key Conclusions of this Study)

- Economies of scale have increased dramatically in milk processing, brought on by improved processing technology, biological engineering, and improved milk quality. This increase in economies of scale has reduced values of many milk products and has resulted in several milk products becoming a generic commodity. Fluid milk, many cheese products, milk powder, condensed milk, and even some ice cream, are all products that have developed a commodity pricing structure throughout the dairy food industry.

- Milk production demographics have changed dramatically in the past fifty years with traditional Midwest production declining, along with production in the Southeastern U.S. California has become the number one producer of milk and large-scale dairies have been developed in California, Southwest U.S., and the U.S. Plains region. Population demographics require large amounts of fluid milk production to move into the Southeast U.S. region during the normal seasonal decline in production that occurs in that region. Overall, milk production facilities are being pushed away from large population centers due to environmental restrictions and the demand for high quality forage at a reasonable price.

- The number of milk cows in Kansas hit an "all-time" low in the early 1990's at 82,000 cows. Since that time, some growth has occurred, but it has been in the western part of the state, as large dairies have been developed with the infusion of new capital, and smaller dairies in the east have disappeared. The increase in Kansas cow numbers recently has been relatively small compared to the large increases that have been seen in California, Idaho, West Texas, New Mexico, and Arizona.

- A key component in the development of any processing facility that would be owned by a group of milk producers is the understanding of the impact of "balancing" milk use and production. In reality, all processed milk products, other than fluid milk, are simply balancing products. Developing a simple fluid milk business has many inherent risks, as it is difficult to balance the seasonal production volatility with seasonal changes in consumption. Therefore, milk producers are faced with developing a plan to utilize their excess milk production at certain times of the year for other products, or face shortfalls in fluid milk sales during times of improved consumption and decreased production.

- Milk-marketing cooperatives in the U.S. have filled many roles since their inception, and there have been vast changes in the number of cooperatives and their structure. Despite integrating into milk processing businesses and developing other key services for members, the true economic function of a milk-marketing cooperative is the act of balancing. This primarily entails selling raw milk for fluid milk sales (highest priced milk) and then marketing the remaining milk on a daily basis to other milk processors (cheese, powder, condensed, etc). A group of milk producers face the reality of attempting to balance with their own production or simply selling their milk into a cooperative system and re-purchasing the milk for a processing center from the cooperative.

- Fluid milk consumption on per-capita basis in the U.S. has been on a steady decline with stiff competition from carbonated sodas, beer, sports drinks, fruit juices, and most recently, bottled water. With the increase in efficiency with milk bottling companies, along with the decline in the demand for fluid milk, these companies have been forced to become "bottling companies" and have looked for opportunities to bottle the competitive products.

- The growth in the dairy food consumption has been in processed products with the substantial growth in the U.S. coming in cheese consumption. This has primarily been the result of increased consumption of pizza products and Hispanic food products (Mexican food), which are foods that require significant amounts of cheese.

- The marketing opportunity for a small milk processing facility in Kansas is in creating a "high-value" niche with a processed product. The best opportunity is in specialty cheese products that require lengthy aging, special flavor or attractive packaging. The commodity cheese business is dominated by large processors, which are located in regions of low milk prices. Large volumes of cheese are shipped long distances from these processing plants into major milk producing regions, and the result is a business that is built on extremely narrow profit margins.

- Small-scale milk processing in Kansas could create many viable marketing opportunities, but barriers to enter into these specialty markets are significant. It is critical to obtain a clear marketing channel prior to the start-up of a proposed operation. This start-up can be very difficult for a group of milk producers as they attempt to manage inventory of milk and finished product in a very slow developing market. This must be accomplished under the difficult task of "balancing" the milk production of the dairies that are part of the group, and the amount of milk that is required for the product in the early stages of operation.

- Any small-scale operation must clearly develop a taste preference for their processed product. Once this is developed, the start-up operation can capitalize on the consumer's desire for the distinct taste that cannot be found in the "commodity" products.

- The range in size and type of possible processing ventures is nearly infinite. Until the parameters of a venture are defined, it is not possible to develop good financial projections.

CURRENT KANSAS DAIRY INDUSTRY TRENDS

Milk Production

Several trends are very apparent in the Kansas Dairy Industry. Here's a description of some of the major trends.

- Production declined gradually through the 1980's, making a low in 1993.
- Since 1993, milk production has climbed sharply. (Figure 1)
- Inside the above, described statewide trends, the long-term trend in production can still be described as stable to declining in all agricultural reporting districts, except the Southwest Kansas district. (Figure 4)
- All the growth in Kansas milk production that has occurred in Kansas since 1993 can be attributed to the Southwest Kansas district. (Figures 4 and 5)

The trends are the result of smaller, traditional dairies that have historically made up the Kansas dairy industry leaving the industry; hence, the decline in production seen in the 80's and the stagnant growth or decline continuing to be seen in most of the state. At the same time, the smaller dairies are leaving; very large dairies are replacing them. The dairies are primarily locating in the Southwest district of the state, though some are locating in other areas. Slight growth is beginning to be evident in the West-central, Northwest and North-central districts. There is no evidence that these trends won't continue through the next decade.

Milk Processing

The milk processing industry can only be described as stationary. Kansas has two large volume processors—Hiland Dairy in Wichita and Jackson Ice Cream Company in Hutchinson. These are the only major commercial dairy processors in the state. Kansas State University Dairy is thought to be the next largest facility. The Newhouse Dairy in Wellsville is growing and would be next in size. All the remaining processing is either inactive or very small niche-type businesses. The processor list also includes several transfer stations. (Table 1)

Hiland-Roberts Dairy in Kansas City and Anderson-Ericson Dairy in Iowa also serve major segments of the Kansas market.

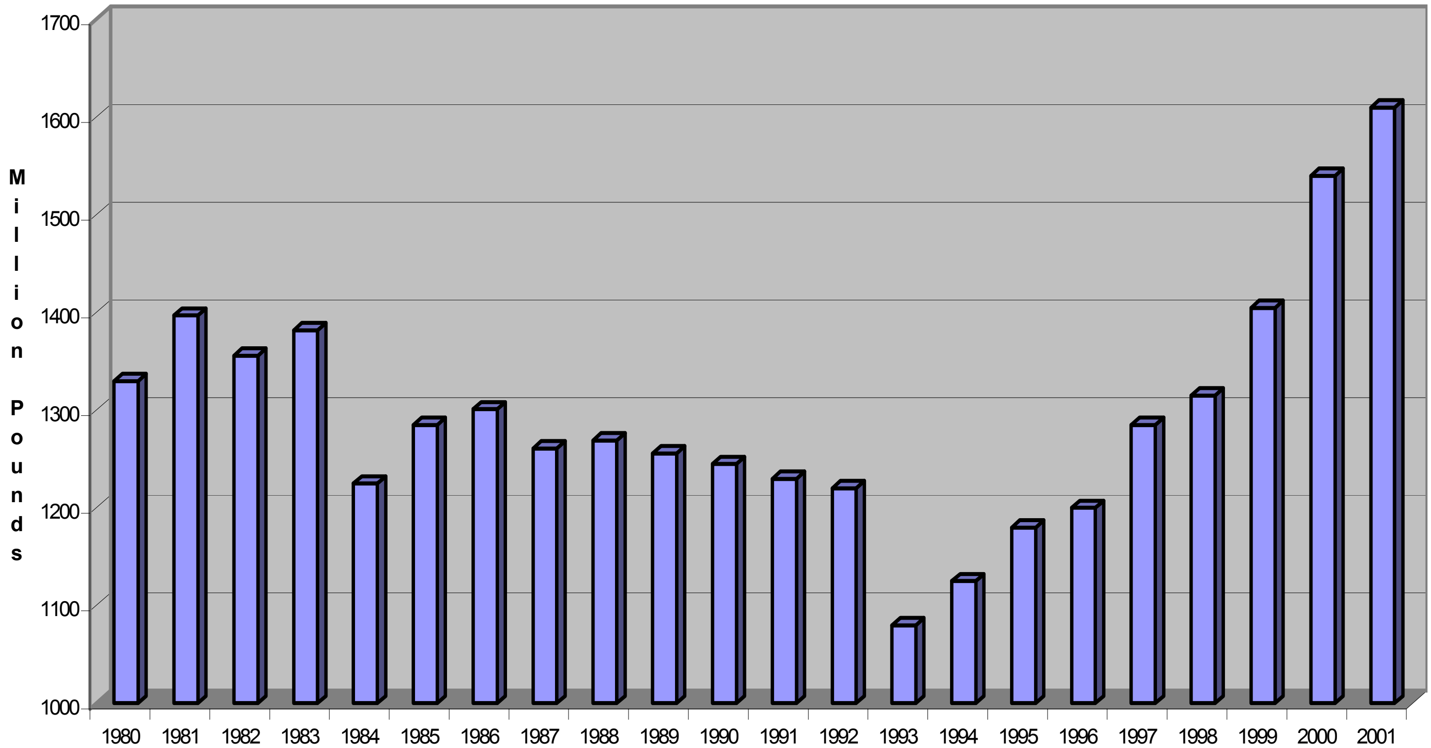
Kansas Department of Agriculture
Records Center – DAIRY Section
109 S.W. 9th Street, Topeka, Kansas 66612
Phone: (785) 296-2263
Fax: (785) 296-0673
E-mail: records@kda.state.ks.us

Dairy Plants Licensed in Kansas for 2002, July 12, 2002

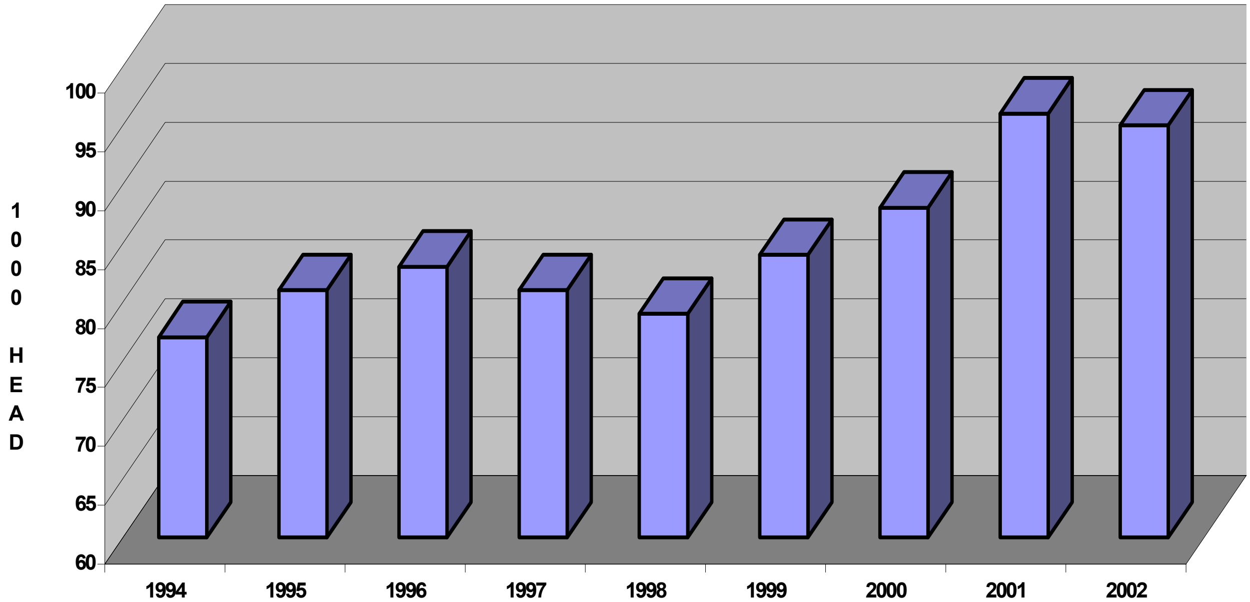
TABLE 1

Bradford Cheese 16432 Headwater Eskridge, Kansas 66423 Phone: (785) 449-2754 License #: 210	Cranston Dairy 1766 N. 500 Road Baldwin City, Kansas 66006 Phone: (785) 594-2683 License #: 192	Gorges Dairy, Inc. 400 N. Main Hillsboro, Kansas 67063 Phone: (316) 947-2747 License #: 191
Hiland 700 E. Central Wichita, Kansas 67201-2199 Phone: (316) 267-4221 License #: 091	IMAC-International Media & Cultures 7210 Oregon Street Sabetha, Kansas 66534 Phone: (785) 284-2161 License #: 147 IMA: 20-350	Jackson Ice Cream Company, Inc. 2600 E. 4th Street Hutchinson, Kansas 67501-0429 Phone: (316) 663-1244 License #: 046 IMA: 20-350
Kan Pak, LLC 1016 S. Summit Street Arkansas City, Kansas 67005 Phone: (620) 442-6820 License #: 150 IMA: 20-301	Kansas State University Dairy Processing Plant 155 Call Hall Manhattan, Kansas 66506 Phone: (785) 532-1293 License #: 302	Newhouse Dairy 4370 Vermont Terrace Wellsville, Kansas 66092 Phone: (785) 883-4547 License #: 036
Niehues Transfer Station 16 Virginia Sabetha, Kansas 66534 Phone: (785) 284-3044 License #: 125	T&R LeDue Milk Hauling 206 2nd Street Greenleaf, Kansas 66943 Phone: (785) 747-2613 License #: 190	Mies Transfer Station 19620 W 85th North Colwich, KS 67030
Hilton House Foods 816 E. Funston Wichita, KS 67211	Jason Wiebe 2932 Goldenrod Durham, KS 67438 (620) 732-2846 License #: 037	Emrich Family Creamery Wheaton, KS License #: 038
Prairie Pride 13700 SW Butler Rd. Rose Hill, KS 67133 License #: not yet assigned		

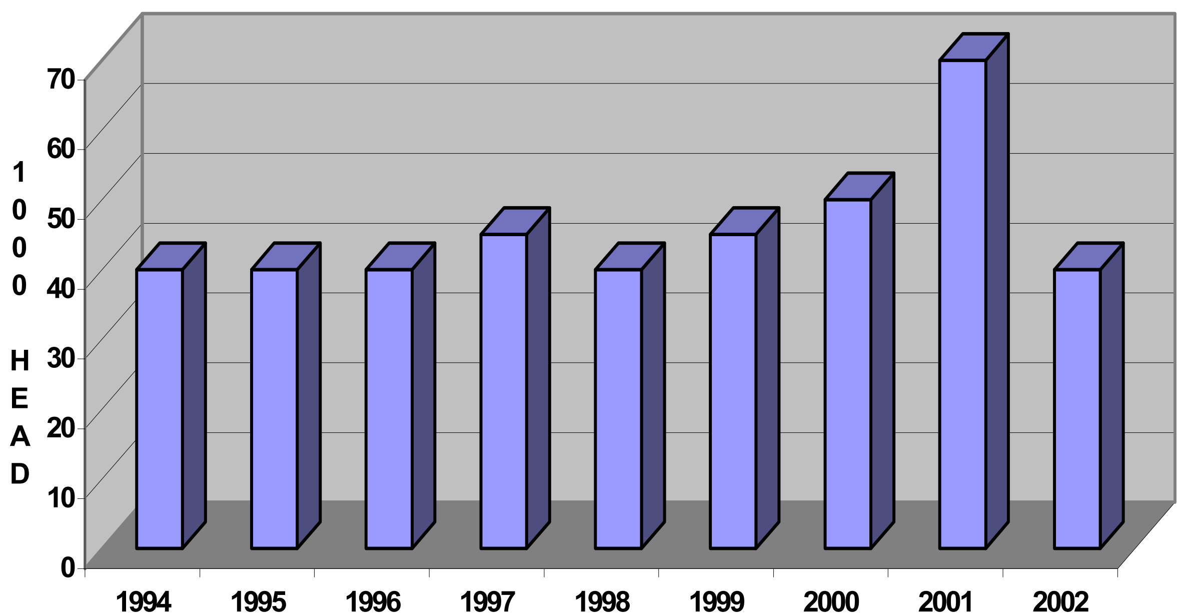
KANSAS MILK PRODUCTION (Figure 1)



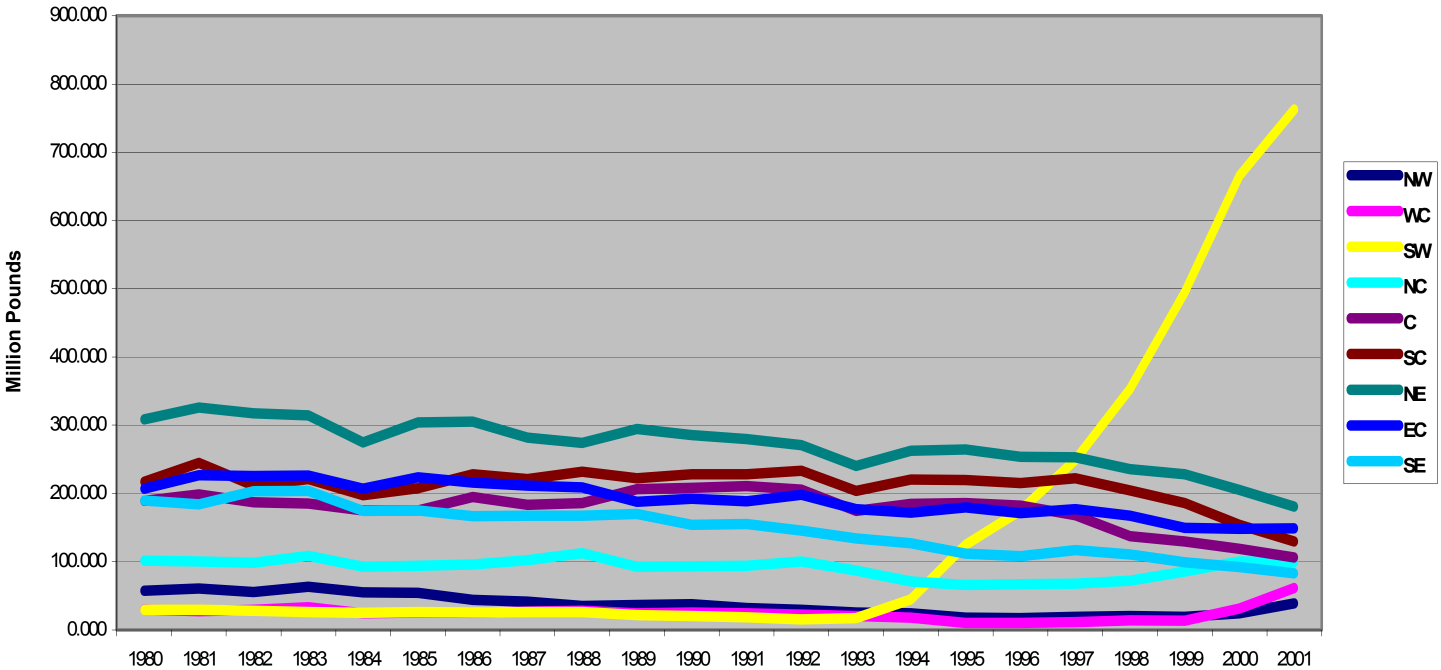
KANSAS DAIRY COW INVENTORY (Figure 2)
January 1



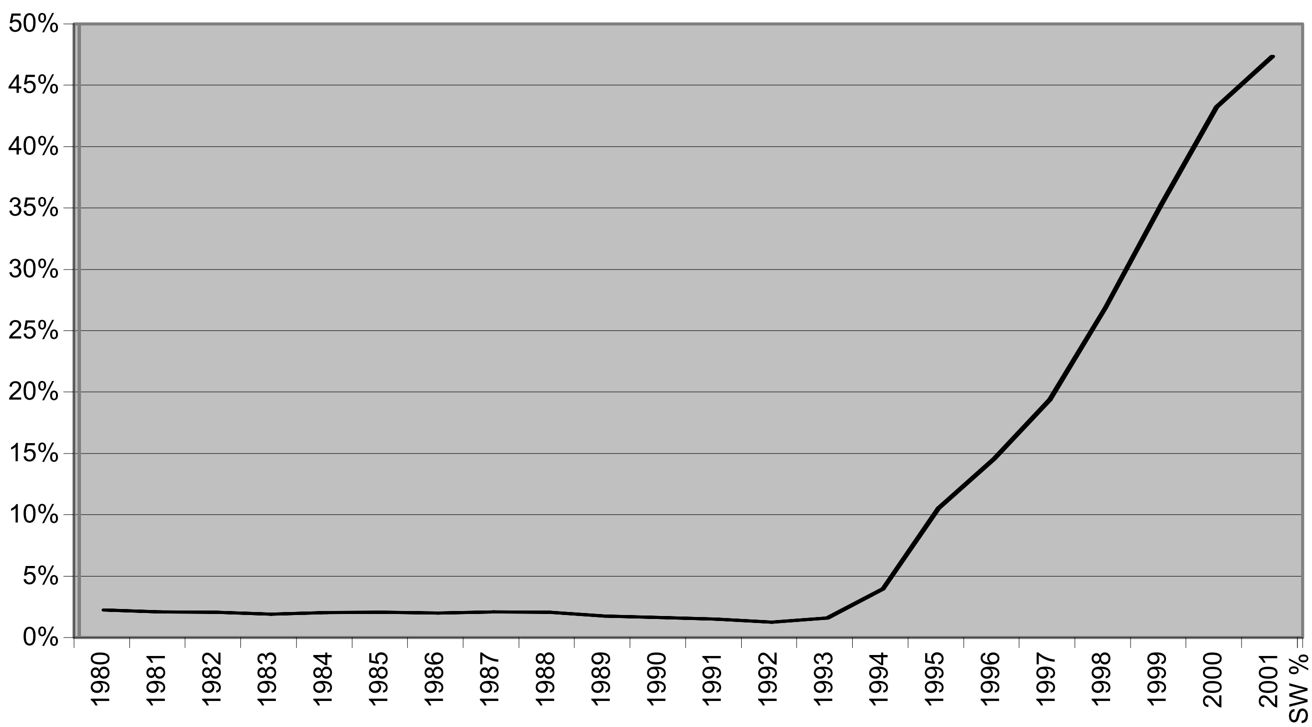
KANSAS DAIRY REPLACEMENT HEIFERS (Figure 3)
January 1



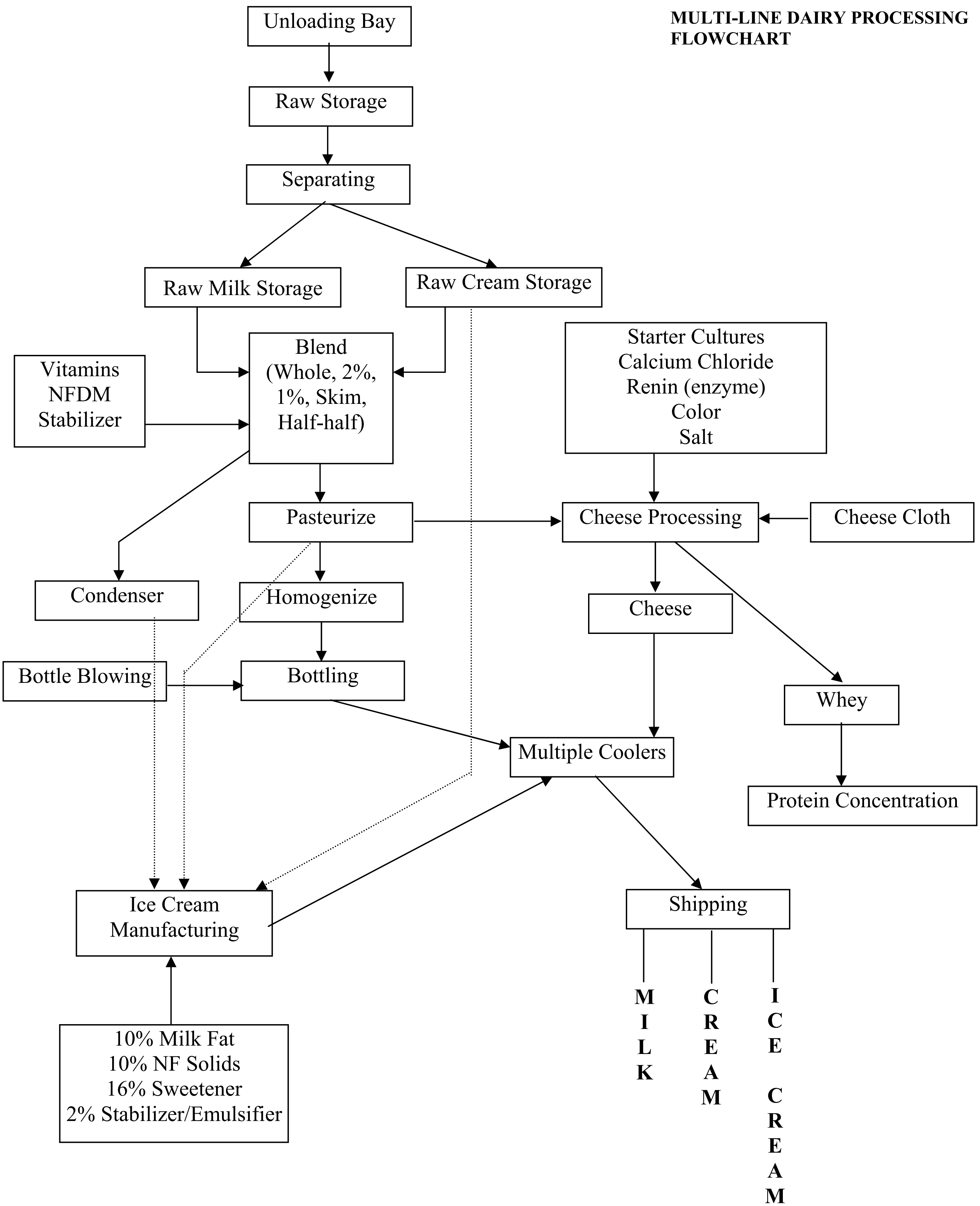
KANSAS MILK PRODUCTION (Figure 4)
By Kansas AG Statistics Reporting Districts



SOUTHWEST PRODUCTION DISTRICT (Figure 5)
As Percent of Total Kansas Production



(Figure 6)
STRUCTURE OF A DAIRY PROCESSSING PLANT



Raw Milk: Dairy processing starts with raw whole milk. On average, the milk that comes from a milking center will contain 87% water and 13% solids. The solids will be made up of about 3.7% fat solids and 9% non-fat solids. The fat solids carry the vitamins A, D, E, and K. The non-fat solids include protein levels that average 2.9%. It is delivered to the processing center at a temperature between 36 and 42 degrees Fahrenheit.

Unloading/Receiving Bay: The milk is delivered to the processing center in tanker trucks. In some instances, small processing centers are located near the milking center allowing for direct delivery of the raw milk to the processing center through a pipe. An enclosed, all-weather unloading bay is required for sanitary delivery of raw milk. This area must provide a system to adequately clean and sanitize the truck after the milk is unloaded.

Raw Milk Storage: Dairy Processing Centers will normally have significant raw milk storage. Small processing centers that are located near a milking center may be able to get by with less raw storage. Most processing plants are not comfortable with storage that is less than the amount of milk that will be utilized in one day.

Separation: The first step in processing is separation. No matter what product is to be produced, the raw milk goes through a separation process. In theory, 100% of the fat is removed and then re-blended to the different fluid products that are to be processed. In practice, some of the fluid and a small amount of non-fat solids are removed with the fat solids. Some plants do not separate all the fat and then re-blend. Instead, they remove (separate) only the fat that needs to be removed for the product being bottled.

The separation process involves separating the 96.3% water and other non-fat solids from the 3.7% fat solids. In some arrangements, the separation process simply removes the amount of fat solids that are needed to push the amount of fat solids contained in the milk down to 3.25% in order to reach the minimum required for whole milk. In other situations, all of the fat solids are removed and then added back to the water to push the fat solids up to the desired level. The excess fat solids (cream) that are not used for the fluid milk process are used to make other dairy products (primarily ice cream) or sold for use in other food manufacturing (i.e. candy).

Raw processing: This consists of putting the raw whole milk through a separator to produce raw skim milk (96.5% water and other non-fat solids) and raw cream. Raw skim milk will be piped to a raw skim storage tank, while the cream will be piped to raw cream storage. There are very few dairy processing operations that would not require a separation process.

Multi-Line versus Single Line Processing: The process for milk processing moves in different directions from this point, based upon whether or not the facility is a Multi-Line (several products) facility or a Single-Line facility. For sake of explanation, the following is a description of a Multi-Line processor that bottles Fluid Milk and manufactures Cheese and Ice Cream.

Multi-Line Processing: After the separation process in a Multi-line operation, the cream and skim can be **blended** for any product. This study assumes that the products will be fluid milk products, cheese or ice cream. Dried milk could also be made, but is more suited to large processing plants since the equipment for this process is relatively more expensive than the other products. In addition, dried milk is a commodity and doesn't allow for product differentiation or niche marketing.

A multi-line processing plant would likely sell as much milk as possible into the high-priced fluid market. The raw milk and raw cream would be re-blended for whole milk, 2% milk, 1% milk, skim and flavored milks such as chocolate or strawberry. Additives such as vitamins, non-fat dry milk and stabilizers will be added when the milk products are blended.

Half and Half can also be produced in a multi-line plant by utilizing the fat solids (cream) that has been separated.

Most of the fluid milk volume will be in whole milk and 2% milk (67% of the total fluid milk business). With milk averaging 3.6% fat, there will be excess cream. This can be stored for a short period and used in ice cream or cheese. If not used in these products, it would be sold to another processor.

After blending, the milk would be **pasteurized and homogenized** before going to a **bottling** machine. The milk would be packaged into plastic bottles. Bottles can be purchased ready to fill, however, moderate to large operations will find it economical to purchase bottle blowing equipment. Plastic beads can be shipped more economically. Bottles made at the processing plant are much cheaper than shipping empty jugs. Milk sold into the school programs would require equipment for the ½ pint paper containers.

After bottling, the fluid products will have to be stored in a cooler until they can be shipped to retail outlets (or direct to consumers). The cooler will have to be large enough to hold at least one day's production.

WHOLE MILK CONVERSION

(Approximate Number as Actual Results will vary)

To make one pound of	Requires
Butter	21.2 lbs whole milk
Whole Milk Cheese	10.0 lbs whole milk
Evaporated Milk	2.1 lbs whole milk
Condensed Milk	2.3 lbs whole milk
Whole Milk Powder	7.4 lbs whole milk
Powdered Cream	13.5 lbs whole milk
Ice Cream (1 gal)	12.0 lbs whole milk
	(15 pounds when including butter and concentrated milks)
Cottage Cheese (Dry Curd basis)	7.25 lbs skim milk
Non-fat Dry Milk	11.00 lbs skim milk

FLUID MILK PRODUCTS

Whole Milk: Contains not less than 3.25% milk fat (fat solids) and 8.25% non-fat solids. Addition of vitamins A and D is optional, but if added, vitamin A must be present at a level of not less than 2,000 International Units (I.U.) per quart. If added, vitamin D must be present at 400 I.U. per quart.

Cultured Milk: Contains not less than 3.25 percent milk fat (fat solids) and 8.25% non-fat solids. Culturing any of the following milk products alone or in combination produces it: cream, milk, partially skimmed milk or skim milk. Culturing normally involves the addition of certain charactering ingredients and lactic-acid producing bacteria. An example of cultured milk is buttermilk.

Half and Half: Consists of a mixture of milk and cream containing not less that 10.5% milk fat, but less than 18% milk fat.

Light Cream: Contains not less than 18% milk fat, but less than 30%. Light cream may also be called "coffee cream" or "table cream."

Light Whipping Cream: Contains not less than 30% milk fat, but less than 36% milk fat. May also be called "whipping cream."

Heavy Cream: Contains not less than 36% milk fat. Heavy cream may also be called "heavy whipping cream."

Sour Cream: The product resulting from the addition of lactic acid-producing bacteria to pasteurized cream containing not less than 18% milk fat. Sour cream may also be call "cultured sour cream."

Dry Curd Cottage Cheese: A soft, unripened cheese made from skim milk and/or reconstituted nonfat dry milk. The cheese curd is formed by the addition of either lactic acid-producing bacteria (cultured) or acidifiers (directly adding lactic acid). The latter process is called direct acidification. Rennet and/or other suitable enzymes may be used to assist curd formation. Dry curd cottage cheese contains less than .5% milk fat and not more than 80% moisture. The product may also be called "cottage cheese dry curd."

Cottage Cheese: The product resulting from the addition of a creaming mixture (dressing) to dry curd cottage cheese. Cottage cheese contains not less than 4% milk fat and not more than 80% moisture.

Yogurt: The product resulting from the culturing of a mixture of milk and cream products with lactic acid-producing bacteria, Lactobacillus bulgaricus and Streptococcus thermophilus. Yogurt contains not less than 3.25% milk fat and 8.25 percent non-fat solids.

Low fat Yogurt: Similar in composition to yogurt except that it contains not less than .5% milk fat and no more than 2% milk fat.

Nonfat Yogurt: Similar in composition to yogurt except that it contains less than .5% milk fat.

Evaporated Milk: Evaporated milk is made by removing about 60% of milk's water. It contains not less than 6.5% milk fat, not less than 16.5% non-fat solid; and not less than 23% by weight of total milk solids. Evaporated milk is a heat-sterilized product with an extended shelf life with a yellowish color and cooked flavor.

Sweetened Condensed Milk: This product results from the removal of about 60% of the water from a mixture of milk (whole and nonfat pasteurized, homogenized milks) and carbohydrate sweeteners such as sucrose. This product contains not less than 8% milk fat and not less than 28% total milk solids. It is obtained by removal of water only from pasteurized skim milk (unless otherwise indicated).

Nonfat Dry Milk: Nonfat dry milk is made by removing water from pasteurized skim (non-fat or fat free) milk. The product contains not more than 5% by weight of moisture, and not more than 1.5% by weight of milk fat (unless otherwise indicated).

FLUID MILK PROCESSING

The processing and selling of fluid milk products has been the backbone of the dairy/milk industry, but is also the industry that has suffered from extreme competition from other fluid products in the past two decades. Carbonated beverages, juices, sports drinks, bottled water and beer are some of the products that have inhibited the growth in per-capita consumption of fluid milk. Twenty-years ago, a fluid milk bottler would have been involved in the fluid milk business exclusively, but today these entrepreneurs now consider themselves "bottlers" and now bottle many other products other than milk products.

This move has become imperative, as bottlers have realized that the fixed costs of processing require that a plant operate at full capacity. Therefore, with the lack of growth in the per capita consumption of milk, bottlers have utilized their plant by bottling water, juice and sports drinks. In addition, distribution costs have increased dramatically and it has become economical for fluid milk bottlers to process the additional items for marketing and distribution. Many distributors and retailers would rather do business with a processor who provides a full line of fluid products, and that has also been an incentive for traditional fluid milk bottlers to add these other products to their processing line.

The improved technology has increased efficiency dramatically. The ability to process large volumes of fluid product with reduced labor costs and reduced packaging costs has lead to a dramatic decrease in margins. Therefore, as margins have become tighter, there has been a continued move to larger scale plants and increased concentration in the fluid milk processing business.

The increase in concentration in the fluid milk processing has made it very difficult for small processors to survive in this business. Small processors are normally not able to establish contracts to process additional product lines (i.e. juices and water), which results in their fixed costs being higher, and are shut out of many markets.

Therefore, small fluid milk processors are forced to work to establish a niche in the fluid milk market. These niches come from promoting their milk in the following ways:

- **Better Flavor.** More solids in their milk, which creates a smoother taste. Many consumers prefer this taste and will pay a premium for this product. This is done by acquiring certain qualities of milk and processing the milk in a manner that the consumer can differentiate the taste. One concern with this market is that consumers have been looking to reduce fat in their milk.

- **Increased Shelf Life.** Small producer/handlers of fluid milk will many times promote a longer shelf life for their fluid product. This has become difficult to maintain as distribution costs have made it difficult to run routes to retailers on a daily basis. Therefore, small processors have found it difficult to demonstrate increased shelf life versus large processors.

- **Perceived Quality.** There is a significant sector of the U.S. economy that is attracted to the idea of buying high quality products from small processors who "control their quality" and create an image of high quality. These consumers are likely to pay a premium for this perceived quality. The critical aspect of this marketing plan is that a small processor must be located near a large metropolitan area, as the percentage of consumers that will move their buying habits for fluid milk to this perceived quality is small (likely less than 10% of a given market area).

- **Organic.** Another segment of differentiation is the organic sector. Small processors are able to capture significant consumer markets that desire to buy fluid milk, which is produced organically. This market requires a substantial premium and is susceptible to dramatic changes in consumer preference.

- **Packaging.** Small processors have also created niche markets centered on attractive packaging (glass bottles & decorative containers). Glass containers many times create a perceived quality. Once again, this is a small percentage of the total market (less than 3%); therefore, marketing into a large metropolitan area with a high-income level is critical.

- **Direct Delivery (Home Delivery).** There is also a sector of the consumer market that will pay a premium for direct delivery of fluid milk. Once again, the marketing plan is based on selling a perceived or real improvement in quality. The costs of distribution for this market have made it very difficult, as consumers have to be willing to pay a premium and work with the processor to find methods to accept delivery of, and pay for, the milk.

In all of the cases listed above, it is critical that the process be located near a large metropolitan area, as the milk in these markets is small and consumer preferences can change dramatically. Because fluid milk has become a commodity in the eye of most consumers, they have become very sensitive to price. Therefore, fluid milk producers will gravitate to the lowest price for fluid milk. In many cases they will develop brand loyalty, but have a difficult time distinguishing between the other fluid milk products sold by large “bottlers.” In other words, consumers may develop some loyalty, but it is very unpredictable for fluid milk, and it is difficult to differentiate.

In comparison, a large number of consumers can differentiate between two different carbonated beverages (i.e. Coke and Pepsi), but they are unable to differentiate between two different brands of whole milk (especially if they are in the same type of container) and will gradually move to the lowest price.

Therefore, it is not economical for a small milk processor to work exclusively with fluid milk. The only successful small fluid process would require a small multi-line plant that could market a small percentage of its milk in the fluid market by utilizing one (or more) of the niches listed above.

FLUID MILK CONSUMPTION AND PRODUCTION

Fluid milk (Class I) is the market that receives the bulk of the milk production in the United States. U.S. milk production is now 170 billion pounds annually and about 56 billion pounds is used to produce and consume fluid milk and fluid milk products (listed below). Therefore, approximately 33% of the U.S. milk production moves into the fluid milk product market.

An indicator of how this market has struggled is the fact that just twenty years ago, 41% of the total milk production in the U.S. was used in the fluid milk product market. Since that time, per capita consumption of fluid milk products has dropped from 235 lbs. to 195 lbs. (despite the introduction of numerous new products) as a result of extreme competition from other products. The per capita consumption drop has been somewhat directly correlated with the growth in the convenience store sales. Convenience stores have increased the sales of many products, but fluid milk products have not kept pace with the new products (carbonated beverages, juice, water, beer). One significant factor has been the lack of innovation in the fluid milk business to provide a bottle that was marketable (convenient) to consumers at the convenience store. Recent innovations in bottling have resulted in some improvement in this packaging, but the industry lost a large amount of ground from 1980 to 2000.

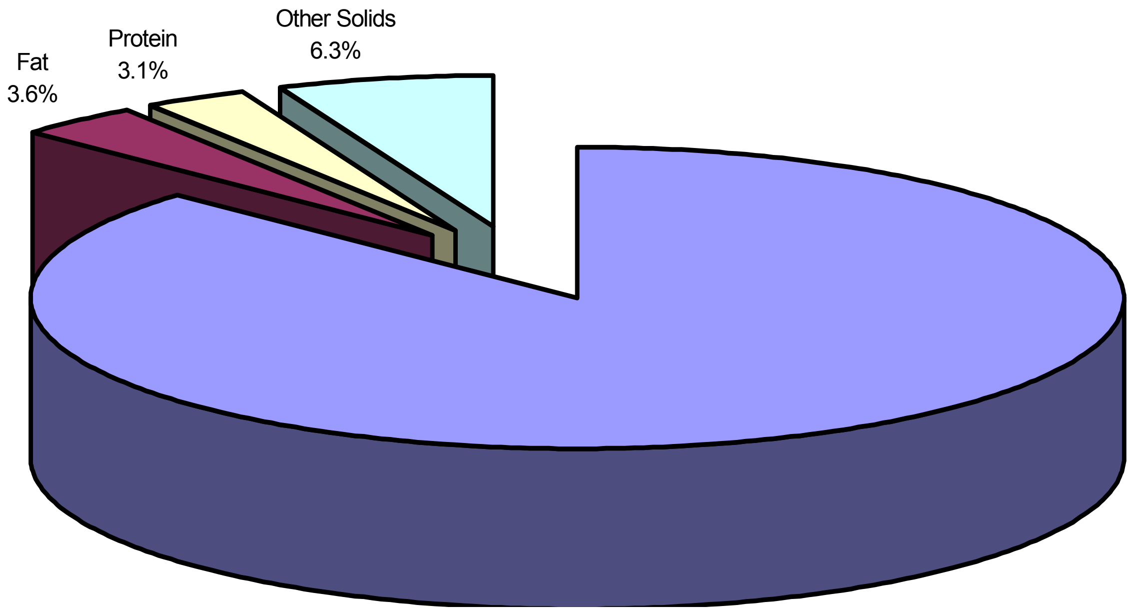
During that period, total U.S. milk production grew from 128 to 167 billion pounds. At the same time, total fluid milk product consumption increased from 53 to 55 billion pounds. Obviously, the growth in the use of U.S. milk has been in products other than fluid products.

A typical fluid milk product plant will likely have the following sales distribution:

Whole Milk	35%
Reduced Fat (2%)	32%
Low Fat (1%)	16%
Non Fat (Skim)	15%
Buttermilk or Half &Half	2%

Financial projections for fluid milk processing are discussed later in section—**Financial Numbers in Dairy Processing.**

COMPONENTS OF MILK (Figure 7)



CHEESE
(Figure 7)

U.S. Production of Cheese

From 1999 through 2001, 37 percent of the milk produced in the U.S. was used for manufacturing cheese. Approximately 44 percent of the cheese manufactured is American type with the remaining 56 percent being other types of cheese. Over three-fourths of the American cheese is Cheddar cheese. Other American cheeses include Colby, Monterey and Jack. Italian cheeses make up approximately 41 percent of the U.S. cheese production. Mozzarella makes up 80 percent of the Italian cheeses. Mozzarella has shown a phenomenal growth from 688 million pounds in 1980 to 2.633 billion pounds in 2000. The primary demand factor behind this growth has been the increasing consumption of pizza. Other Italian cheeses include Ricotta, Provolone, Romano, and Parmesan. The remaining 15 percent of the U.S. market—other category—includes Swiss, Muenster, Brick, Limburger, Cream & Neufchatel, Bleu and Hispanic, as well many other specialty varieties.

Basic Process of Making Cheese

The basic principal involved in making all natural cheese is to coagulate or curdle the milk so that it forms into curds and whey. As anyone knows who has left milk un-refrigerated for a period, milk will curdle quite naturally. The milk sours and forms into an acid curd.

Today's methods help the curdling process by the addition of a starter (a bacterial culture which produces lactic acid) and rennet, the coagulating enzyme, which speeds the separation of liquids (whey) and solids (curds). There are two basic categories of starter cultures. Mesophilic starter cultures have microbes that cannot survive at high temperatures and thrive at room temperatures. Examples of cheeses made with these bacteria are Cheddar and Gouda. Thermophilic starter cultures are heat-loving bacteria. They are used when the curd is cooked to as high as 132 degrees F. Examples of cheese made from these bacteria are Swiss and Italian cheeses. (Table 2)

The least sophisticated cheeses are fresh, unripened varieties typified by Cottage Cheese. These are made by warming the milk and letting it stand, treating it with a lactic acid starter to help the acid development and then cutting and draining the whey from the cheese. The cheese can then be salted and eaten fresh. This is the simplest, most basic form of cheese.

Acidification: Generally, cheese making starts with acidification. This is the lowering of the pH (increasing acid content) of the milk, making it more acidic. Classically, this process is performed by bacteria. Bacteria feed on the lactose in the milk and produce lactic acid as a waste product. With time, increasing amounts of lactic acid lower the pH of the milk. Acid is essential to production of good cheese. However, if there is too much acid in the milk, the cheese will be crumbly. If not enough acid is present, the curd will be pasty.

Rennet: After acidification, coagulation begins. Coagulation is converting milk into curds and whey. As the pH of the milk changes, the structural nature of the casein proteins changes, leading to curd formation. Essentially, the casein proteins in the milk form a curd that entraps fat and water. Although acid alone is capable of causing coagulation, the most common method is enzyme coagulation. The physical properties of enzyme-coagulated milk are better than that coagulated purely with acid. Curds produced by enzyme coagulation achieve lower moisture content without excessive hardening.

Enzymes used to coagulate milk come from a number of sources: animal, plants, and fungi. The traditional source of enzyme is rennet. Rennet is a preparation made from the lining of the fourth stomach of calves. The most important enzyme in rennet is chymosin. Today, most chymosin is a recombinant product made possible by genetic engineering. Until 1990, the only source of rennin was calves. Around 1990, scientists created a system to make chymosin that doesn't require calves. Using genetic engineering, the gene for chymosin was cut from a calf cell and inserted into genomes of bacteria and yeast. The microbes make an exact copy of the calf chymosin. Microbes replicate and grow rapidly, and can be grown continuously. Thus, the supply of rennet is assured. Approximately 70 percent of the cheese made in the U.S. is coagulated using chymosin. The chymosin made by the yeast cells is the same as that made by the calf cells.

Cutting and Pressing the Curd: After the coagulation sets the curd, the curd is cut. This step is usually accompanied with heating the curd. Cutting the curd allows the whey to escape, while heating increases the rate at which the curd contracts and squeezes out the whey. The purpose of this stage of the process is to make a hard curd. The term hard curd is relative; the cheese at this stage is still quite pliable. The main difference between a soft curd and a hard curd is the amount of water remaining in the curd. Hard curds have very little water left in them.

Once the curds have sufficiently hardened, salting and shaping begins. In this part of the process, salt is added to the cheese. Salt is added for flavor and to inhibit the growth of undesirable microbes. Large curds are formed as smaller curds are pressed together. This will often involve the use of a cheese press.

Ripening: The shaped cheese is allowed to ripen or age for various periods of time. During this time, bacteria continue to grow in the cheese and change its chemical composition, resulting in flavor and texture changes in the cheese. The type of bacteria active at this stage in the cheese making process and the length of time the cheese is aged determine the type and quality of cheese being made.

The ripening process varies widely depending on the type of cheese being made. The shortest ripening period is for mozzarella or mild cheddar. Sharp cheddars are often ripened for 8-9 months. One of the longer ripened cheeses is Parmesan, which is ripened a minimum of 10 months in the U.S., but it may be ripened 2-3 years in Europe. Swiss cheese is normally ripened 7 to 9 weeks. Provolone is the same as mozzarella, but is aged several weeks.

Sometimes an additional microbe is added to the cheese. Blue-veined cheeses are inoculated with a penicillium spore, which creates their aroma, flavor and bluish or greenish veining. Such cheeses are internally molded and ripen from the inside out. On the other hand, cheeses such as Camembert and Brie have their surfaces treated with a different Penicillium spore, which creates a downy white mould (known as a bloomy or flowery rind). This makes them surface-ripened cheeses.

Many surface-ripened cheeses have surfaces smeared with a bacterial broth. With others, the bacteria are in the atmosphere of the curing chambers. These cheeses are called washed rind varieties, as they must be washed regularly during their ripening period (longer than for Camembert or Brie) to prevent their interiors from drying out. The washings also help promote an even bacterial growth across the surfaces of the cheeses. As this washing can be done with liquids as diverse as salt water and brandy, it also plays a part in the final flavor of the cheese.

Rinds. The rinds of the cheeses are formed during the ripening process, many quite naturally. Some are created artificially. Rinds may be brushed, washed, oiled, treated with a covering of paraffin wax, or simply not touched at all. Traditional Cheddars are wrapped around with a cotton bandage. The rind's basic function is to protect the interior of the cheese and allow it to ripen harmoniously. Its presence thus affects the final flavor of the cheese. Salting plays an important role in rind formation. Heavily salted cheeses develop a thick, tough outer rind, typified by the Swiss range of cheeses. Cheddar, another natural rind cheese, is less salted than the Swiss varieties, and consequently has a much thinner rind.
(http://www.geocities.com/Heartland/Cottage/1288/intro/Intro.htm)

Economics of Cheese Processing

On average, it takes approximately 10 pounds of milk to make a pound of cheese. In a study of cheddar cheese plants done by Cornell in 1985, the cheese yields ranged from 9.43 to 10.27 pounds of cheese from every 100 pounds of milk processed. The highest yielding plants obtained nearly 9 percent more cheese from the same amount of milk.

There are two main systems for manufacturing cheddar cheese. The older "cheddaring" process has two basic steps: a) matting of the curd and, b) cutting the curd mat into blocks and continuing the operation of piling and repiling curd blocks for about two hours. The purpose is to control bacterial growth, to obtain more uniform structure of the cheese, to control cheese moisture, and to attain a proper texture of the curd. The newer process is called "stirred curd" where rennet coagulated cheddar-style cheeses are made without cheddaring. The curd is not matted and milled; instead the curd is stirred continually until placed in hoops. Omission of the cheddaring step makes stirred curd cheese making simpler and shorter, but higher risks to undesirable bacteria growth if milk quality is poor.

On average, the stirred curd method yields about two-tenths of a pound more cheese per 100 pounds than cheddaring. The stirred curd process takes approximately 4.5 hours from the time the milk is pasteurized, compared to 5.5 hours for the cheddaring process. (Figure 8)

Each type of cheese has it own process. Some of the different processes were described in the preceding section on Basic Cheese Making. It is outside the scope of this study to define each of the processes specific to every variety of cheese made in the U.S.

Most cheese processing is found where milk is produced. For example, the two largest cheese-producing states are Wisconsin and California. Economics of transportation provide incentives for cheese plants to be operated in rural areas, relatively far from population centers (compared to fluid processing which must be located relatively close to population). Two economic factors drive this. First, is the fact that milk is cheaper the farther it is from population centers. The bigger factor is that cheese weighs only 10% of the equivalent weight of the milk. This results in significant savings in freight. It costs approximately 40 cents per hundredweight to ship milk 100 miles. It would cost $2000 to ship a truckload of raw milk 1000 miles. Cheese can often be shipped 2000 miles for 6 cents a pound. This would be $1500 for 1000 miles. A truckload of cheese is equal to 10 loads of milk. Therefore, the cost of shipping a truckload of cheese 1000 miles is $1500 versus $20,000 required to ship the 10 loads of milk that were made into that truckload of cheese.

Cheese can be stored. However, as cheese is stored, its properties change. As discussed above, microbes constantly change the cheese. Some cheddars are marketed with only 10 days aging while others, usually with a much sharper flavor, are aged 6 months or more. A multi-line plant balance could use cheese production as a balancing mechanism, increasing production as milk output rises, and cutting as seasonal production falls. It is difficult to meet marketing requirements of customers who do not want seasonal fluctuations in their supplies. The stored cheese could be used to buffer the seasonal fluctuations in production, but differences in aging would probably mean differences in cheese flavor or quality.

Cheddar cheese and mozzarella can be considered commodity cheeses. They are made in large volume, mainly by large plants with very little aging. Other types of cheeses, particularly the specialty cheeses, require more time for aging or more special steps in the making or ripening, and often are more labor-intensive. These types of cheeses, in many cases, do not fit the assembly line requirements of the large plants. This is an area where small or moderate-sized plants may develop a niche with a high quality, special flavored cheese.

Table 2
Important lactic acid bacteria in the dairy industry

Species	Optimum temp. °C	Fements lactose		Ferments citric acid to	Protein-splitting enzymes	Used in
		to lactic acid %	to other substances			
Str termophilus	40 - 45	0.7 – 0.8	--	--	Yes	Acidified milk, cheese
Lc lactis	25 – 30	0.5 – 0.7	--	--	Yes	Acidified milk
Lc cremoris	25 – 30	0.5 – 0.7	--	--	Yes	Acidified milk
Lc diacetylactis	25 – 30	0.3 – 0.6	--	CO_2 volatiles, diacetyl	Yes	Acidified milk, cheese, butter
Leuc cremoris	25 – 30	0.2 – 0.4	CO_2	CO_2 volatiles, diacetyl	Yes	Acidified milk
Lb acidophilus	37	0.6 – 0.9	--	--	--	Acidified milk
Lb casei	30	1.2 – 1.5	--	--	Yes	Cheese
Lb lactis	40 – 45	1.2 – 1.5	--	--	Yes	Cheese
Lb helveticus	40 – 45	2.0 – 2.7	--	--	Yes	Acidified milk, cheese
Lb bulgaricus	40 – 45	1.5 – 2.0	--	--	Yes	Acidified milk
Bifidobacterium	37	0.4 – 0.9	Acetic acid	--	--	Acidified milk

Str = Streptococcus   Leuc = Leuconostoc
Lc = Lactococcus   Lb = Lactobacillus

Time Schedule for making cheddar cheese from pasteurized and heat-treated milks using a granular or stirred curd process.

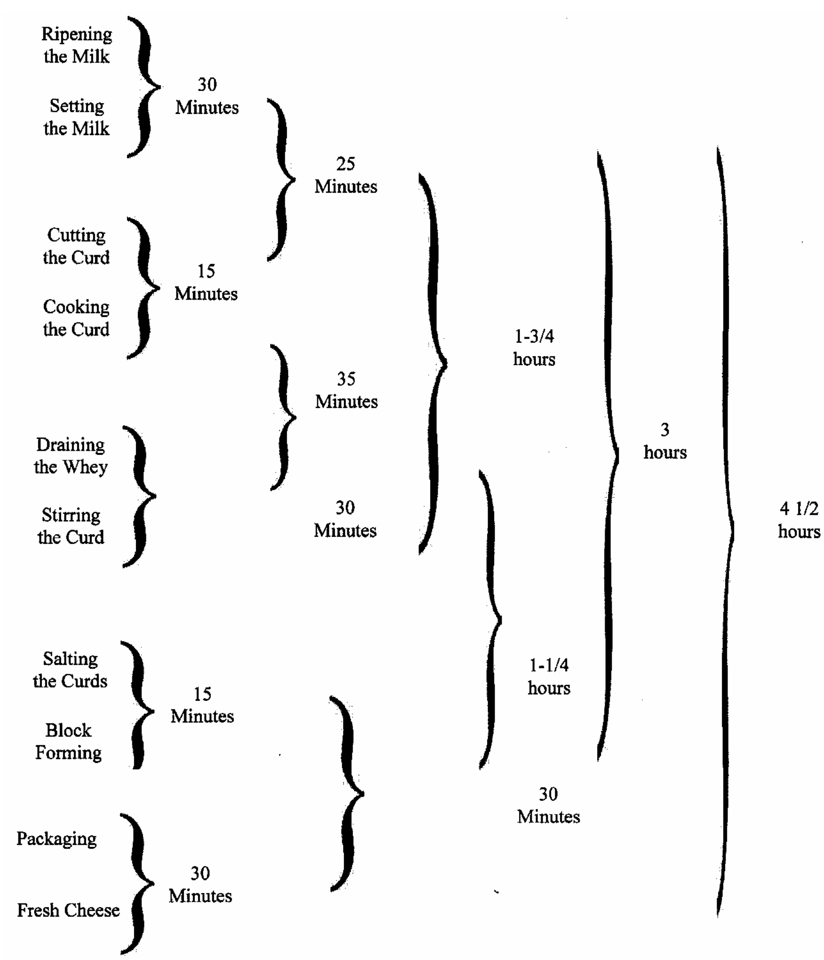


Figure 8

Source: Adapted from observed current manufacturing practices; Kosikowski, 1982; Lilwall, 1971; and Wilster, 1964.

Table 3
Classification of cheese

If the MFFB* is, %	Term I The 1st phrase in the designation shall be	If the FDB** is, %	Term II The 2nd phrase in the designation shall be	Term III Designation accounting to principal curing characteristics
<41	Extra hard	>60	High fat	1. Cured or ripened
49 – 56	Hard	45 – 60	Full fat	a. mainly surface
54 – 63	Semi-hard	25 – 45	Medium fat	b. mainly interior
61 – 69	Semi-soft	10 – 25	Low fat	2. Mould cured or ripened
>67	Soft	<10	Skim	a. mainly surface
				b. mainly interior
				3. Uncured or unripened***

* MFFB equals percentage moisture on fat-free basis, i.e.

$$\frac{\text{Weight of moisture in the cheese}}{\text{Total weight of cheese – weight of fat in cheese}} \times 100$$

** FDB equals percentage fat on dry basis, i.e.

$$\frac{\text{Fat content of the cheese}}{\text{Total weight of cheese – weight of moisture in cheese}} \times 100$$

*** Milk intended for this type of cheese to be pasteurized.

Examples:

Type	Origin	FDB	MFFB	Term 1
Parmesan	I	35+	= 40%	Extra hard
Grana	I	35+	= 41%	Extra hard
Emmenthal	CH	45+	= 52%	Hard
Gruyere	F	45+	= 52.5%	Hard
Cheddar	UK	50+	5%	Hard/Semi-hard
Gouda	NL	45+	= 57%	Semi-hard
Tilsiter	D	45+	= 57%	Semi-hard
Havarti	DK	45+	= 59%	Semi-hard
Bleu cheese	DK, F, S, etc.	50+	= 61%	Semi-hard/Semi-soft
Brie	F	45+	= 68%	Semi-soft
Cottage cheese	USA	>10	<69%	Soft

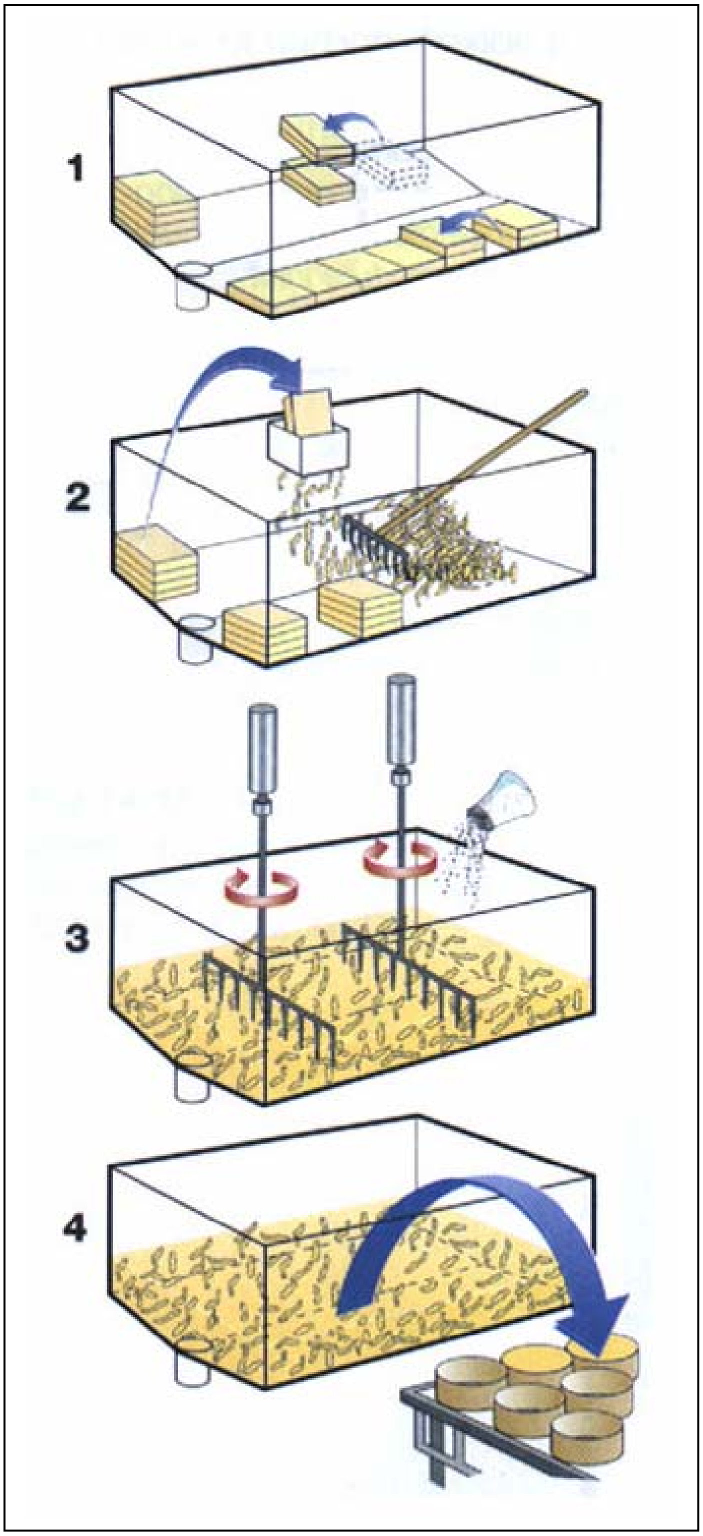


Figure 9 Process steps in making Cheddar-type cheese.

1. Cheddaring
2. Milling of chips
3. Stirring the salted chips
4. Putting the chips into hoops

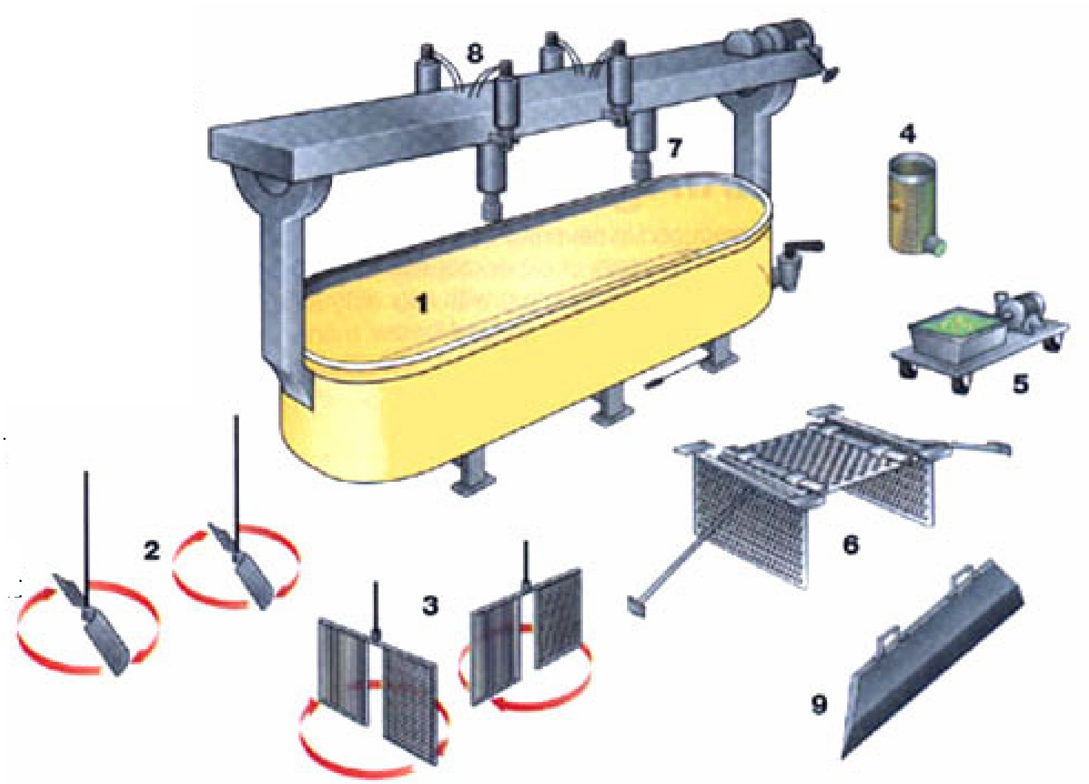


Figure 10 Conventional cheese vat with tools for cheese manufacture.

1. Jacketed cheese vat with beam and drive motor for tools
2. Stirring tool
3. Cutting tool
4. Strainer to be placed
5. Whey pump on a trolley with a shallow container
6. Pre-pressing plates for round-eyed cheese
7. Support for tools
8. Hydraulic cylinders for pre-pressing equipment
9. Cheese knife

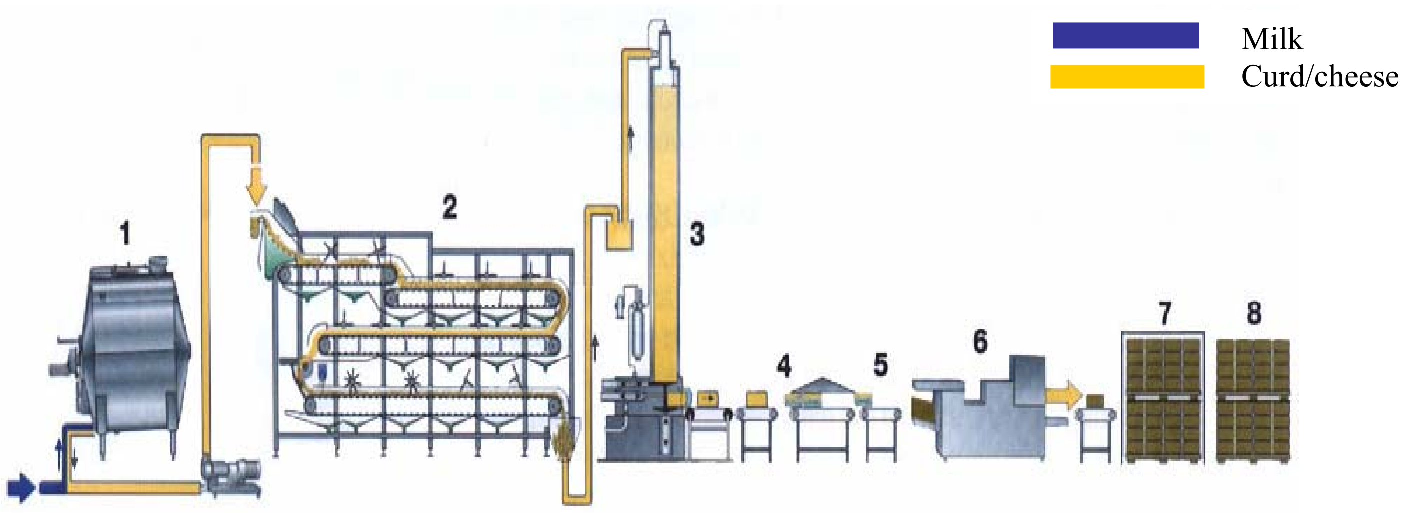


Figure 11 Flowchart for mechanized production of Cheddar cheese

1. Cheese vat
2. Cheddaring machine
3. Block former and bagger
4. Vacuum sealing
5. Weighing
6. Carton packer
7. Palletizer
8. Ripening store

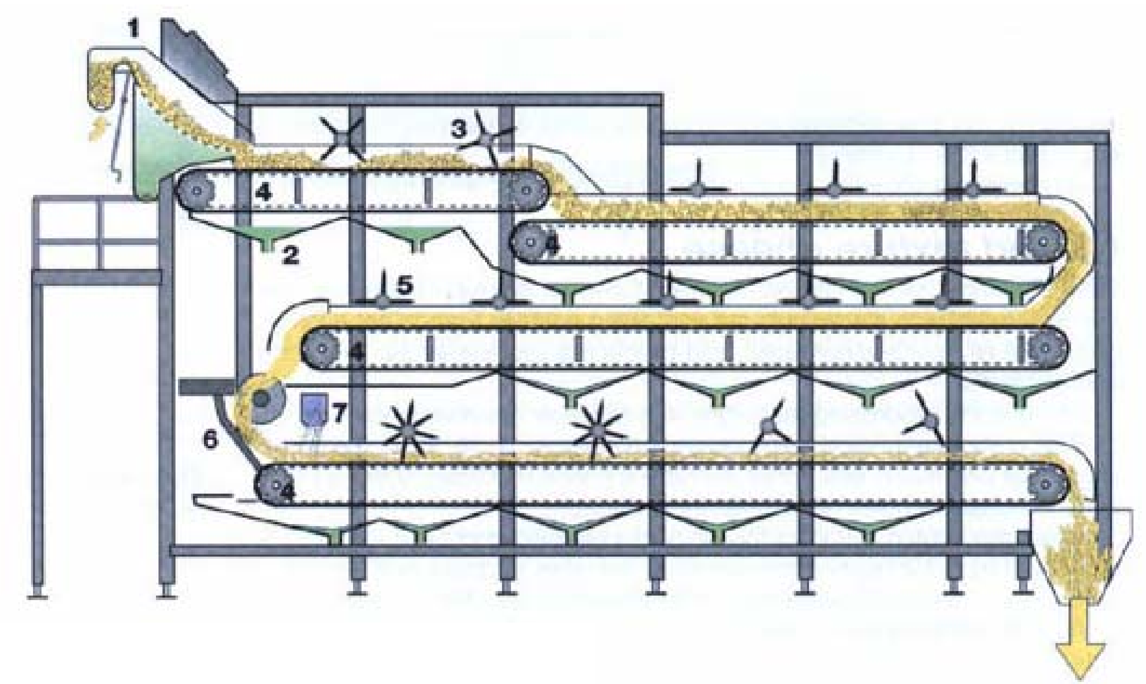


Figure 12 Continuous system for de-wheying, cheddaring, milling, and salting curd intended for Cheddar cheese.

1. Whey Strainer
2. Whey syrup
3. Agitator
4. Conveyors with variable-speed drive
5. Agitators (optional) for production of stirred curd Cheddar
6. Chip mill
7. Dry salting system

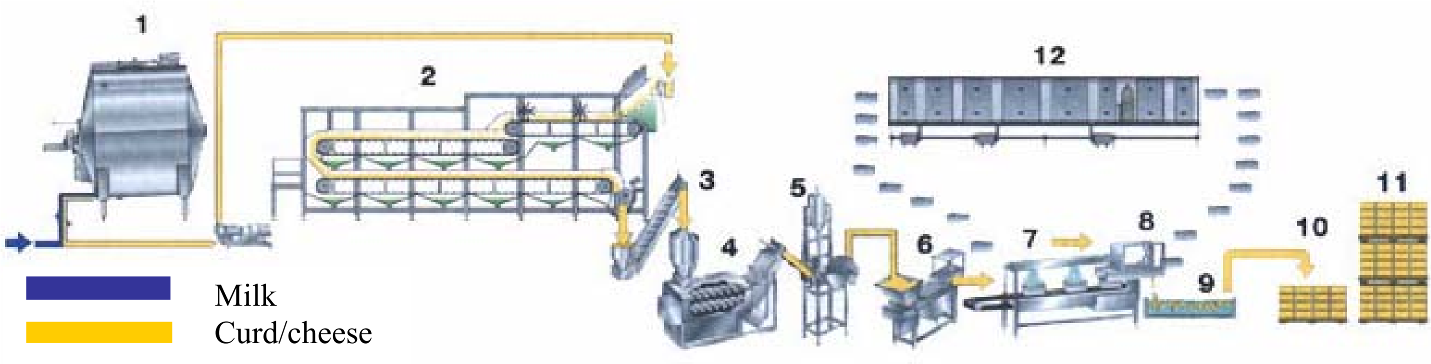


Figure 13 Flowchart for mechanized production of Mozzarella cheese.

1. Cheese vat
2. Cheddaring machine
3. Screw conveyor
4. Cooker/stretcher
5. Dry salting
6. Multi-moulding
7. Hardening tunnel
8. De-moulding
9. Brining
10. Palletising
11. Store
12. Mould washing

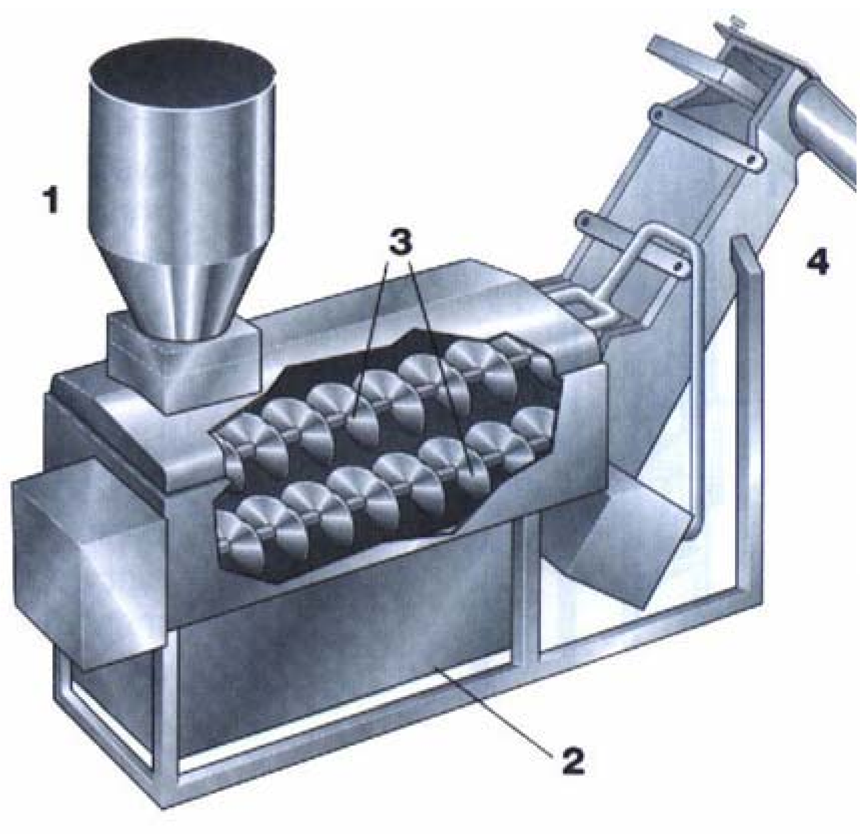


Figure 14
Continuous operating Cooker-Stretcher for Pasta.

Filata types of cheese.

1. Feed hopper
2. Container for temperature-controlled hot water
3. Two counter-rotating augers
4. Screw conveyor

ICE CREAM

Ice cream and other frozen dairy products represent an extremely diverse variety of products. Ice cream is a frozen food made from a mixture of dairy products, such as milk, cream, and non-fat milk, combined with sugars, flavorings, fruits, nuts, etc. If the ice cream contains at least 1.4% egg yolk it is called French ice cream. Both regular ice cream and French ice cream must contain 10% milk fat and weigh at least 4.5 pounds of solids per gallon with a minimum of 1.6 pounds solids per gallon. Light ice cream has less than 50% of the fat of regular ice cream. Sherbet, both fruit sherbets and those with non-fruit flavors, contain between 1 and 2 percent milkfat and weigh not less than 6 pounds per gallon. Water ices are similar to sherbet but contain no dairy ingredients. Mellorine is a frozen desert similar to ice milk in which the milkfat is replaced, wholly or partially, with vegetable fat and the minimum fat content is 6%. (The Latest Scoop)

Basic Ice Cream Making

The basic mix for the manufacture of ice cream is cream and other milk ingredients, plus sweeteners. The ingredients of the mix are carefully blended in proper proportions in a mixing tank. The mix may also contain small amounts of functional ingredients, such as a stabilizer, which prevents the formation of ice crystals in the ice cream after it is frozen. (Table 4)

The mix then goes to a pasteurizer where it is heated and held at a pre-determined temperature for a specific time. The most common type of pasteurization is the high-temperature-short-time (HTST) method in which the mix is heated to 175 degrees F and held for 25 seconds.

The hot mix then goes to the homogenizer where, under pressure of 2,000 to 2,500 pounds per square inch, the milkfat globules are broken down into still smaller particles to help make the ice cream smooth.

After homogenization, the hot mix is quickly cooled to a temperature of about 40 degrees F. Next, freezing of the mix is accomplished by one of two methods: a "continuous freezer," which uses a steady flow of mix; or a "batch freezer," which makes a single quantity of ice cream at a time.

Table 4

Typical ice cream formulas

Type of ice cream	Fat % wt	MSNF % wt	Sugar % wt	E/S % wt	Water % wt	Overrun % vol
Dessert ice	15	10	15	0.3	59.7	110
Ice cream	10	11	14	0.4	64.6	100
Milk ice	4	12	13	0.6	70.4	85
Sherbert	2	4	22	0.4	71.6	50
Water ice	0	0	22	0.2	77.8	0

Fat:	Milk, cream, butter or vegetable fat
Water:	May include flavoring or coloring matter
MSNF:	Milk solids-non-fat (protein, salts, lactose)
Sugar:	Liquid or solid sucrose (10% of sugar may be glucose or non-sugar sweetener)
E/S:	Emulsifier and stabilizer, e.g. monoglycerides, gelatin, alginate
Overrun:	Amount of air in product
Other ingredients:	Egg, fruit and chocolate pieces may be added during processing.

Figure 15 The ice cream process.

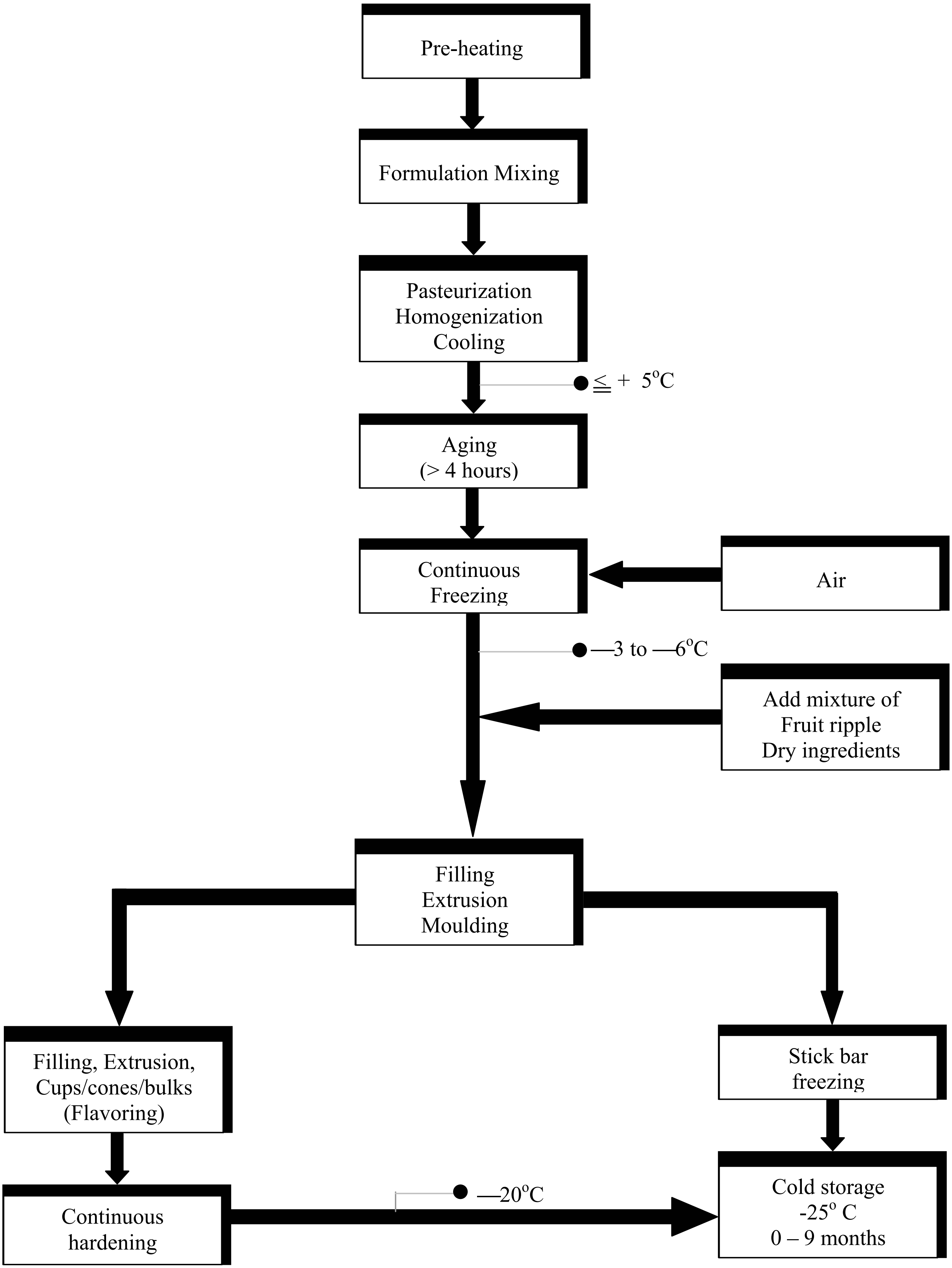
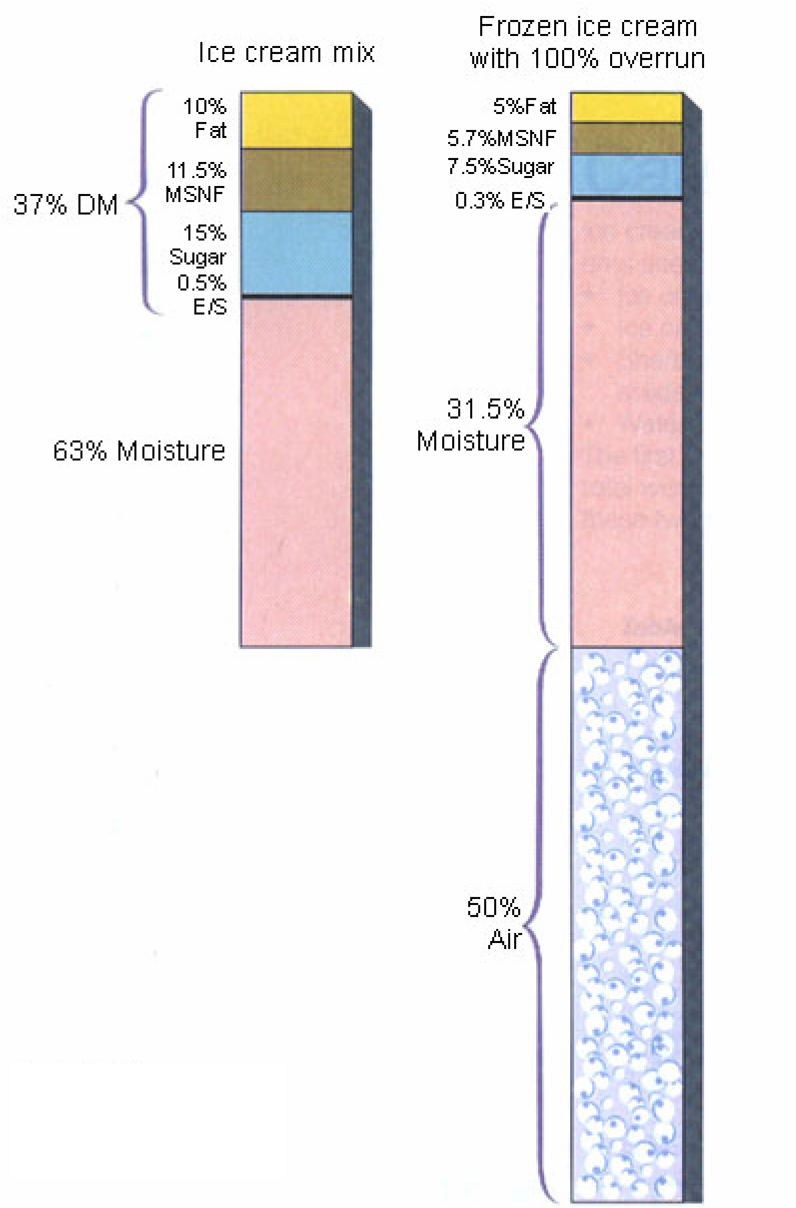


Figure 16
From ice cream mix to ice cream.



While ice cream is being frozen, blades in the freezer, or “dashers” as they are commonly called, whip and aerate the products. Without this aeration, the finished product would be an inedible, solidly frozen mass of cream, milk, sugar and flavoring. (Figure 16)

The products are then placed in containers for retail sale, ranging from large multi-gallon containers to half-gallon cartons to ice cream bars. After freezing and filling, ice cream goes to the “hardening room” where sub-zero temperatures further harden the ice cream. (Figure 15) (The Latest Scoop)

Ice Cream in Multi-line Processing

Ice cream is an excellent complement to fluid milk bottling. With fluid plants already having much of the milk processing equipment such as pasteurizers and homogenizers, relatively little equipment must be added to the plant. Mixers, ice cream freezers and filling equipment, as well as additional coolers for hardening and storing the ice, are needed. The fat (cream) that is removed from raw milk before bottling becomes the main ingredient of ice cream. Ice cream recipes are numerous, but they all follow some guidelines. Regular ice cream normally has 10% milkfat, 10% non-fat solids, 16% sweetener and 2% stabilizers/emulsifiers. The remaining fraction of the ice cream mix, approximately 60%, is water. The milkfat portion of the ice cream commonly comes from cream, but it can come from other sources, even butter. The non-fat solids may come from milk, but often non-fat dry milk is added to bring the solids in the ice cream to the desired level. Fluid plants have excess cream and non-fat dry milk is a surplus commodity that is easy to acquire. One gallon of ice cream mix will yield approximately 2 gallons of ice cream after freezing. The “dashers” add air to mix during freezing. The specifications mentioned above protect the consumer by requiring minimum weight and solids concentrations per gallon of ice cream. Ice cream is probably the most differentiated product of all categories of dairy products. While it might be possible to add additional air to the product and increase profit margins, it is likely that the lower quality in texture and flavor could cost market share.

In addition to the fact that ice cream provides an outlet for the excess cream of a bottling operation, it provides other benefits to the fluid bottling operation. Seasonally, the lowest utilization of milk is during the summer. Summer is the highest utilization period for ice cream. These products complement each other, increasing plant utilization and decreasing unit overhead costs. From an industry standpoint, ice cream utilization is more closely aligned with seasonal milk production than any other product.

Since 1950, regular ice cream production has nearly doubled. Lowfat and nonfat ice cream has grown ten-fold since 1950. Since 1995, total ice cream production, both regular and lowfat, has grown steadily, but per capita consumption has been steady at 13 to 13.5 pounds of regular, and approximately 6 pounds of lowfat ice cream. The ice cream market appears to have saturated the market on a per capita basis. If so, future growth will be limited to growth in population. A new processor entering this market will have to take market share from other ice cream manufacturers. New ice cream makers must find a niche or a way to differentiate their product from all the ice cream products in the market.

NFDM
(Non-Fat Dry Milk)

Non-fat dry milk is the great balancer. It is the most effective way to use excess milk. Excess milk is converted to a form with a long storage life. Milk can be removed from the market but later used in many products when milk supplies are lower. The process can be used to dry whole milk, skim milk, whey, etc. It is most often used to dry skim milk or whey. The fat in whole milk or cream is usually more valuable for other food uses and is removed before drying.

Approximately 10% of the milk on a whole milk basis will be made into NFDM annually. In 2000, total U.S. milk production was 167.559 billion pounds, of which 16.61 billion pounds (whole milk basis) were dried. In 2001, production was 165.336 billion with 16.18 billion pounds being dried. Milk production fell 1.3 percent between 2000 and 2001. In the face of this lower production, NFDM fell 2.6%, as milk goes to the higher valued uses first. The volume of NFDM produced in 2000 was 1.451 billion pounds, with 1.414 billion pounds produced in calendar 2001.

It is a simple process. A furnace heats air which is blown into a vertical column. Milk is sprayed into this column of heated air. The water is evaporated by the heated air, leaving the dried solids. A cyclone system is used to collect the dried solids, which are then packaged. Much the NFDM is packaged in bulk containers. Figures 17, 18 and 19 showing different plant designs follow this section.

NFDM plants are energy intensive and the product is a "low value" commodity. NFDM plants are therefore usually quite large to take advantage of economies of scale. These plants are usually owned by large dairy coops. They often set idle for significant periods of the year. The plants are operated whenever the coop has, or projects, sufficient supplies of "excess" milk to justify starting up the plant. Sometimes when milk supplies are "tight", such as 2001, the plant may not operate at all during the year. Most private processing companies can't afford, or don't want, an investment with such sporadic utilization.

NFDM has many uses. It is also obviously used as a food ingredient in any number of foods. NFDM is frequently an ingredient added to ice cream mixes to bring the other solids to the 10% level required. A significant use is in feed products for animals and livestock.

NFDM is a primary method for the operation of USDA's milk price support system. The Commodity Credit Corporation purchases NFDM and puts it in government storage when prices fall. NFDM is to be purchased at the milk equivalent price of $9.90, which supports the price of Class IV milk near that level.

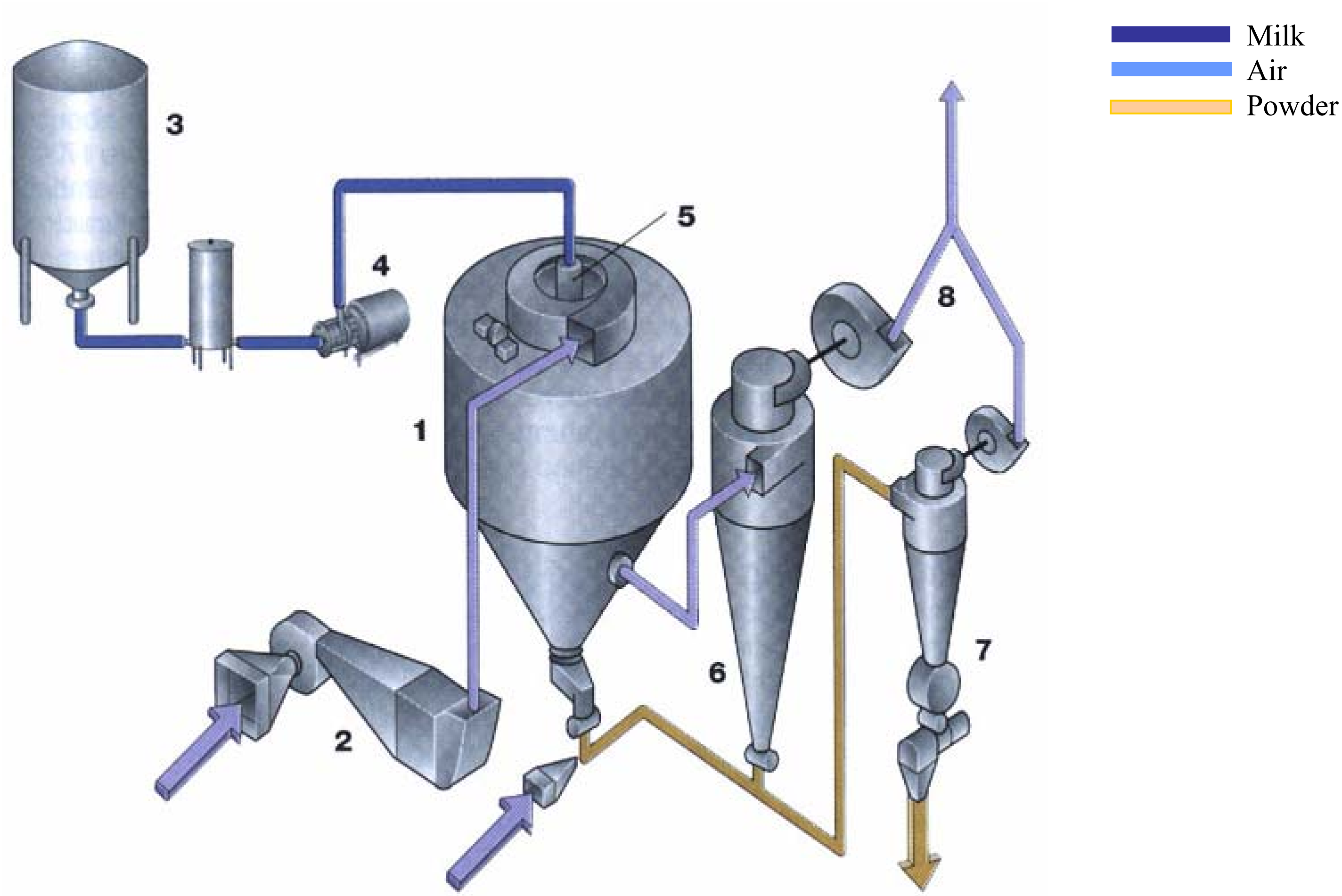


Figure 17 Conventional spray dryer (one-stage drying) with conical base chamber.

1. Drying chamber
2. Air heater
3. Milk concentrate tank
4. Atomizer
5. Atomizer
6. Main cyclone
7. Transport system cyclone
8. Air suction fans and filters

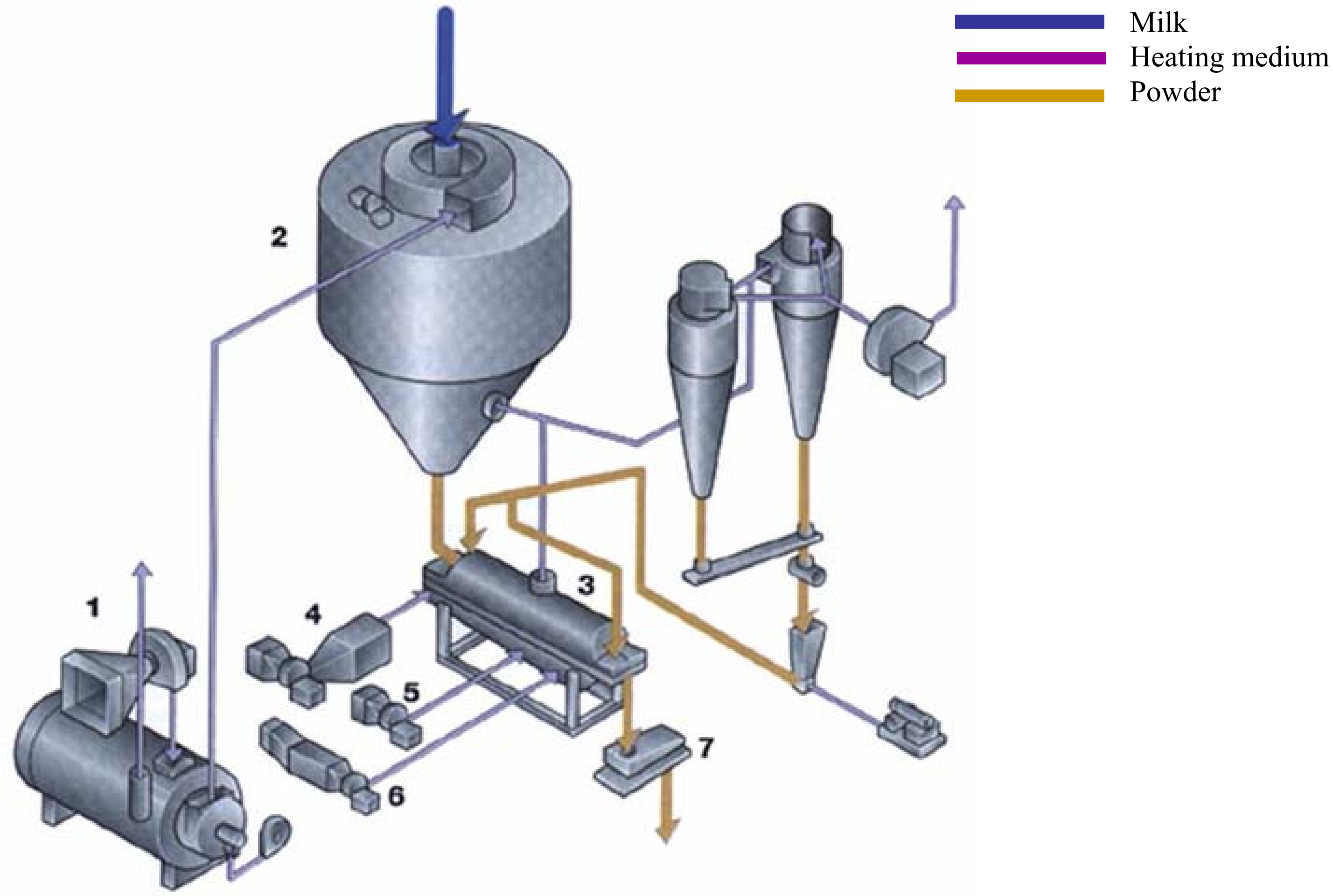


Figure 18 Spray dryer with fluid bed attachment (two-stage drying).

1. Indirect heater
2. Drying chamber
3. Vibrating fluid bed
4. Heater for fluid bed air
5. Ambient cooling air for fluid bed
6. Dehumidified cooling air for fluid bed
7. Sieve

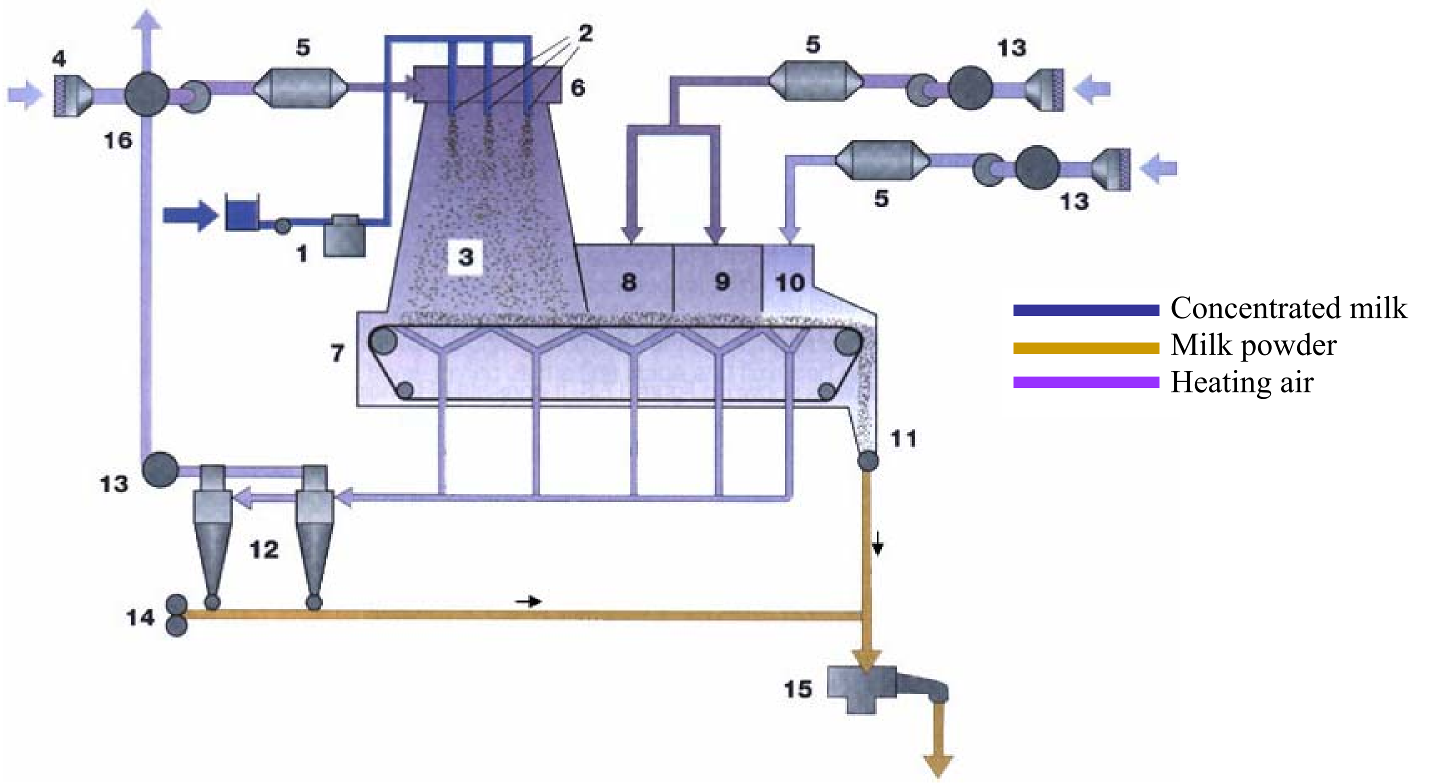


Figure 19 Spray dryer with integrated belt, Filtermat (three-stage drying).

1. High pressure feed pump
2. Nozzle arrangement
3. Primary drying chamber
4. Air filters
5. Heater/cooler
6. Air distributor
7. Belt assembly
8. Retention chamber
9. Final drying chamber
10. Cooling chamber
11. Powder discharge
12. Cyclone arrangement
13. Fans
14. Fines recovery system
15. Sifting system
16. Heat recovery system

MARKET ORDER

The Milk Market Order is designed to provide an orderly pricing system for the dairy industry. The main effect is to pool all milk in a given region and equalize the prices paid to dairy producers. This "levels the field" so that farmers selling milk to a cheese plant receive the same price as farmers selling milk to a fluid plant.

There are 11 market orders in the U.S. after they were consolidated in reforms implemented in 1999. All of Kansas is located in the Central Market Order (Market Order 32). The Central Market Order includes a large part of Colorado, most of Illinois and Iowa, most of Nebraska and Missouri, all of Oklahoma, a large part of South Dakota, four counties in Minnesota and two counties in Wisconsin. The Central Order Administrator is Donald Nicholson with offices located in Lenexa, Kansas.

Milk Market Classes

Class I	Milk bottled for fluid. This includes whole milk, lowfat milks, flavored milks, buttermilk, and eggnog.
Class II	Milk used for ice cream, package cream and cottage cheese
Class III	Milk used for cheese
Class IV	Milk used for butter and non-fat dry milk (NFDM)

Price Determination

Each class of milk is priced at a different level. The formulas used for setting prices of each class are diagramed in Figures 20 and 21. The prices are based on costs of butterfat, protein and other solids. These components are used to set the value by formula for each class of milk.

Prices are announced twice a month by the administrator of each Federal Milk Marketing Order. Prices released on the 23rd of the month are used by buyers to calculate the advance check for producers. These prices are calculated based on the two most recent NASS U.S. average weekly price surveys. They are announced on the 23rd and will be used for pricing milk in the following month. For example, prices released on October 23rd will be used to price milk delivered and sold in November. Prices released on the 23rd are:

Class I	price
Class I	skim milk price
Class I	butterfat price
Class II	skim milk price
Class II	nonfat solids price

The advanced pricing factors discussed below are used to calculate the Class I and Class II prices.

Advanced Pricing Factors

The advanced Class III milk price is based on the weighted average price of 40 pound blocks and 500 pound barrels of cheese after subtracting the Make Allowance. Make Allowance is the cost of making a product. This cost is changed periodically based on surveys conducted by the Market Order Administrators. The Make Allowance is 16.5 cents per pound for cheese, 14 cents for dry whey and NFDM, and 11.5 cents for butter.

Two values are calculated based on cheese yield per pound of protein and cheese yield per pound of butterfat. The price of butterfat is removed and the remaining amount is added together. This is the price of protein. To this is added the value of other solids based on the price of dry whey. **The Advanced Class III price represents the value of the milk used when processed into cheese, less the value of the butterfat that is contained in the cheese.**

The advanced Class IV price is based on the price of non-fat dry milk. The Make Allowance of 14 cents is deducted and the result is the non-fat solids price. This is then adjusted to a skim milk price by multiplying by nine (9). This is the advanced Class IV price. **The Advanced Class IV price represents the value of milk when processed in NFDM after the butterfat is removed.**

The advanced butterfat price is calculated by subtracting the 11.5 cents Make Allowance from the price of butter. This is then divided by 0.82 (the percentage of fat in butter) to reach the advanced butterfat price.

The second set of prices are released on the 5th of the month. They are based on a weighted average of all the weekly prices announced by NASS for the previous month. The prices that are released on the 5th are the following:

Class II	price
Class II	butterfat price
Class III	price
Class III	skim milk price
Class IV	price
Class IV	skim milk price
Butterfat price	
Nonfat solids price	
Protein price	
Other solids price	
Somatic cell adjustment rate	

The following narrative roughly explains the price calculations for each class of milk. The actual calculations require tremendous amounts of data. NASS surveys cheese, butter and other product markets. Using weekly NASS survey data, each market order publishes the price data for producers in their region. The formulas are somewhat complex. The understanding of the formulas will be enhanced by studying the diagrams which accompany this section in Figures 20 and 21.

Class I milk is based on the higher of the advanced Class III or advanced Class IV skim price plus the Class I differential for the skim portion of the milk. The butterfat portion is based on the advanced Butterfat Price adjusted for the Class I differential. The final Class I price is the sum of the skim portion and the butterfat. The Class I differential for all Kansas counties is either $2.00 or $2.20, depending on location. A table of values for all Kansas counties is included in Table 9.

Class II milk is based on the advanced Class IV price plus 70 cents to determine the skim portion. The fat portion is the Butterfat price. The Butterfat formula is the same formula as the advanced butterfat price, but is based on a weighted average of butter prices for the full month, not the two-week period of the prior month used for the advanced price. The Class II skim portion is added to the Butterfat price for the final Class II price. Class II and Class IV are considered interchangeable. Class II can become Class IV by drying. Class IV can replace Class II in many products. The difference in price is the 70 cents cost of drying.

Class III final price formula is very similar to that used to calculate the Class III advance price, but uses cheddar cheese prices for the whole month instead of just the two weeks data from the previous month. This yields a Class III skim price. Butterfat is added to this to determine the Class III final price.

Class IV final price formula is based on non-fat dry milk for the full month rather than only two weeks to determine the skim price. Butterfat is added in to determine the final Class IV price.

Class III milk is usually the lowest priced, though Class IV is sometimes the lowest priced class.

When handlers sell milk in classes priced higher than Class III, they must send the premium above Class III to the market administrator. The premiums are totaled and divided by total milk production for the month. This average premium is called the producer price differential (PPD). This is paid back to the handlers, usually coops, who allocate the premium back to dairy producers. If Class IV is priced lower than Class III, then Class IV will be subsidized back to the handler. This assures that all producers receive a fair price. It avoids a few receiving high prices for fluid milk (Class I) and others receiving lower prices for manufacturing milk. There are exceptions:

Exempt plants are plants that process less than 150,000 lbs. of milk per month. An exempt plant is a very small plant. This would be 60 to 100 cows depending on productivity. University- or government-owned plants can be exempt and are not limited to the 150,000 limit. There is some discussion of limiting the size of producer-handlers to some amount, for example 1,000,000 pounds per month. All producer-handlers exceeding this size would then be regulated and forced to become a part of the pool. While most producer-handlers are small, there are some very large producer-handlers, such as Bram's.

Producer-handlers can process their own milk. There is no limit on the size of these plants, but producer-handlers must be single-entity, family-owned dairies processing their own milk. If a producer-handler is larger than 150,000 pounds per month, then they are limited to purchases of no more than 150,000 pounds per month to make a production shortfall. If a producer-handler's milk production is less than 150,000, then there is no limit to how much milk can be purchased and processed from a regulated handler. This would be the milk from 80 cows producing 60 pounds per day.

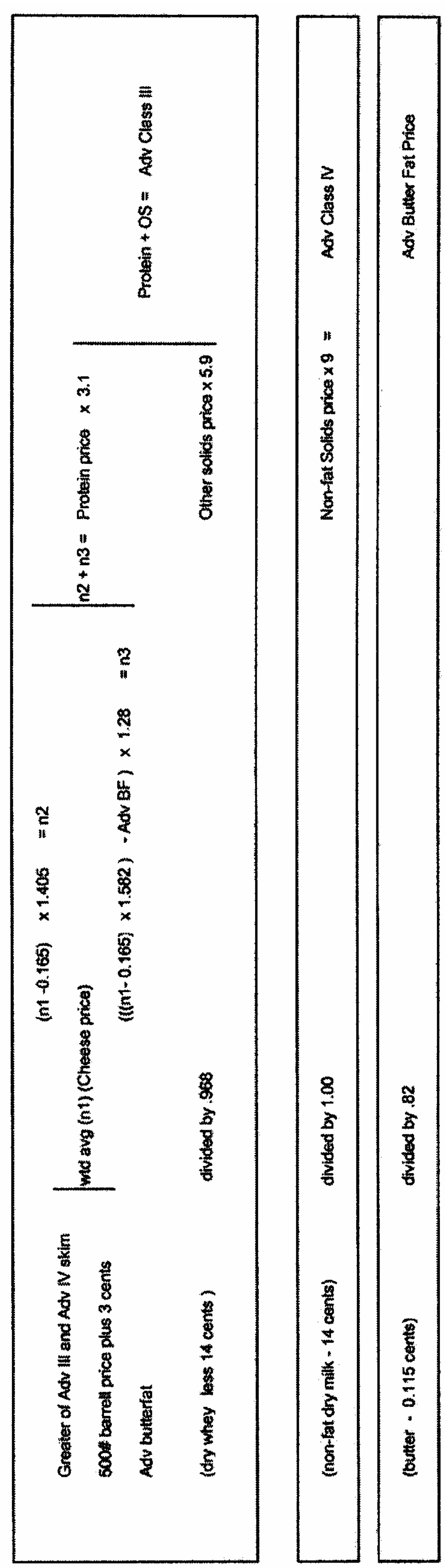
Three or more producers could form their own coop and begin processing. This coop, being owned by more than one entity, will be regulated by the market administrator. Premiums will have to be paid into the pool for all milk used in classes that are priced above Class III. If producers take this route to form their own coop and process their own milk, the price received (paid) for the raw milk will not differ much from that paid by traditional dairy coops.

Dairy coops can allocate the proceeds in any way that they choose. Usually some producers are subsidized while others receive less than average. This "subsidy" comes in several forms. Common ways for a coop to subsidize certain members would be freight and volume premiums. To the extent that producers have been subsidizing others within the coop, as well as the extent that they can save on operating expenses, forming their own small coop may raise the farm price of the milk.

The main benefit of forming a processing coop will be to make the profit on the processing. It is important not to confuse margin with profit. Margin is the difference between the cost of the raw milk and price received for the products. Profit is the part of margin, if any, remaining after all processing expenses—labor, overhead, etc. — have been deducted.

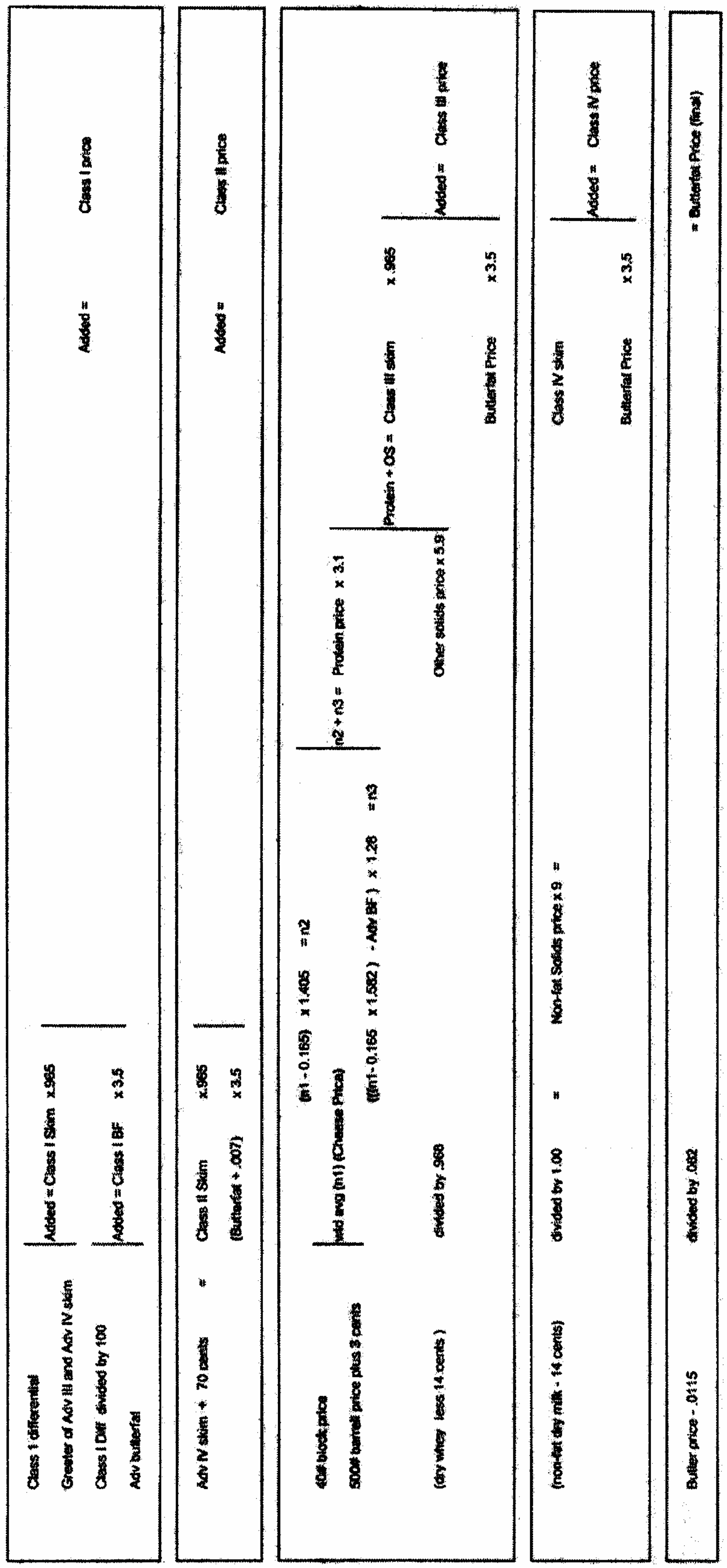
The Market Orders are very complex legal documents. There are unlimited possibilities to shift milk between Market Orders. Rules can be changed relatively quickly after scheduling hearings. Large coops probably have some advantages in exploiting differences between the different Market Orders. Their sheer size may be a disadvantage. Extra overhead costs and shifting funds to certain areas at the expense of other areas in the coop's territory may be negative to individual producers.

Advanced Pricing Factor (Figure 20)
Released on 23rd – based on previous 2 weeks prices



Class Prices (Figure 21)

Based on Prior months prices – released on 5th (except Class I which is released on the 23rd of the prior month based on advanced prices)



Central Federal Milk Order #32 (Figure 5)
Announcement of "Advanced" Class Prices for October 2002

Class I Price @ 3.5% Butterfat	
$2.00 Location Adjustment @ Jackson Co. (MO)	$12.15/cwt
Fluid Milk Promotion Order Processor Assessment[1]	+0.20
	$12.35
Class I Butterfat Price	
$2.00 Location Adjustment @ Jackson Co. (MO)	$1.0135/lb
Class I Skim Price	
$2.00 Location Adjustment @ Jackson Co. (MO)	$8.91/cwt
Class II Skim Price	
Class II Nonfat Solids Price	$0.8456/lb

(1) Processor Assessment: The processor assessment is an obligation under the Fluid Milk Promotion Order (7 CFR 1160.101 et seq.). The order requires that all persons who process and market commercially more than 3,000,000 pounds of fluid milk products in consumer-type packages in the 48 contiguous States and the District of Columbia on a monthly basis, excluding those fluid milk products delivered to the residence of a consumer, be assessed 20 cents per hundredweight on all marketings of such packaged fluid milk products during the month.

Announcement of Class Prices for October 2002
Released on November 1, 2002

Class II Price @ 3.5% BF……………………………..…$11.12/cwt

Class II Butterfat……………………………………………$1.0796/lb

Class III Price @ 3.5% BF…………………………………$10.72/cwt

Class III Skim Milk…………………………………………$7.22/cwt

Class IV Price @ 3.5% BF…………………………………$10.50/cwt

Class IV Skim Milk……………………………………..... $6.99/cwt

Butterfat Price………………………………………………$1.0726/lb

Nonfat Solids Price………………………………..…………$0.7765/lb

Protein Price…………………………………….………..$2.1839/lb

Other Solids Price…………………………………….……$0.0755/lb

Somatic Cell Adjustment Rate………………………….$0.00060/cwt
Per 1,000 Somatic Cell Count

"Advanced" Pricing Factors For October 2002 (Table 6)

Prices Used Only in Calculating Advanced Class I & II Prices		
Advanced Class III Skim Milk Price	$6.64	/cwt
Advanced Butterfat Price	$0.9935	/lb
Advanced Class III Price @ 3.5% BF	$9.88	/cwt
Advanced Class IV Skim Milk Price	$6.91	/cwt
Advanced Class IV Price @3.5% BF	$10.15	/cwt
Base Price @ 3.5% BF For Class I	**$10.15**	**/cwt**

NASS Two-Week Product Price Weighted Averages (Per Lb)

	Butter	Nonfat Dry Milk	Cheese[2]	Dry Whey
Wtd. 2-Week Average	$0.9297	$0.9080	$1.1427	$0.1703

Component Prices for October 2002

	Butter	Nonfat Dry Milk	Cheese[2]	Dry Whey
Week 1 Ending 10/05/02	$0.9617	$0.9139	$1.1754	$0.2026
Week 2 Ending 10/12/02	$0.9840	$0.9179	$1.2092	$0.2162
Week 3 Ending 10/19/02	$1.0099	$0.9194	$1.2216	$0.2127
Week 4 Ending 10/26/02	$1.0316	$0.9152	$1.2004	$0.2199
Wtd. Monthly Average	$0.9945	$0.9165	$1.2020	$0.2131

[2]The cheese price is weighted average of the: (a) NASS 40lb. block cheese and (b) NASS 500 lb. barrel cheese (38% moisture) plus 3 cents

Note: These prices were computed using the formulas in the U.S. District Court's preliminary injunction order dated January 31, 2001. The price formulas may be found at: www.ams.usda.gov/dairy/price_formula.htm

Regional Milk Production Costs ($/cwt)

Note: For information contact the following Economic Research Service (ERS) staff members:
James Johnson, 202-694-5560;
William McBride, 202-694-5577;
or Sara Short, 202-694-5588.
Additional Information can be found at
www.ers.usda.gov/data/costsandreturns/testpick.htm
(select milk)

Federal Milk Order Price Information

Price Formulas – 2002

Note: Milk prices are per 100 pounds or cwt., rounded to the nearest cent. Component prices are per pound, rounded to nearest one-hundredth cent. Cheese, dry whey, butter, and nonfat dry milk prices are weighted monthly averages of weekly NASS survey prices, rounded to the nearest one-hundredth cent.

Class I

Class I Price = (Class I skim milk price x 0.965) + (Class I butterfat price x 3.5).

Class I Skim Milk Price = Higher of advanced Class III or IV skim milk pricing factors + applicable Class I differential.

Class I Butterfat Price = Advanced butterfat pricing factor + (applicable Class I differential divided by 100).

Note: Advanced pricing factors are computed using applicable price formulas listed below, except that product price averages are for two weeks.

Class II:

Class II Price = (Class II skim milk price x 0.965) + (Class II butterfat price x 3.5).

Class II Skim Milk Price = Advanced Class IV skim milk pricing factor + $0.70.

Class II Butterfat Price = Butterfat price + $0.007.

Class II Nonfat Solids Price = Class II skim milk price divided by 9.

Class III:

Class III Price = (Class III skim milk price x 0.965) + (Butterfat price x 3.5).

Class III Skim Milk Price = (Protein price x 3.1) + (Other solids price x 5.9).

Protein Price = ((Cheese price – 0.165) x 1.405 +((((Cheese price – 0.165) x 1.582) – Butter price) x 1.28).

Other Solids Price = (Dry whey price – 0.14) divided by 0.968, snubbed at zero.

Butterfat Price = (Butter price – 0.115) divided by 0.82.

Classs IV

Class IV Price = (Class IV skim milk price x 0.965) + (Butterfat price x 3.5).

Class IV Skim Milk Price = Nonfat solids price x 9.

Nonfat Solids Price = Nonfat dry milk price –0.14

Butterfat Price = See Class III.

Somatic Cell Adjustment Rate = Cheese price x 0.0005, rounded to fifth decimal place. Rate is per 1,000 somatic cell count difference from 350,000.

Go to: Dairy Programs

(Table 9) **Class I Differentials in Kansas**

Allen	2.20	Greeley	2.20	Osborne	2.00
Anderson	2.00	Greenwood	2.20	Ottawa	2.00
Atchison	2.00	Hamilton	2.20	Pawnee	2.20
Barber	2.20	Harper	2.20	Phillips	2.00
Barton	2.20	Harvey	2.20	Pottawatomie	2.00
Bourbon	2.20	Haskell	2.20	Pratt	2.20
Brown	2.00	Hodgeman	2.20	Rawlins	2.00
Butler	2.20	Jackson	2.00	Reno	2.20
Chase	2.20	Jefferson	2.00	Republic	2.00
Chautauqua	2.20	Jewell	2.00	Rice	2.20
Cherokee	2.20	Johnson	2.00	Riley	2.00
Cheyenne	2.20	Kearny	2.20	Rooks	2.00
Clark	2.20	Kingman	2.20	Rush	2.20
Clay	2.00	Kiowa	2.20	Russell	2.00
Cloud	2.00	Labette	2.20	Saline	2.00
Coffey	2.00	Lane	2.20	Scott	2.20
Comanche	2.20	Leavenworth	2.00	Sedgwick	2.20
Cowley	2.20	Lincoln	2.00	Seward	2.20
Crawford	2.20	Linn	2.00	Shawnee	2.00
Decatur	2.00	Logan	2.20	Sheridan	2.00
Dickinson	2.00	Lyon	2.00	Sherman	2.20
Doniphan	2.00	Marion	2.20	Smith	2.00
Douglas	2.00	Marshall	2.00	Stafford	2.20
Edwards	2.20	McPherson	2.20	Stanton	2.20
Elk	2.20	Meade	2.20	Stevens	2.20
Ellis	2.00	Miami	2.00	Sumner	2.20
Ellsworth	2.00	Mitchell	2.00	Thomas	2.00
Finney	2.20	Montgomery	2.20	Trego	2.20
Ford	2.20	Morris	2.00	Wabaunsee	2.00
Franklin	2.00	Morton	2.20	Wallace	2.20
Geary	2.00	Nemaha	2.00	Washington	2.00
Gove	2.20	Neosho	2.20	Wichita	2.20
Graham	2.00	Ness	2.20	Wilson	2.20
Grant	2.20	Norton	2.00	Woodson	2.20
Gray	2.20	Osage	2.00	Wyandotte	2.00

SEASONALITY
Seasonality of Production

Production varies seasonally for individual operations and the industry as a whole. The primary cause of this seasonality in production is weather. Summer heat results in lower feed consumption, leading to lower production. The degree of change in production depends on many factors. The first factor is the actual temperatures and humidity that occurs, and the duration of the hot conditions. This is different every year, making planning extremely difficult.

Other factors are the ability to meliorate the heat effects on the cattle through use of shades, fans and sprinklers, as well as changing diets to improve consumption and calorie intake. Modern freestall dairies can provide optimum comfort to cows. This is reducing the degree of seasonality as newer, well-designed dairies replace more old-fashioned dairies. Organic dairies are required to have cows on pasture in natural conditions. This results in greater seasonal differences. The seasonal concept of managing a dairy—normally calving the cows in the spring and drying them up in late winter—results in a tremendous seasonal pattern that must be balanced by the dairy if they process their own milk, or the milk handler if the milk is sold.

Another less obvious effect of heat is on fertility and conception rates on cows. This results in increased days-in-milk and lower production about 290 days following the summer heat. Production falls as days-in-milk increases.

Weather also affects feed quality, price and quantity. These changes in feed availability and cost will affect production for longer periods, often a full year.

Over the period of 1970 through 2001, the seasonal low in total U.S. milk production averaged 95 percent of annual average production and occurred in early November. During that period, milk production peaked at nearly 107 percent of the annual average, with peak production coming in May. Regionally, production peaks and lows occur at different times due to differences in climate across the country. For example, the Northwest region of the country peaks in July, two months later than the peak in total U.S. production. The Southeast and South-central areas of the country tend to bottom in September, two months earlier than the U.S. average.

Organic dairies have greater seasonal changes in production than "conventional" dairies. Pasture conditions in most areas of the country result in more seasonal changes compared to the managed conditions of a freestall facility. While the lower productivity of most organic cows is positive for conception rates, breeding problems caused by heat have more impact on production in organic dairies, which cannot use BST. BST extends lactations and maintains production, as days-in-milk increases, at a significantly higher level than non-treated cows.

Production seasonality charts for the U.S., as well as regional charts, can be found in Figures 22, 23, 29, 30 and 31.

Seasonality of Demand

The highest value usage for milk is for fluid consumption. Demand for fluid milk has some definite seasonal factors, as well. One of the biggest factors is the increase in milk consumption during the school year. This may become less of a factor due to a trend to year-round school, as well as a trend for children to have more choices in drinking or not drinking milk in school. In many areas, milk consumption shifts from the school to home when school is out. Total consumption doesn't change, but packaging and location of sales and consumption changes.

Fluid uses of milk all fall into Class I under the Federal Market Orders. During the 5-year period from 1997 through 2001, average daily utilization of Class I milk was 124.4 million pounds. This varied from a peak period from January through March at approximately 128 million pounds per day, to a low in early July of just 117 million pounds. There is a second peak just under 128 million pounds per day from September through November. Class I utilization falls off during December when eggnog consumption fails to offset drops in other fluid uses during the holidays. See Average Daily Class I Milk Utilization chart (Figure 28).

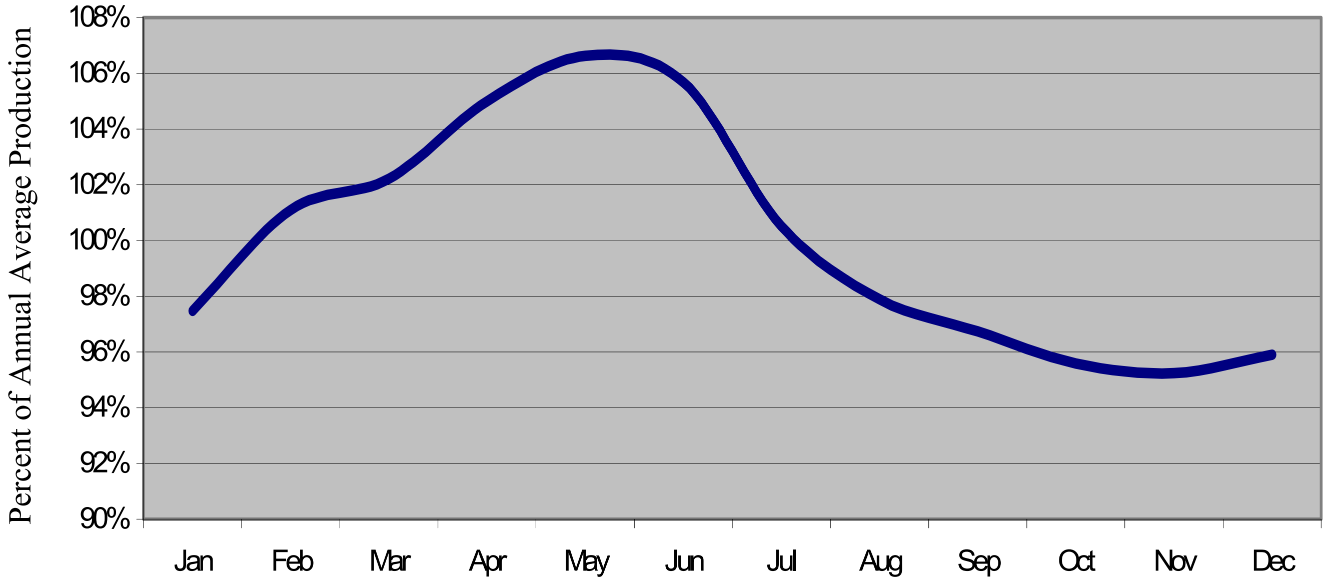
There is a very strong seasonality in cheese production. Cheese production is strong through the first five months of the year before falling off sharply to a low in August. It then steadily rebounds into the end of the year. There is a strong visual correlation between seasonal cheese production and seasonal milk production. Data from an AC Nielsen study printed in the Idea's Cheese Facts show similar seasonal trends. Frequency of cheese purchases is highest in the first and fourth quarters and lowest in the third quarters. Pounds per buying household are significantly higher in the first and fourth quarters at 5.7 and 6.0 pounds respectively. The third quarter is much lower at 5.3 pounds. This data shows cheese consumption following a seasonal pattern that complements the seasonal production of milk. It is not clear whether cheese consumption drives cheese production or whether milk production drives cheese production and consumption. All cheese production and Cheddar cheese production charts are found in Figures 24 and 25. With more shelf life than fluid, a multi-line plant for balancing the fairly large seasonal variations in production could use cheese processing.

Seasonal ice cream production differs markedly from other dairy products. Production is lowest in the winter, bottoming in December, and highest in the summer, peaking in June 65% higher than the winter lows. This production pattern is clearly driven by seasonal consumption patterns. The ice cream consumption pattern should be the same as the ice cream production, but it is lagged approximately one month. The ice cream industry gears up and builds inventory ahead of the prime consumption period for ice cream. See the ice cream production chart (Figure 26). The seasonality in the consumption of ice cream offsets the seasonality of fluid consumption. A plant that processes both fluid milk and ice cream could use nearly the same quantity of raw milk each week year round. (Do not confuse this with balancing the seasonality of production)

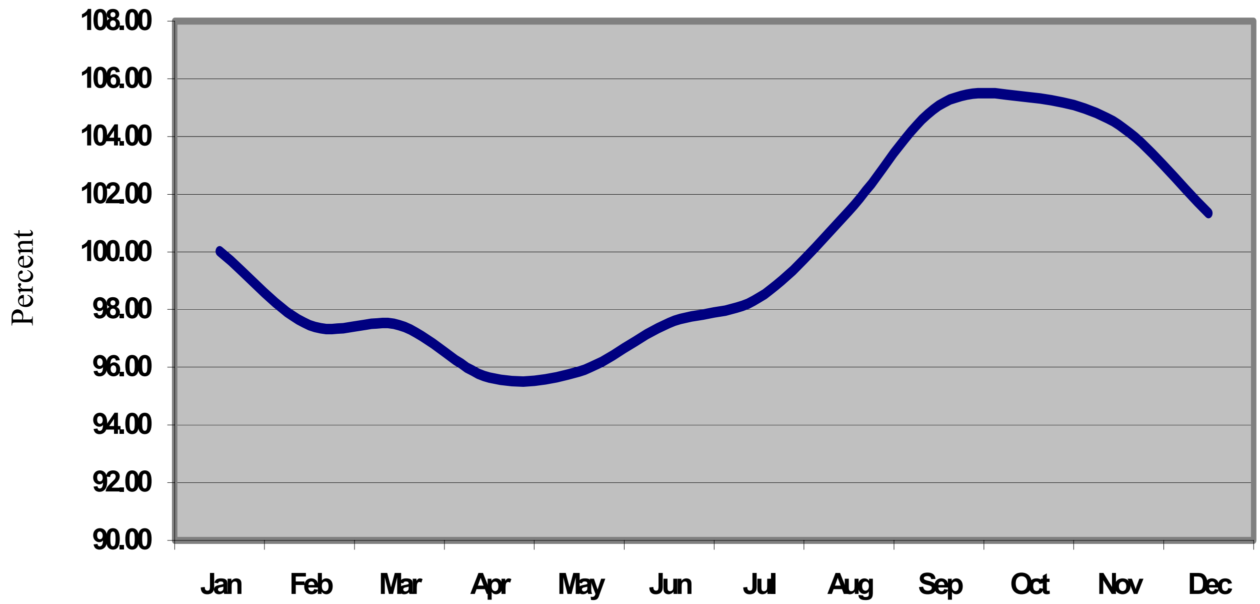
NFDM is manufactured for use in many products. In addition, it has the role of residual use for the industry. When the milk market has excess milk that is not being used in other dairy products, it is dried and taken off the market. If milk is short, the NFDM industry reduces production. The NFDM production seasonal closely follows the milk production seasonal. (Figure 27). Butter and NFDM can be substituted for raw milk to provide the needed fat and non-fat solids needed to make ice cream.

In the preceding discussion, seasonal production of the various dairy products was analyzed. Consumption data is not readily available for any dairy products. Production data has been analyzed as a proxy for consumption data. The assumption has been made that monthly production of individual dairy products roughly matches consumption. This assumption becomes less valid as products have less value and/or are more storable. Cheese consumption and production are less correlated than fluid milk. Dry milk obviously has the lowest degree of correlation between production and consumption.

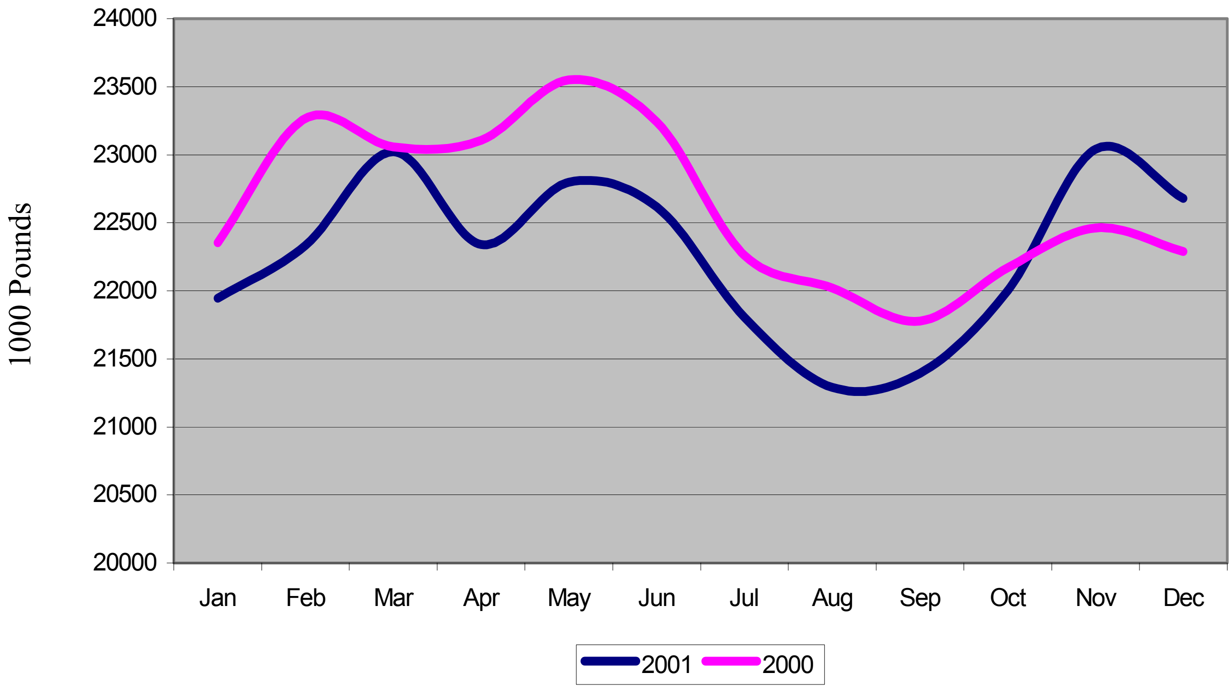
U.S. MILK PRODUCTION (Figure 22)
Seasonal Changes in Average Daily Milk Production
1970 through 2001



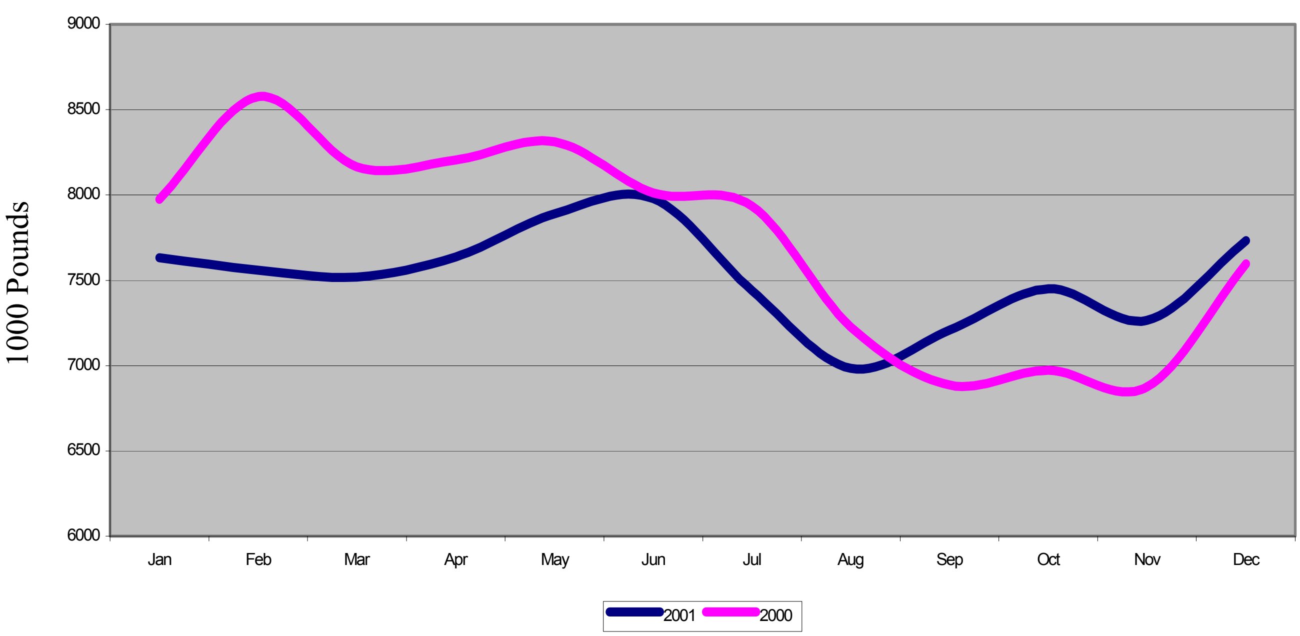
U.S. MILK PRICE SEASONAL (Figure 23)
1992 through 2001

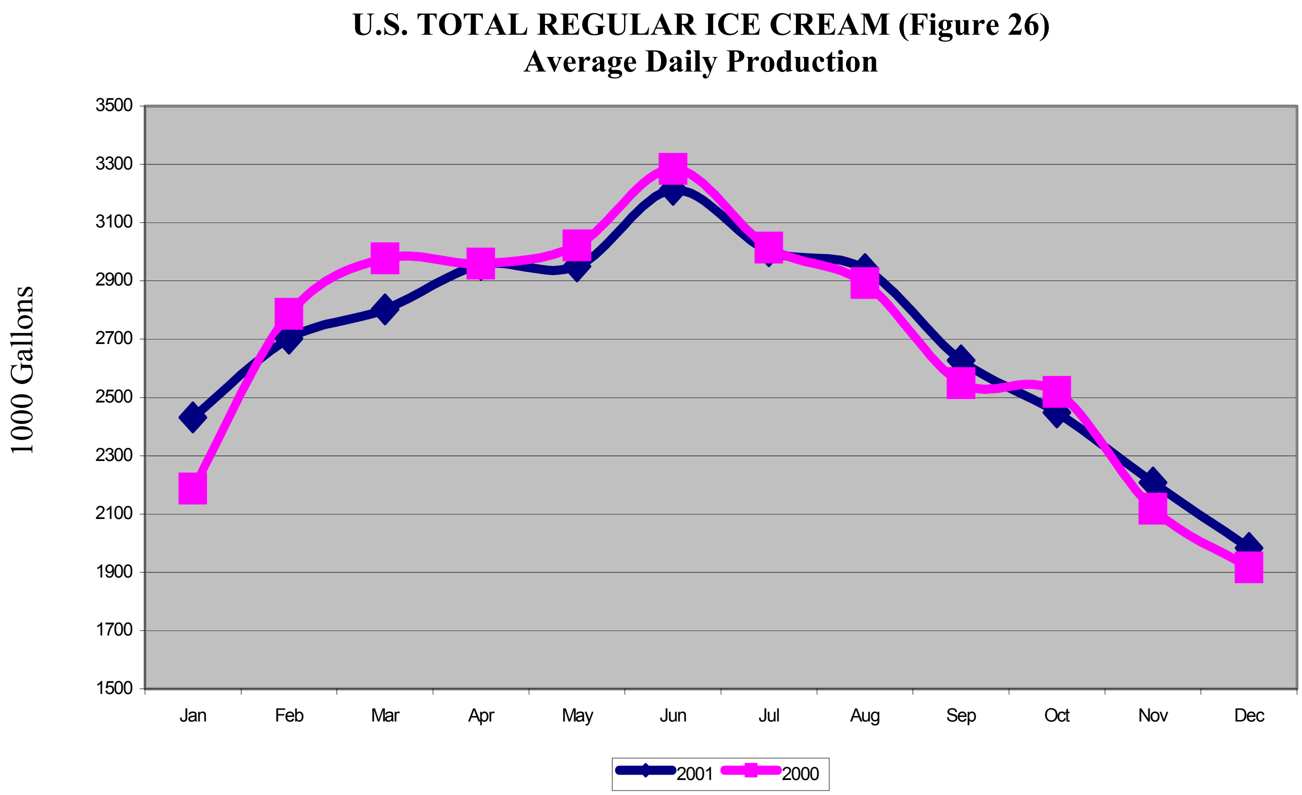


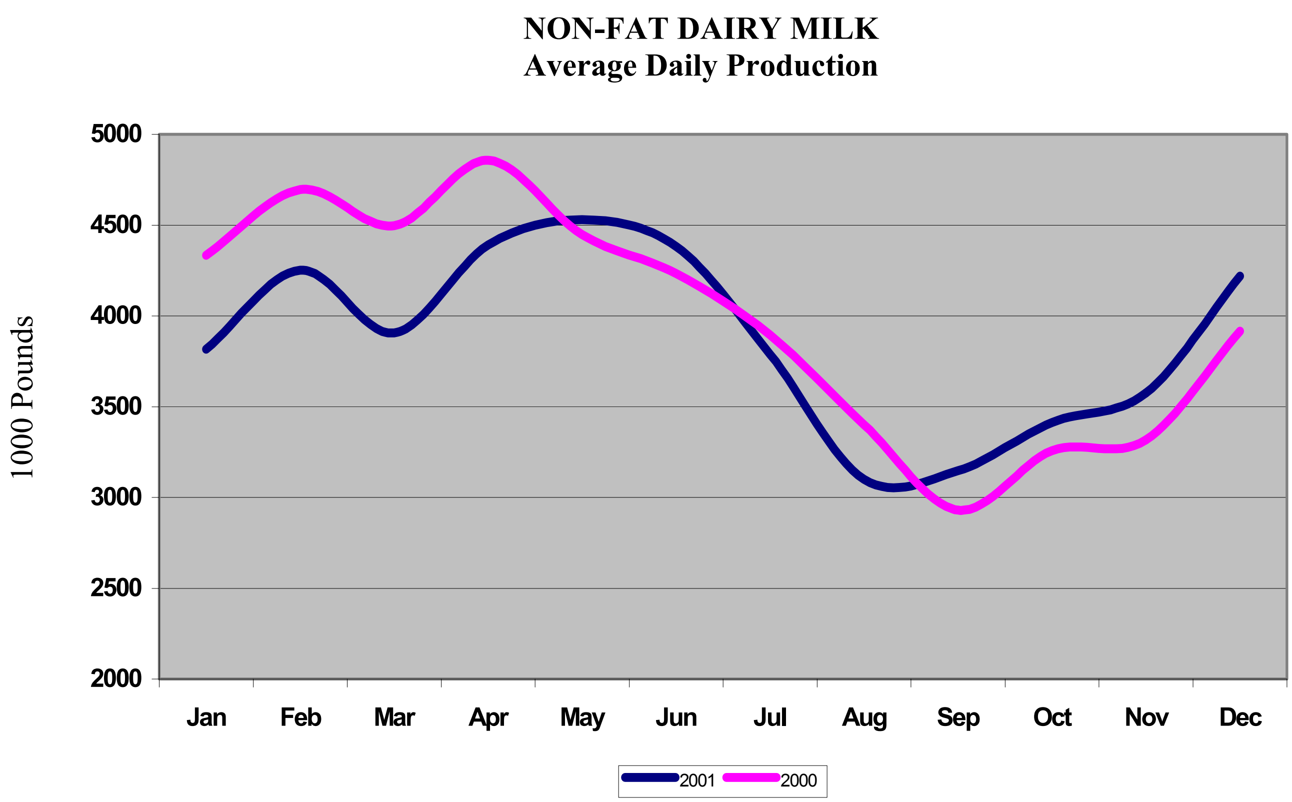
U.S. TOTAL CHEESE (Figure 24)
Average Daily Production



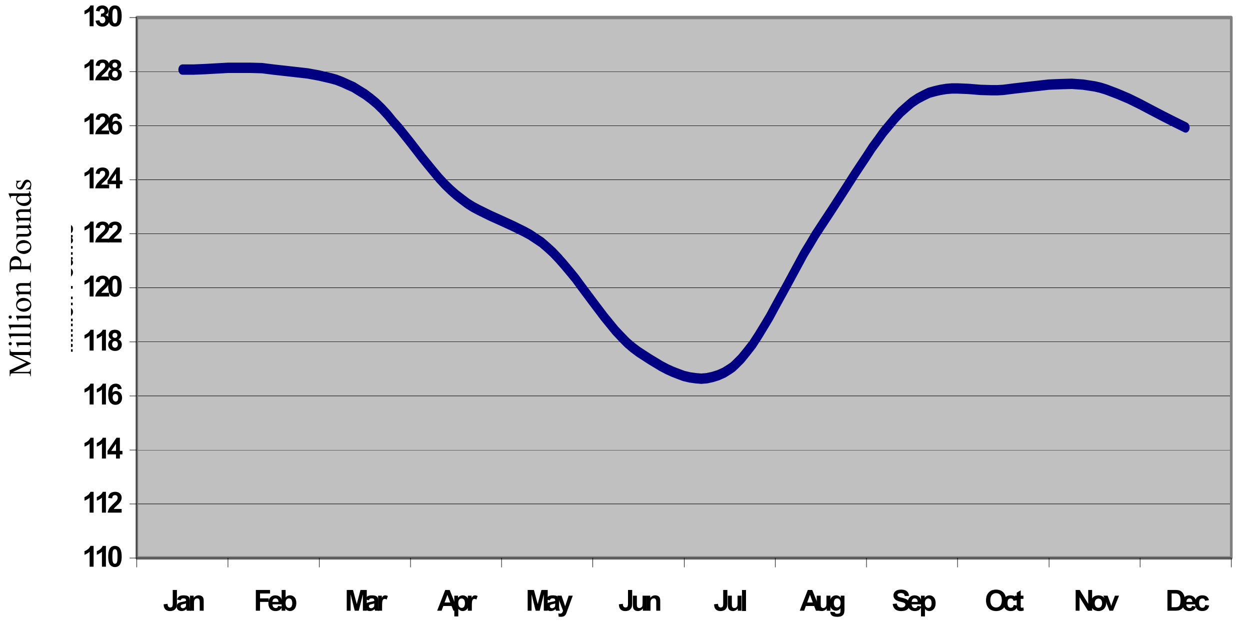
U.S. CHEDDAR CHEESE (Figure 25)
Average Daily Production



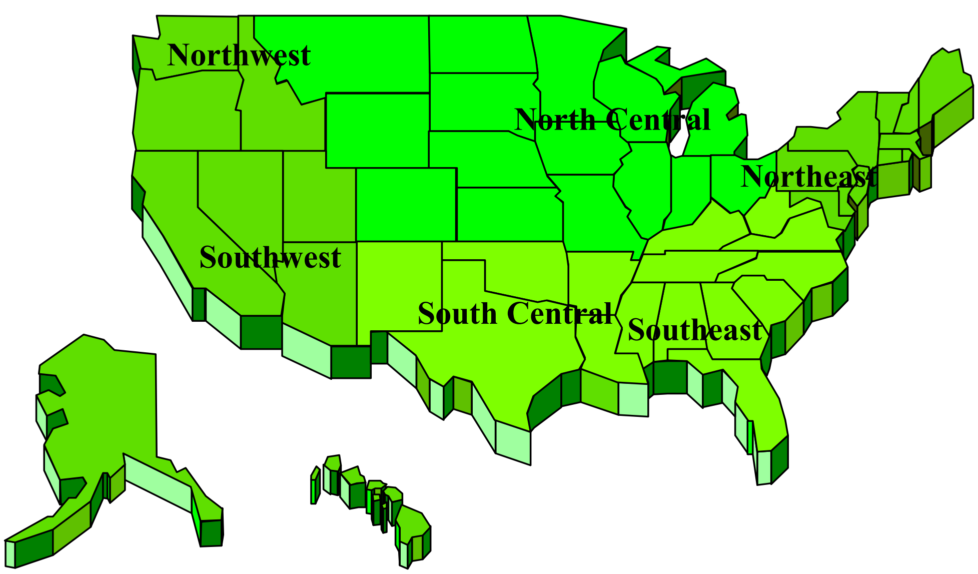

U.S. TOTAL REGULAR ICE CREAM (Figure 26)
Average Daily Production
1000 Gallons
3500
3300
3100
2900
2700
2500
2300
2100
1900
1700
1500
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2001
2000


NON-FAT DAIRY MILK
Average Daily Production
1000 Pounds
5000
4500
4000
3500
3000
2500
2000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2001
2000

AVERAGE DAILY CLASS I MILK UTILIZATION (Figure 28)
1997 through 2001

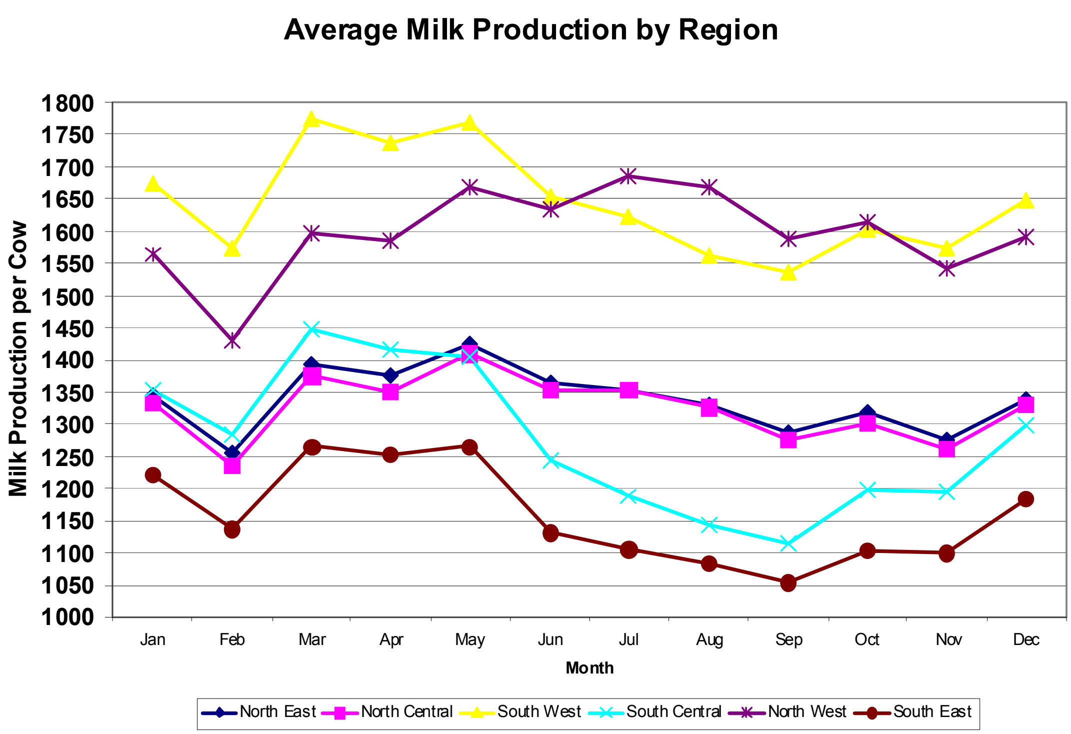


REGIONAL COMPARISON (Figure 29)



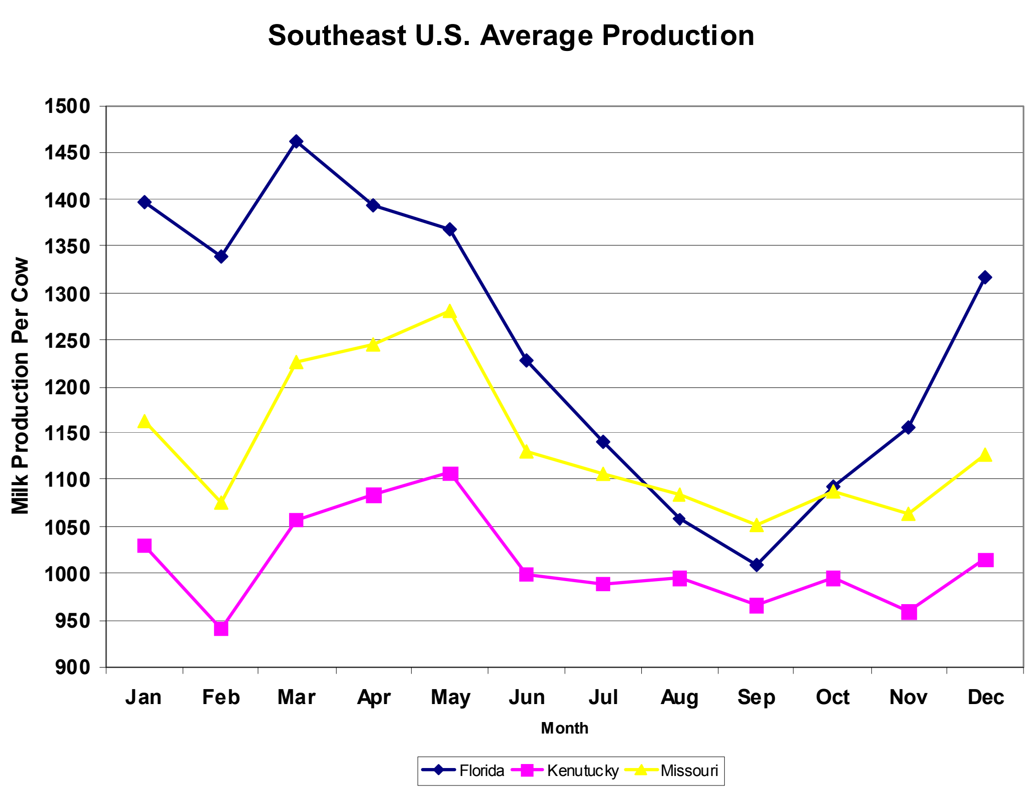
AVERAGE MILK PRODUCTION BY REGION (Figure 30)

Milk Production Per Cow



SOUTHEAST U.S. AVERAGE PRODUCTION (Figure 31)

Milk Production Per Cow



BALANCING

The seasonality of the production and demand of individual products do not match each other. Cheese and ice cream have some similarities with seasonal milk production. Fluid products' seasonal demand is almost opposite seasonal milk production. There are large discrepancies between the amount of milk produced and the demand for milk during any given week of the year. Variability in production is by far the largest contributor to the need to balance supply and usage. A buffer system is required to deal with excess milk not needed for fluid consumption, cheese or ice cream when production exceeds the amount that can be sold in these markets. This buffer system is referred to as balancing. The amount of milk used must be balanced with the amount that is produced. As indicated earlier, fluid milk has the highest value. After this demand is met, excess milk goes into various manufacturing processes, the largest being cheese and non-fat dried milk.

Balancing can occur at several levels. A multi-line plant can conceivably balance its own milk. This can be done by making products such as cheese when milk supplies are large, and putting them in storage, then taking them out of storage over the remaining part of the year, as needed, to meet demand. A single plant could have a drying system, but as mentioned earlier, making NFDM is a capital-intensive process not well suited for balancing small to moderate operations.

Nationwide, most balancing occurs between plants. This is a market-driven process. Milk goes to the highest value uses first. What remains at any given time goes to the lowest value use, which is almost always NFDM. The large cooperatives, such as Dairy Farmers of America, buy all the milk. After shipping milk to bottling plants first, the cooperative then markets as much milk as possible to cheese plants and other dairy processing plants. The balance remaining that can't be sold to processors is dried, often by a plant owned or joint-ventured with the cooperative.

The prices of all the different uses of the milk are blended. The cooperative pays the average price to producers. It is extremely difficult to compete as a single-line bottling plant without buying from a cooperative (or other handler), which can handle the balancing. A producer (or a small group of producers) has to plan to balance their milk before they can consider getting into processing. Without a balancing plan, excess milk must be sold at Grade B Manufacturing grade prices.

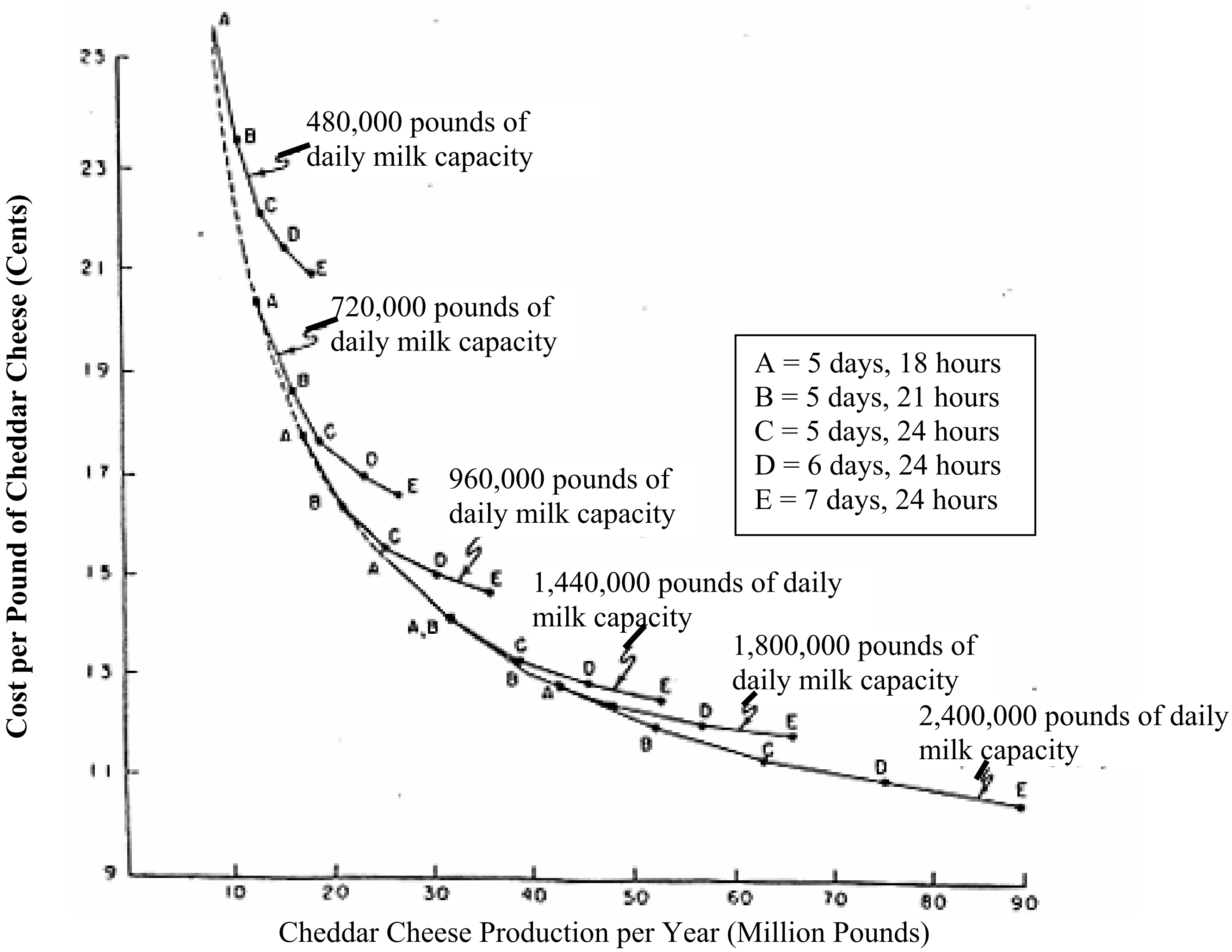
Class is used to designate the use of milk under the Federal Market Order. Grade is to designate quality and wholesomeness. Grade A is required for fluid uses of milk. Grade B is a lower grade, usually because the producer's facility doesn't meet some Grade A requirement. Grade B and Grade C represent the same grade of milk, which can be used only for manufacturing. Some states use the term Grade B while others use Grade C. The Federal Market Order does not control manufacturing grade prices. If manufacturing grade milk is used to make cheese, the cheese maker can set any price he chooses. The cheese maker can buy the entire Grade A milk he needs from a handler for the Class III price. It would be rare that any buyer would pay more than Class III for manufacturing grade for a significant period of time. Grade B would not be expected to sell above the Class III price of Grade A milk. Because there is normally plenty of Grade milk available, in practice, Grade B milk is priced below Class III, on a take-it-or-leave-it basis. Grade B producers have few options. The producer has no negotiating power.

This low price will likely result in disastrous economic consequences for the producer/bottler. Bottling part of your milk and selling the remainder into the pool is not allowed. It is considered double-dipping to sell part of your milk into the fluid market and still get the pool price (which includes Class I) for your remainder. Therefore, a producer/handler has excess Grade A milk, but since it can't be pooled, the only place to sell it is into the manufacturing grade market. Producer-handlers are viewed as competitors. The Grade B manufacturing price offered by the cooperative is not usually desirable. The producer has little choice. He can either take it or dump the milk.

The major balancing use for the industry is drying milk to produce non-fat dry milk. Drying plants are expensive. There is no small-scale technology. The drying plants are high-volume to spread the overhead costs.

There are many reasons for cooperative marketing of milk. In the past, coops helped improve prices through centralized, group marketing. At the present time, milk prices are controlled by the federal market orders with prices determined based on the price of cheese and butter. Coops function as handlers, buying the milk and distributing to processors. The major benefit that cooperatives currently provide to the industry is balancing milk supply and demand. Most processors want to buy the milk they can process each day, week or month. They are not in position to take all milk produced. The coops agree to take all milk produced. They own or have access to drying facilities. Any excess milk is diverted to the drying plants.

Figure 11: Long Run Cost Curve for Cheddar Cheese Production



ORGANIC MILK PRODUCTION

The Organic Foods Production Act of 1990 was adopted as a part of the 1990 Farm Bill. It "required USDA to develop national standards for organically produced agricultural products to assure consumers that agricultural products marketed as organic meet consistent, uniform standards". The final rule, known as the National Organic Program (NOP), was finalized and published December 2000. (http://www.ams.usda.gov/nop/facts/overview.htm)

Any farm that desires to sell products as organically produced must be certified under the standard. The exception is that a farm selling less than $5,000 is not required to develop an organic system plan or to be certified, but must still adhere to the standards. Retail establishments that sell, but do not process organic products, are exempted from certification.

The Kansas State Organic Program is administered by:

Carole Jordan
Kansas Dept of Agriculture
2524 S.W. 6th Street
Topeka, KS 66606
Phone: (785) 296-3558
Fax: (785) 296-8389
E-mail: cjordan@kda.state.ks.us
Web Page: http://www.ink.org/public/kda/

The organic standards address the methods, practices and substances used in producing crops and livestock. The requirements apply to the way the product is created, not to measurable properties of the product itself.

The final standard can be located in its entirety at http://www.ams.usda.gov/nop/facts/standards.htm and at http://www.ams.usda.gov/nop/regtext.htm.

Definitions

Organic. Very specifically defined with official specifications and regulated by USDA. The standards define how the product will be produced, but there are no standards on the final product as long as the production system met the standards.

Grass-fed and All Natural. Neither of these terms is defined with any official specs or regulations. These terms could be used as a part of marketing strategy to develop a niche where the consumer perceives a higher quality or more wholesome product. This assumes the consumer will pay some premium for this quality. Since there is not a standard for these terms, they are subject to each producer's/marketer's definition.

Organic milk production and processing must begin with a marketing plan. Organic milk makes up a very small fraction of the milk market. The demand for organic milk can easily be exceeded, which results in receiving ordinary milk prices on excess production.

Organic producers generally follow one of two marketing paths:

1. The producer processes his own milk and then personally develops markets within a 100-300 mile radius, which includes distribution.

2. The producers sell to an organic processor that has its own brand and markets. This milk may be shipped long distances to major cities.

Kelly Shea
Horizon Organic Dairy
PO Box 17577
Boulder, CO 80308-7577
Phone: (719) 372-9233

Horizon is a private organic processor with contract plants that co-pack for them in many areas of the U.S. At this time, they don't have any plants that could take milk from Kansas organic dairies. They are constantly evaluating new opportunities to purchase milk and develop new markets.

Wayne Shaker
Organic Valley/CROPP Cooperative
PO Box 159
507 W. Main Street
LaFarge, WI 54639
Phone: (608) 783-6455

This cooperative started as a vegetable marketing cooperative—the Coulee Region Organic Produce Pool—(CROPP). The coop has expanded into a wide variety of organic products that are sold under the Organic Valley brand name.

In Kansas at this time, the only avenue for organic milk production is marketing path 1—developing your market and distributing milk yourself. The established organic dairy bottlers and processors do not have any plants close enough for buying organic milk from Kansas producers. If a large enough group of organic producers could be put together, the established companies would be open to contracting a co-processor and marketing the organic milk.

SIZE OF ORGANIC PRODUCERS

At the present time, based on Kansas Organic Producers Association data, organic grain supplies in Kansas would support only small herds of organic production. Organic dairy production is currently limited to smaller scale operations. Kansas Organic Producers is organized as a marketing and bargaining cooperative. The 2002 sales are projected to be 100,000 bushels of corn; 20,000 bushels of feed beans; 20,000 bushels of feed wheat and 20,000 bushels of milo. These volumes of organic feed supplies would barely support ten dairies averaging 100 lactating cows. The trend to large dairies has avoided the organic movement. Investors are very cautious regarding investing large amounts of money in a large organic dairy due to the risk of uncertain markets for organic milk. There is also some question on the productivity of cows handled under organic conditions. Most large dairies rely on a considerable amount of hormones in their breeding programs, as well as antibiotics, BST, and other products not approved for organic milk production.

Organic grain may be more plentiful if suppliers from outside Kansas are considered. One organic dairy in Missouri indicated that they have received plenty of offers for certified organic grain. Only Kansas-grown supplies marketed by Kansas Organic Producers were considered for this study.

Those in the organic industry are making philosophical decisions. As evidence, this quote from Horizon Organic Dairy, "We are looking for people with a heart felt commitment to sustainable agriculture; we discourage producers whose primary interest is motivated by the additional premiums that an organic dairy provides."

Attached to this report is a set of financial projections done on the Finpack 2001 analysis. The projections were provided by the Kansas Organic Producers Association. The assumptions were made and the analysis completed by Donn Teske and Ed Reznicek. Each producer must incorporate his own financial information and make its own assumptions, personalizing the projections before making a decision to convert to organic production. A discussion of the projections as included in this report follows:

The sample organic farm consists of 410 acres—250 acres of cropland valued at $700 per acre and 160 acres of pasture at $400 per acre. Current land values are above this in Kansas. It would be unusual to find cropland below $800 per acre, with most dryland above $900 per acre. Pasture is priced above $500 per acre, with pasture in many areas costing considerably more.

The investment in machinery and dairy facilities is inadequate. The projections are based on owning $50,000 of equipment and $50,000 for the dairy facilities. Annual depreciation is $5000. The cropping operations are considered to be custom-farmed. The total overhead cost in the operation is $21,000, which includes the $16,174 of custom fees plus the $5,000 depreciation. Overhead costs are understated, depending on the age and size of the equipment. We believe more investment will be required in both equipment and milking facilities to run a Grade A operation. To build and equip a new dairy facility capable of milking 60 cows in 2 hours or less would cost $200,000 to $250,000. Adding a bottling facility with used equipment would add a minimum of another $150,000. If equipment and facilities are presently owned and fully depreciated, then overhead costs may be insignificant. Each operation should evaluate the cost based on their financial situation. If fully depreciated facilities will be used, increased repair and maintenance costs would be expected. (Fully depreciated facilities would lower overhead costs for either conventional or organic dairies.)

Crop yield projections are as follows with comparison to the numbers reported in the National Organic Farmers Survey:

		Organic Survey	
	In Projection	**Median**	**Range**
Corn	75 bu	100	35 - 145
Oats	60 bu	50	20 - 65
Soybeans	35 bu	30	10 - 55
Alfalfa	4.0 tons	4.0	1.5 – 7.0

This is a hypothetical scenario so the productivity of the land is not known. The prices used in the projection suggest average upland ground (not bottomland). These yields are probably similar to those expected over the long term from conventional practices on this type of land. There are farmers who have been growing organically for several years and getting yields close to conventional practices. While it is possible that producers could reach these yields immediately, it is more likely that there will be a considerable learning curve before reaching this level of efficiency for an organic farm. It is highly likely that producers may find problems with weed competition, which results in lower yields than projected, particularly in the first few years under organic rules.

According to the National Organic Survey, 28 percent of farmers said that weed problems were the greatest barrier to producers switching to organic production. Another 17% said that lack of knowledge and experience of organic production practices was the greatest barrier. Quotes, such as "I thought I was smarter than I was" and "Second and third were unnecessary disaster years", suggest that managing an organic farm requires knowledge and experience different from conventional. The most likely difference is that, without the use of chemicals, problems have to be isolated and solved early before they become unsolvable. There are no rescue treatments—no second chances—for organic growers. Producers will be required to use organic methods for 3 years on crops and 1 year on dairy cows before they will be able to sell their production labeled "organic." Non-organic production during transition will have higher costs, but will not be eligible for the organic premiums, if any. The highest costs per unit of production are expected to occur in the first three years due to the fact that the problems will be more severe from lack of experience.

Organic projection relies on crop rotation and tillage for weed control. Most organic producers will need to own their equipment in order to complete timely tillage, particularly cultivation. A farm of this size will have excess labor if all the crop work is custom hired.

The cow projections are reasonable. The cost of feed per cwt of milk is between $5.00 and $6.00, which is a reasonable cost. The ration has not been evaluated from a nutritional standpoint. Silage is considered important in most dairy rations. A number of feeds such as cottonseed are also used extensively in dairy rations. No opinion is made to the adequacy of the diet to produce 17,000 pounds per cow, but the cost is adequate compared to conventional dairies.

The projected net income ranges from $46,500 to $84,000 for the 100% organic scenario. Put another way, this is a range in net income of $113 to $205 per acre. Net returns at this level should pull considerable amounts of capital and labor into organic production fairly quickly. A significant shift in capital is not obvious at this point.

TRANSITION TO ORGANIC PRODUCTION

The rules and requirements for organic production encompass over 100 pages and are not being made a part of this report in their entirety.

Crops: In general, no synthetic inputs can be applied to the crop. The land must not have any prohibited substances applied for a period of three years prior to the year the organic crop is produced.

Dairy Cows: Milk or milk products must be from animals that have been under continuous organic management beginning no later than 1 year prior to the production of the milk or milk products that are to be sold, labeled or represented as organic, except, that when an entire, distinct herd is converted to organic production, the producer may:

i. for the first 9 months of the year, provide a minimum of 80 percent feed that is either organic or raised from land included in the organic system plan and managed in compliance with the organic crop requirements;
ii. provide feed grown organically in compliance with the standards; and
iii. once an entire, distinct herd has been converted to organic production, all dairy animals shall be under organic management during the last third of gestation.

In general, all feed additives are banned. No antibiotics or hormones are to be used on the dairy cows. Genetically manipulated products are banned. Vaccines for prevention of disease are generally allowed. If animals are sick, treatment including antibiotics, cannot be withheld, but the animals will lose its organic status if a prohibited substance is used to treat the animal. Animals must have access to the outdoors, to pasture, and be maintained in livestock living conditions which accommodate the health and natural behavior of the cows.

Kansas Organic Producers
P.O. Box 82
Whiting, KS 66552

Ed Reznicek
General Manager
(785) 939-2032
Route 2, Box 23
Goff, KS 66428

Oren Holle
President
(785) 337-2662
979 2nd Road
Bremen, KS 66412

	Yield/Acre	Share	Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
Plan Description					
Total Crop Acres			250	250	250
Total Labor Hours			--	--	--
Change in Farm Assets			--	--	--
Change in Farm Liabilities			--	--	--
Crop Plan	**Yield/Acre**	**Share**			
Feed Oats, Alfalfa mix	60.00 bu.	100%	35.7	35.7	35.7
Alfalfa Hay, Double Crop	1.50 ton	100%	35.7	35.7	35.7
Alfalfa Hay	4.00 ton	100%	71.4	71.4	71.4
Feed Corn, corn 1	75.00 bu.	100%	35.7	35.7	35.7
Fd Soy, feed, soy 1	35.00 bu.	100%	35.7		24.3
Feed Corn, corn 2	75.00 bu.	100%	35.7	35.7	35.7
Fd Soy, feed, soy 2	35.00 bu.	100%	35.7		35.7
Soybeans, Cash, soy 1	35.00 bu.	100%		35.7	
Soybeans, Cash, soy 2	35.00 bu.	100%		35.7	
Livestock Plan	**Unit**	**Sales/Unit**			
Dairy, $12.50	Cow	17000/lb	60		
Dairy, $12.50 milk, buy	Cow	17000/lb		60	
Dairy, $16.00 milk	Cow	17000/lb			60
Corn, Feed (bu.)					
Produced			5,355	5,355	5,355
Fed			6,000	6,000	5,340
Balance			-645	-645	15
Oats, Feed (bu.)					
Produced			2,142	2,142	2,142
Fed			2,100	2,100	2,100
Balance			42	42	42
Soybeans, Feed (bu.)					
Produced			2,499		2,100
Fed			2,100		2,100
Balanced			399		
Hay Equivalents (ton)					
Produced			339	339	339
Fed			297	297	297
Balanced			42	42	42

			Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
INCOME STATEMENT (Typical Year)					
Corn, Feed	$ 2.80	/bu.			42
Oats, Feed	$ 1.20	/bu.	50	50	50
Soybeans, Feed	$ 6.00	/bu.	2,394		
Hay Equivalents	$ 70.00	/ton	2,951	2,951	2,951
Soybeans	$ 12.00	/bu.		2,988	4,788
Milk	$ 12.50	/bu.	127,500		
Milk	$ 12.50	/bu.		127,500	
Milk	$ 16.00	/bu.			163,200
Cull breeding livestock					
Cull cows			6,480	6,480	6,480
Total cull breeding livestock			6,480	6,480	6,480
Misc. livestock income					
Bull calves			2,340	2,340	2,340
Total misc. livestock income			2,340	2,340	2,340
Other farm Income					
Gov Payment			3,500	3,500	3,500
Total other farm income			3,500	3,500	3,500
(A) Gross farm income			145,215	172,809	183,351
Seed					
Oats, alfalfa			564	564	564
Other seed			3,056	3,056	3,056
Total seed			3,620	3,620	3,620
Fertilizer					
Manure appl	$ 1.45	/ton	776	776	776
Lime	$ 9.00	/ton	643	643	643
Total fertilizer			1,419	1,419	1,419
Crop Insurance			643	643	643
Crop, custom hire					
Till, disc			677	677	677
Till, drill			249	249	249
Combine			3,420	3,420	3,420
Swathing	$ 7.00	/cutting	2,249	2,249	2,249
Baling	$ 6.81	/bale	3,078	3,078	3,078
Hauling	$ 3.33	/ton	1,130	1,130	1,130
Till, plow	$ 10.15	/acre	362	362	362
Till, F Cult	$ 5.97	/pass	853	853	853
Till, Planting	$ 6.99		998	998	998
Cultivation	$ 5.33	/pass	1,522	1,522	1,522
Till, Disc	$ 6.32	/pass	451	451	451
Till, F Cult	$ 5.97		853	853	853
Rotary Hoe	$ 4.65		332	332	332
Total crop custom hire			16,174	16,174	16,174
Purchased Feed Corn	$ 3.08	/bu.			

			Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
Purchased Feed					
Processed Beans	$ 2.00	/bu	3,840	3,840	3,840
Calcium & Ph			2,655	2,655	2,655
Min & Vit			1,320	1,320	1,320
CALF RATION			1,800	1,800	1,800
Roasted Bns	$ 5.50	/bu.		11,550	
Puch or Corn	$ 3.75	/bu.			2,475
Total Purchased Feed			9,615	21,165	12,090
Breeding Fees			2,316	2,316	2,316
Veterinary			3,900	3,900	3,900
Livestock supplies			7,800	7,800	7,800
Livestock marketing					
Misc. Expense			7,800	7,800	7,800
Total Livestock Marketing			7,800	7,800	7,800
Interest					
Interm Debt			5,250	5,250	5,250
Long Term Debt			12,447	12,447	12,447
Operating Interest			4,212	4,212	4,212
Total interest			21,909	21,909	21,909
Fuel & Oil			2,000	2,000	2,000
Repairs			4,000	4,000	4,000
Custom Hire			200	200	200
Hired Labor			1,000	1,000	1,000
Real Estate Taxes			2,000	2,000	2,000
Personal property taxes			250	250	250
Farm Insurance			2,000	2,000	2,000
Utilities			3,240	3,240	3,240
(A) Dues & Professional Fees			1,800	1,800	1,800
(B) Total Cash Farm Expense			93,672	105,222	94,161
(C) Net Cash Farm Income			51,543	67,587	89,190
Depreciation			5,000	5,000	500
(D) Net Farm Income			**46,543**	**62,587**	**84,190**

		Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
PROFITABILITY MEASURES (Market)				
Net Farm Income	(D)	46,543	62,587	84,190
Labor & Manag. Earnings	(D-E)	30,682	46,726	68,330
Rate of Return on Farm Assets	(H/I)	12.9%	16.0%	20.3%
Rate of Return on Farm Equity	(J/K)	15.1%	20.8%	28.6%
Rate of Return on added investment	(L/M)			
Operating Profit Margin	(H/N)	46.2%	51.5%	57.0%
Asset Turnover	(N/I)	27.8%	31.2%	35.7%
(E) Interest on Farm Net Worth	(K*6%)	15,860	15,860	15,860
(F) Farm Interest Paid		21,909	21,909	21,909
(G) Value Operators Labor & Mgt.		6,681	7,483	8,563
(H) Return on Farm Assets	(D+F-G)	61,771	77,013	97,536
(I) Total Farm Assets		479,840	479,840	479,840
(J) Return on Farm Equity	(D-G)	39,862	55,104	75,627
(K) Total Farm Net Worth		264,340	264,340	264,340
(L) Added return to added investment			15,242	35,765
(M) Added Capital Invested		133,613	149,657	171,261
(N) Value of Farm Production				
LIQUIDITY				
CASH FLOW (Typical Year)				
Net Cash Farm Income	C	51,543	67,587	89,190
Nonfarm Income	(+)			
Net Cash Available	(=)	51,543	67,587	89,190
Family Living	(-)	35,000	35,000	35,000
	(-)	6,130	8,584	9,768
(R) Cash Available for Principal Payments	(=)	10,413	24,002	44,423
Farm Interest paid	(+)	21,909	21,909	21,909
Cash Avail. For Principal & Interest	(=)	32,322	45,900	66,332
Interm Debt		10,784	10,784	10,784
Long Term Debt		16,601	16,601	16,601
Operating Loan Interest		4,212	4,212	4,212
(S) Total Scheduled Principal & Interest	(-)	31,597	31,597	31,597
Cash Available after Loan Payments	(=)	726	14,315	34,735
Annual Capital Replacement				
Principal Paid on Intermediate Debts				
(T) Cash Required for Replacement	(-)	5,534	5,534	5,534
(U) Cash Surplus for Deficit	(=)	726	14,315	34,735

		Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
LIQUIDITY MEASURES				
Cash Available for Principal Payment	R	10,413	24,002	44,423
Annual Farm Long Term Principal Pymts.	(-)	4,154	4,154	4,154
(V) Cash available for Farm Intermed. Debt	(=)	6,260	19,849	40,269
(W) Farm Intermediate Debt to be served		52,500	52,500	52,500
Years to turnover Farm Intermed Debt	(W/V)	8.4	2.6	1.3
Surplus as a percent of Payments	(U/(S+T))	2.3%	45.3%	109.9%
Cash Farm Expense as % of Income	**(B/A)**	**64.5%**	**60.9%**	**51.4%**
Farm interest as % of value of Prod.	(F/N)	16.4%	14.6%	12.8%
Farm Debt Pymts as % of Value of Prod.		23.6%	21.1%	18.4%
SOLVENCY				
BALANCE SHEET (Market)				
Current Farm Assets		48,840	48,840	48,840
Intermediate Farm Assets	(+)	105,000	105,000	105,000
Long Term Farm Assets	(+)	326,000	326,000	326,000
Nonfarm Assets	(+)			
(X) Total Assets	(=)	479,840	479,840	479,840
Current Farm Liabilities		9,495	9,495	9,495
Intermediate Farm Liabilities	(+)	46,703	46,703	46,703
Long Term Farm Liabilities	(+)	159,302	159,302	159,302
Nonfarm Liabilities	(+)			
(Y) Total Liabilities	(=)	215,500	215,500	215,500
Net Worth	(X-Y)	264,340	264,340	264,340
SOLVENCY MEASURES				
Current Percent in Debt		19.4%	19.4%	19.4%
Current & Intermediate % in Debt		36.5%	36.5%	36.5%
Long Term percent in Debt		48.9%	48.9%	48.9%
Nonfarm Percent in Debt				
Total Percent in Debt	**(Y/X)**	**44.9%**	**44.9%**	**44.9%**
NET WORTH CHANGE (Typical Year)				
Net farm Income		46,543	62,587	84,190
Nonfarm Income	(+)			
Family Living	(-)	35,000	35,000	35,000
Income taxes and Social Security	(-)	6,130	8,584	9,768
Net Worth Change per Year	**(=)**	**5,413**	**19,002**	**39,423**

		Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
FINANCIAL STANDARDS MEASURES				
Liquidity				
Current Ratio		5.14	5.14	5.14
Working Capital		39,345	39,345	39,345
Solvency				
Farm Debt to Asset Ratio		4.9%	4.9%	4.9%
Farm Equity to Asset Ratio		55.1%	55.1%	55.1%
Farm Debt to Equity Ratio		81.5%	81.5%	81.5%
Profitability				
Rate of Return on Farm Assets		12.9%	16.0%	20.3%
Rate of Return on Farm Equity		15.1%	20.8%	28.6%
Operating Profit Margin		46.2%	51.5%	57.0%
Net Farm Income		46,543	62,587	84,190
Repayment Capacity				
Term Debt Coverage Ratio		102.6%	152.3%	226.8%
Capital Replacement Margin		726	14,315	34,735
Efficiency				
Asset Turnover		27.8%	31.2%	35.7%
Operating Expense Ratio		49.4%	48.2%	39.4%
Depreciation Expense Ratio		3.4%	2.9%	2.7%
Interest Expense Ratio		15.1%	12.7%	11.9%
Net Farm Income Ratio		32.1%	36.2%	45.9%
INCOME TAX				
Federal Income Tax				
State Income Tax				
Social Security Tax		6,130	8,584	9,768
Total Income & Social Security Tax		6,130	8,584	9,768
CROP AND LIVESTOCK PRODUCTION				
Oats, Feed	bu.	2,142	2,142	2,142
Hay, Alfalfa	ton	339	339	339
Corn, Feed	bu.	5,355	5,355	5,355
Soybeans, Feed	bu.	2,499		2,100
Soybeans	bu.		2,499	399
Milk	lb.	1,020,000		
Milk	lb.		1,020,000	
Milk	lb.			1,020,000

		Base Plan Dairy, Crop Org Prod Stnd Price	Alt. 1 Organic Soybeans Stnd Price	Alt. 2 Dairy, Crop Org Prod Org. Price
PLANNED INPUT QUANTITIES				
Manure Appl	ton	536	536	536
Lime	ton	71	71	71
Till, Disc		71	71	71
Swathing	Cutting	321	321	321
Bailing	bale	452	452	452
Hauling	ton	339	339	339
Till, Plow	acre	36	36	36
Till, F Cult	pass	143	143	143
Till, Plant		143	143	143
Cultivation	pass	286	286	286
Till, Disc	pass	71	71	71
Till, F Cult		143	143	143
Rotary Hoe		71	71	71
Proc. Beans	bu.	1,920	1,920	1,920
Roasted Beans	bu.		2,100	
Puch or Corn	bu.			660
SENSITIVITY ANALYSIS				
Effect of a 2% Decrease in All Enterprises				
Net Farm Income		42,660	58,404	79,525
Cash Surplus or Deficit		-2,563	10,772	30,205
Net Worth change per Year		2,125	15,460	34,893
Effect of a 10% Decrease in all Enterprises				
Net Farm Income		27,110	41,655	60,827
Cash Surplus or Deficit		-15,734	-3,414	12,824
Net Worth change per Year		-11,046	1,273	17,512
LOAN DETAIL				
Current Liabilities				
Original Principal Balance		--	--	--
Interm Debt				
Original Principal Balance		52,500	52,500	52,500
Long Term Debt				
Original Principal Balance		163,000	163,000	163,000

FINPACK BALANCE SHEET

CURRENT FARM ASSETS

	Quantity	Value/Unit	Value
Cash & Checking Balance			1
Prepaid Expense & Supplies			--
Growing Crops			--
Accounts Receivable			--
Hedging Accounts			--
Other Current Assets			--
Crops (Schedule G)			
Alfalfa Hay	341	63.55/ton	21,670
Feed Corn	5,357	2.80/bu.	14,999
Soybeans	1,600	6.00/bu.	9,600
Feed Oats	2,142	1.20/bu.	2,500
Crops under Govt. Loan			--
Market Livestock			--
Total Current Assets			48,840

CURRENT FARM LIABILITIES

	Balance
Farm Accrued Interest	
Accounts Payable and Accrued Expense	

Current Loans	Interest Rate	P & I Due	Principal Balance
Government Crop Loans			--
Principal due within 12 months of term liabilities			9,495
Total Current Liabilities			9,495

INTERMEDIATE FARM ASSETS

	Market
Breeding Livestock	55,000
Farm Machinery & Equipment	50,000
Other Intermediate Assets	--
Total Intermediate Assets	105,000

INTERMEDIATE FARM LIABILITIES (Schedule S)

	Interest Rate	Principal Balance	P & I Due	Principal Due	Intermediate Balance
Interm Debt	10.00	52,500	10,784	5.797	46,703
Total Intermediate Liabilities					46,703

LONG TERM FARM ASSETS

	Acres	Market
Land (Schedule L)	250	175,000
Cropland	160	64,000
Pasture		--
Building & Improv. (Schedule M)		87,000
Other long term assets		--
Total Long Term Assets		105,000

LONG TERM FARM LIABILITIES (Schedule T)

	Interest Rate	Principal Balance	P & I Due	Principal Due	Intermediate Balance
Interm Debt	8.00	163,000	16,601	3,698	159,302
Total Long Term Liabilities					159,302

TOTAL FARM ASSETS	479,840
NONFARM ASSETS	--
TOTAL ASSETS	479,840

TOTAL FARM LIABILITIES	215,500
NON FARM LIABILITIES	--
TOTAL LIABILITIES	215,500
NET WORTH	264,340

FINPACK BALANCE SHEET

Schedule G: Crop & Feed

	Description	Quantity	Value Per Unit	Value
Alfalfa Hay	Poor	55 ton	30.00	1,650
Alfalfa Hay	Good	286 ton	70.00	20,020
Feed Corn		5,357 bu.	2.80	14,999
Soybeans	For Feed	1,600 bu.	6.00	9,600
Feed Oats		2,142 bu.	1.20	2,570
For crops held for sale or feed				48,839

Schedule L: Farm Land

	Acres	Market Value Per Acre	Value
Crop Land	250	700	175,000
Pasture	160	400	64,000
Total Land			239,000

Schedule M: Buildings & Improvements

	Year Built	Market Value
Dairy Facility	--	50,000
Shop	--	10,000
Machine Shed	--	12,000
Grain Bins	--	15,000
Total Buildings & Improvements		87,000

Schedule S: Intermediate Farm Liabilities

	Interest Rate	Principal Balance	Accrued Interest	Normal P & I	Past Due P & I	Month Due	Final Year	Principal Due	Intermed Balance
Interm Debt	10%	52,500	--	10,784	--	Multiple	2,008	5,797	46,703

Schedule T: Long Term Farm Liabilities

	Interest Rate	Principal Balance	Accrued Interest	Normal P & I	Past Due P & I	Month Due	Final Year	Principal Due	Intermed Balance
Long Term Debt	8%	163,000	--	16,601	--	Multiple	2,021	3,698	159,302
Total Long Term Farm Liabilites		163,000	--	16,601	--			3,698	159,302

Schedule W: Ratio Analysis

	Market
Current Ratio	5.14
Farm Working Capital	39,345
Current Farm Percent in Debt	19%
Intermediate Farm Percent in Debt	44%
Current + Intermediate Farm Percent in Debt	37%
Long Term Farm Percent in Debt	49%
Nonfarm Percent in Debt	--
Total Debt to Asset Ratio	45%
Total Equity to Asset Ratio	55%
Total Debt to Equity Ratio	82%

Crop Budget No.	**1**
Crop	Oats, Feed
Unit	bu.
Type	
Description	Alfalfa Mix

	Long Range	Year 1
Yield	60.0	--
Price	1.20	--
Product Income	72.0	0
Miscellaneous Income	--	--
Gross Income	72.0	0
Seed		
Oats, Alfalfa	15.80	--
Fertilizer		
Manure Appl	7.25	--
Crop Chemicals	--	--
Crop Insurance	--	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, disc	6.32	--
Till, drill	6.98	--
Combine	15.80	--
Hired Labor	--	--
Total Direct Expense	52.15	0
Return over Direct Expense	19.85	0
Labor Hours	--	--
Corn Equivalents (bu.)	30.00	--

Crop Budget No.	**2**
Crop	Hay, Alfalfa
Unit	ton
Type	Double Crop
Description	Oats Mix

	Long Range	**Year 1**
Yield	1.50	--
Price	30.00	--
Product Income	45.00	0
Miscellaneous Income	--	--
Gross Income	45.00	0
Seed	--	--
Fertilizer	--	--
Crop Chemical	--	--
Crop Insurance	--	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Swathing	7.00	--
Baling	13.62	--
Hauling	5.00	--
Hired Labor	--	--
Total Direct Expense	25.62	0
Return over Direct Expense	19.38	0
Labor Hours	--	--
Hay Equivalents (ton)	1.50	--

Crop Budget No.	**3**
Crop	Hay, Alfalfa
Unit	ton
Type	
Description	

	Long Range	**Year 1**
Yield	4.00	--
Price	75.00	--
Product Income	300.00	0
Miscellaneous Income	--	--
Gross Income	300.00	0
Seed	9.80	--
Fertilizer	--	--
Crop Chemicals	--	--
Crop Insurance	--	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		--
Swathing	28.00	--
Baling	36.30	--
Hauling	13.32	--
Hired Labor	--	--
Total Direct Expense	87.42	0
Return over Direct Expense	212.58	0
Labor Hours	--	--
Hay Equivalents (ton)	4.00	--

Crop Budget No.	**4**
Crop	Corn, Feed
Unit	bu.
Type	
Description	Corn 1

	Long Range	**Year 1**
Yield	75.0	--
Price	2.80	--
Product Income	210.0	0
Miscellaneous Income	--	--
Gross Income	210.0	0
Seed	18.00	
Fertilizer		
Manure Appl	7.25	--
Crop Chemical	--	--
Crop Insurance	4.00	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, plow	10.15	--
Till, disc	6.32	--
Till, F Cult	11.94	--
Till, Plant	6.99	
Cultivation	10.66	
Combine	20.00	--
Hired Labor	--	--
Total Direct Expense	95.31	0
Return Over Direct Expense	114.69	0
Labor Hours	--	--
Corn Equivalents (bu.)	75.00	--

Crop Budget No. **5**
Crop Corn, Feed
Unit bu.
Type
Description Corn 2

	Long Range	Year 1
Yield	75.0	--
Price	2.80	--
Product Income	210.0	0
Miscellaneous Income	--	--
Gross Income	210.0	0
Seed	18.00	
Fertilizer		
Manure Appl	7.25	--
Crop Chemical	--	--
Crop Insurance	4.00	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, disc	6.32	--
Till, F Cult	11.94	--
Till, Plant	6.99	
Cultivation	10.66	
Combine	20.00	--
Hired Labor	--	--
Total Direct Expense	85.16	0
Return Over Direct Expense	124.84	0
Labor Hours	--	--
Corn Equivalents (bu.)	75.00	--

Crop Budget No.	**6**
Crop	Soybeans, Feed
Unit	bu.
Type	
Description	Soy 1

	Long Range	**Year 1**
Yield	35.0	--
Price	6.00	--
Product Income	210.0	0
Miscellaneous Income	--	--
Gross Income	210.0	0
Seed	15.00	
Fertilizer		
Crop Chemical	--	--
Crop Insurance	5.00	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, disc	6.32	--
Till, F Cult	11.94	--
Till, Plant	6.99	
Rotary Hoe	4.65	
Cultivation	10.66	--
Combine	20.00	--
Hired Labor	--	--
Total Direct Expense	80.56	0
Return Over Direct Expense	129.44	0
Labor Hours	--	--
Corn Equivalents (bu.)	35.00	--

Crop Budget No.	**7**
Crop	Soybeans, Feed
Unit	bu.
Type	
Description	Soy 2

	Long Range	**Year 1**
Yield	35.0	--
Price	6.00	--
Product Income	210.0	0
Miscellaneous Income	--	--
Gross Income	210.0	0
Seed	15.00	
Fertilizer		
Lime	18.00	--
Crop Chemical	--	--
Crop Insurance	5.00	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, disc	6.32	--
Till, F Cult	11.94	--
Till, Plant	6.99	
Rotary Hoe	4.65	
Cultivation	10.66	--
Combine	20.00	--
Hired Labor	--	--
Total Direct Expense	98.56	0
Return Over Direct Expense	111.44	0
Labor Hours	--	--
Corn Equivalents (bu.)	35.00	--

Crop Budget No.	**8**
Crop	Soybeans, Feed
Unit	bu.
Type	
Description	Cash, Soy 1

	Long Range	**Year 1**
Yield	35.0	--
Price	12.00	--
Product Income	420.0	0
Miscellaneous Income	--	--
Gross Income	420.0	0
Seed	15.00	
Fertilizer		
Crop Chemical	--	--
Crop Insurance	5.00	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, disc	6.32	--
Till, F Cult	11.94	--
Till, Plant	6.99	
Rotary Hoe	4.65	
Cultivation	10.66	--
Combine	20.00	--
Hired Labor	--	--
Total Direct Expense	80.56	0
Return Over Direct Expense	339.44	0
Labor Hours	--	--

Crop Budget No.	**9**
Crop	Soybeans
Unit	bu.
Type	
Description	Cash, Soy 2

	Long Range	**Year 1**
Yield	35.0	--
Price	12.00	--
Product Income	420.0	0
Miscellaneous Income	--	--
Gross Income	420.0	0
Seed	15.00	
Fertilizer		
Lime	18.0	
Crop Chemical	--	--
Crop Insurance	5.00	--
Drying Fuel	--	--
Irrigation Energy	--	--
Custom Hire		
Till, disc	6.32	--
Till, F Cult	11.94	--
Till, Plant	6.99	
Rotary Hoe	4.65	
Cultivation	10.66	--
Combine	20.00	--
Hired Labor	--	--
Total Direct Expense	98.56	0
Return Over Direct Expense	321.44	0
Labor Hours	--	--

Livestock Budget No.	**1**	
Livestock Enterprise	Dairy	
Budget Unit	Per Cow	
$12.50		
	Long Range	**Year 1**
Milk		
Quantity (lb.)	17,000	--
Price (cwt.)	12.50	--
Product Income	2,125	0
Cull Income		
Cull Cows	108	--
Miscellaneous Income		
Bull Calves	39	--
Gross Income	2,272	0
Purchase Feed		
Proc. Beans	64	--
Calcium & Ph	44.25	--
Min & Vit	22	--
Calf Ration	30	--
Breeding Fees	38.60	--
Veterinary	65	--
Livestock Supplies	130	--
Marketing		
Miscellaneous Expense	130	--
Total Direct Expense	523.85	0
Labor Hours	--	--
Feed Corn (bu.)	135 Fd soy, feed(bu.)	
Hay Equivalents (ton)	4.95	
Silage Equivalents (ton)	--	--
Pasture Equivalents (AUM)	--	--
Feed Expense	878.50	
Return over Budget Expense	869.65	0

Livestock Budget No. **2**
Livestock Enterprise Dairy
Budget Unit Per Cow

	Long Range	Year 1
Milk		
Quantity (lb.)	17,000	--
Price (cwt.)	12.50	--
Product Income	2,125	0
Cull Income		
Cull Cows	108	--
Miscellaneous Income		
Bull Calves	39	--
Gross Income	2,272	0
Purchase Feed		
Roasted Beans	192.50	--
Proc. Beans	64	--
Calcium & Ph	44.25	--
Min. & Vit.	22	--
Calf Ration	30	--
Breeding Fees	38.60	--
Veterinary	65	--
Livestock Supplies	130	--
Marketing		
Miscellaneous Expense	130	--
Total Direct Expense	716.35	0
Labor Hours	--	--
Feed Corn (bu.) 135 –Feed Oats (bu.)		
Hay Equivalents (ton)	4.95	
Silage Equivalents (ton)	--	--
Pasture Equivalents (AUM)	--	--
Feed Expense	668.50	
Return over Budget Expense	887.15	0

Livestock Budget No. **3**
Livestock Enterprise Dairy
Budget Unit Per Cow

	Long Range	Year 1
Milk		
Quantity (lb.)	17,000	--
Price (cwt.)	16.00	--
Product Income	2,720	0
Cull Income		
Cull Cows	108	--
Miscellaneous Income		
Bull Calves	39	--
Gross Income	2,867	0
Purchase Feed		
Proc. Beans	64	--
Calcium & Ph	44.25	--
Min & Vit	22	--
Calf Ration	30	--
Puch or Corn	41.25	--
Breeding Fees	38.60	--
Veterinary	65	--
Livestock Supplies	130	--
Marketing		
Miscellaneous Expense	130	--
Total Direct Expense	565.10	0
Labor Hours	--	--
Feed Corn (bu.)	135 Fd soy, feed(bu.)	
Hay Equivalents (ton)	4.95	
Silage Equivalents (ton)	--	--
Pasture Equivalents (AUM)	--	--
Feed Expense	847.70	
Return over Budget Expense	1,454.20	0

FEED PRICES

	Sale Price	Purchase Price
Corn Equivalents (bu.)	2.67	2.94
Hay Equivalents (ton)	70.00	75.00
Silage Equivalents (ton)	--	--
Pasture Equivalents (AUM)	--	--
Feed Corn (bu.)	2.80	3.08
Feed Oats (bu.)	1.20	1.32
Fd Soy, Feed (bu.)	6.00	6.60

CROP ROTATION SUMMARY

Farm | Ave. An. Rainfall: 34” | Date of Plan: 1995

Crop Acres: | Livestock Enterprises: Cow/Calf Pair

Basic Rotation:

Year in Rotation	**1** **Oats/Alf./ Red C.**	**2** **Alfalfa**	**3** **Alfalfa**	**4** **Corn**	**5** **Soybean**	**6** **Corn**	**7** **Soybean**	**8**
Yield Goal:	Oats – 75 bu. Alfalfa – 1.5 ton	4 Ton	4 Ton	100 bu.	35 bu.	100 bu.	35 bu.	
Seeding Rate:	Oats – 2 bu. Alfalfa 10# Red Clover – 3#	None	None	18,000 Seeds/ac	175,000 Seeds/ac	18,000 Seeds/ac	175,000 Seeds/ac	
Tilage:	Ligth Disc – 1	None or Springtooth	None or Light Springtooth	Plow Green Manure, Disc – 1	Disc – 1 Field Cult 1-2	Field Cult. 1-2	Disc – 1 Field Cult 1-2	
Fertility	Soybean N, 5 ton Manure	None Added	None Added	Alfalfa Green Manure	Soil Test (Primarily for P) Supplement as Needed	Legume N Carryover, 5 ton Manure	None Added, Soil Test: Lime if Needed	
Weed Control	May Graze after oat harvest, Cut Hay	Cut Hay	Cut Hay	Crop Rotation Pre-plant tillage, Hoe 1-2, Cult 1-2	Crop Rotation Preplant tillage, Hoe 1-2, Cult 1-2	Crop Rotation Preplant tillage, Hoe 1-2 Cult 1-2	Crop Rotation Preplant tillage, Hoe 1-2 Cult 1-3	
Cover Crop:	Alfalfa	Alfalfa	Alfalfa	Stubble, May Use Rye	Stubble, May Use Oats and Hairy Vetch	Stubble, May Use Rye	Stubble	
Other Practices	**FALL AND WINTER GRAZE CATTLE**							

ORGANIC PRODUCTION CONSTRAINTS AND CHALLENGES

Q Organic farmers can be classified as either "starting from scratch as an organic producer," or as "transitioning" from conventional production. How did you start farming organically?

1,161 respondents. 1995 survey results are provided for comparison

Table 6.1 Did Farmers Transition From Conventional Production Or Start With Organic?

1997 # of responses	1997 n=1,192 %	1995 n=945%	Response category
687	58%	56%	Began farming with organic production
475	40%	40%	Transitioned from conventional production
30	2%	4%	No Response

Q If you transitioned from conventional farming, what were your greatest barriers to transitioning to organic production?

405 respondents provided written responses, which have been assigned to the following categories (categories were chosen by the data reviewers, please see Methodology; Results Analysis). Multiple responses are possible for each respondent. Arranged in descending order of number of responses, as assigned to each category. Examples of individual responses (in italics, in respondents' own words) are also provided.

Greatest barriers: Categories and Individual Responses

Table 6.2 For Transitioning Farmers, Greatest Barriers To Organic Production

# of responses	n=405%	Greatest barriers to organic production: categories and individual responses (in italics)
115	28%	Weed control, management or pressure: *Learning to rely on tillage for weed control. Fear of weeds. Looking at weeds. Controlling weeds the first years. Stopping spraying for weeds.*
69	17%	Information and experience: *Re-education. The learning curve. I thought I was smarter than I was. Know how! Second and third were unnecessary disaster years*
46	11%	Markets – finding, establishing or developing markets for transitional and/or organic products.
37	9%	Pest control: *Slugs, Mites, Scale, Codling moth, Cutworms, Psylla, Ants, Gophers, Bacterial wilt, Fireblight.*
32	8%	Fertility Management
28	7%	Transition period – no organic labeling or price premiums during transition time: *Lower income while transitioning. No market for transitional crops. No premium price during transition. Just the waiting.*
23	6%	Frame of mind – For positive thinking types these included: *Attitude, Belief, Courage, Mindset.* On the darker side: *Nerves, Stupidity, Ignorance, Uncertainty, Fear!*
21	5%	Materials – costs of materials and where to find them. Everything from seeds to manures to granular fertilizer: *Finding appropriate fertilizer at a decent price.*
17	4%	Soil restoration: *Bringing soil back to life. Dead Soil. Condition Soil. Rebuilding Soil. Ecosystem. Getting soil balanced. Getting life back in the soil.*
16	4%	Organic feed cost, quality and/or supply: *Our cows do not like the organic grain we purchased since it is a mash and has no molasses.*
14	3%	Yields – potential or actual reductions, especially during transition, maintaining yields: *Reduced yields at first.*

Continued

Continued

# of responses	n=405%	Greatest barriers to organic production: categories and individual responses (in italics)
15	3%	Organic regulations – Figuring out and/or dealing with organic certification regulations, paperwork and record keeping. *Complexity of certification process. Figuring out the regulations. Getting better organized.*
13	3%	Costs, financial concerns, concerns about profitability.
13	3%	Labor and time increases with organic practices, adjustments in labor and management. *Product segregation in mixed operations.*

Q. Could you provide some examples of the crops or products that are most economically important to your farm, and provide information about yield, as well as price ranges and averages received for these products in 1997?

Respondents were asked to list up to two products, and to provide 1997 yield per product, and a low, high and average price for each product.

Notes: In the table headers below.
Total response # = the entire number of respondents mentioning the product category as important.
Yield calc # = the number of responses utilized to calculate yield data for the indicated product category.
Price calc # = the number of responses utilized to calculate price data for the indicated product category.

**data insufficient to develop figure

Field Crops
Table 4.6A Yields and Prices for 1997

Total Resp. #	Category	Yield Calc #	1997 Yield			Price Calc #	Price received, 1997 (in dollars)		
			Lowest	Highest	Median		Lowest	Highest	Median
15	Alfalfa	14	1.5 tons/ac	7 tons/ac	4 tons/ac	12	30.00/ton	200.00/ton	80.00/ton
3	Amaranth	2	3 bu./ac	10 bu./ac	**	1	1.00/bu.	1.50/bu.	1.35 bu.
8	Barley	7	35 bu./ac	120 bu./ac	42 bu./ac	3	3.00/bu.	7.00/bu.	4.25/bu.
						3	6.75/cwt.	7.00/cwt.	6.75/cwt.
2	Beans, dry	1	**	**	20 bu./ac	2	.40/lb.	3.50/lb.	.60/lb.
1	Beans, garbanso	1	**	**	**	1	.65/lb.	.75/lb.	.70/lb.
2	Beans, red kidney	2	1,350 lb/ac	2,000 lbs/ac	**	1	**	**	42.00/cwt
4	Buckwheat	3	10 bu./ac	28 bu./ac	20 bu./ac	1	4.50/bu.	8.00/lb.	**
76	Corn	65	35 bu./ac	145 bu./ac	100 bu./ac	57	2.00/bu.	30.00/bu.	4.50/bu.
3	Cotton	3	35 lbs/ac	750 lbs/ac	375 lbs/ac	3	.90/lb.	1.40/lb.	1.10/lb.
7	Flax	7	10 bu./ac	20 bu./ac	15 bu./ac	7	7.90/bu.	18.40/bu.	12.40/bu.
3	Forage	3	3 tons/ac	3 tons/ac	3 tons/ac	2	30.00/ton	120.00/ton	60.00/ton
33	Hay	20	1 ton/ac	6 tons/ac	3 tons/ac	13	10.00/ton	200.00/ton	100.00/ton
	*	4	50 bales/ac	240 bales/ac	100 bales/ac	4	.25/bale	4.25/bale	2.00/bale
1	Kamut	1	**	**	20 bu./ac	1	**	**	8.25/bu.
2	Lentils	2	500 lbs/ac	1,000 lbs/ac	**	2	.24/lb	.40/lb	.38/lb
7	Millet	5	20 bu./ac	50 bu./ac	25 bu./ac	3	4.00/cwt.	12.00/cwt	9.00/cwt.
1	Oat Straw	1	**	**	55 bales/ac	1	1.50/bale	2.00/bale	**
11	Oats	8	20 bu./ac	65 bu./ac	50 bu./ac	5	2.00/bu.	3.00/bu.	2.50/bu.
	*					3	.25/lb	2.50/lb	1.00/lb
1	Peanuts	1	**	**	3,000 lbs/ac	1	725.00/ton	725.00/ton	725.00/ton
3	Popcorn	2	30 bu./ac	40 bu./ac	**	2	.18/lb	1.25/lb	1.10/lb
1	Quinoa	1	**	**	700 lbs/ac	1	1.00/lb	2.00/lb	1.50/lb
4	Rice	4	35 cwt/ac	71 cwt/ac	55 cwt/ac	4	12.00/cwt	25.50/cwt	19.00/cwt

Continued

Total Resp. #	Category	Yield Calc #	1997 Yield Lowest	Highest	Median	Price Calc #	Price received, 1997 (in dollars) Lowest	Highest	Median
1	Rice, wild	1	**	**	700 lbs/ac	1	1.00/lb	2.00/lb	1.50/lb
160	Soybeans	157	10 bu./ac	55 bu./ac	30 bu./ac	151	4.00/bu.	28.00/bu.	16.50/bu.
3	Spelt	3	40 bu./ac	100 bu./ac	65 bu./ac	2	.07/lb	.14/lb	.13/lb
3	Sunflower	2	1,000 lbs/ac	1,500 lbs/ac	**	2	.21/lb	.21/lb	**
54	Wheat	51	10 bu./ac	125 bu./ac	30 bu./ac	42	2.50/bu.	12.00/bu.	6.25/bu.

Fruit, Nut and Tree Crops
Table 4.6B Yields and Prices for 1997

Total Resp. #	Category	Yield Calc #	1997 Yield Lowest	Highest	Median	Price Calc #	Price received, 1997 (in dollars) Lowest	Highest	Median
4	Almonds	4	200 lbs/ac	1,400 lbs/ac	1,200 lbs/ac	3	2.95/lb	4.85/lb	3.00/lb
50	Apples	13	80 lbs/ac	1,00 bu./ac	400 bu./ac	12	3.80/bu.	40.00/bu.	20.00/bu.
	**	4	3 tons/ac	20 tons/ac	10 tons/ac	6	80.00/ton	2,000.00/ton	200.00/ton
	**	9	6 bins/ac	69 bins/ac	40 bins/ac	8	65.00/bin	425.00/bin	160.00/bin
4	Apricots	2	3 tons/ac	18 tons/ac	**	--	**	**	**
	*	1	**	**	400 boxes/ac	1	20.00/box	25.00/box	22.50/box
2	Avocados	2	1,000 lbs/ac	5,000 lbs/ac	**	1	.50/lb	1.20/lb	.80/lb
25	Blueberries	7	500 lbs/ac	7,000 lbs/ac	2,078 lbs/ac	9	1.00/lb	3.50/lb	1.50/lb
	*	--	**	**	**	4	9.00/flat	40.00/flat	5.00/flat
77	Cherries	1	**	**	**	5	1.00/lb	3.00/lb	2.50/lb
1	Cranberries	1	**	**	50 barrels/ac	1	**	**	350.00/brl.
1	Dates	1	**	**	1-200 lbs/tree	1	2.00/lb	5.00/lb	3.00/lb
4	Figs	2	1 ton/ac	2.5 tons/ac	**	4	.40/lb	1.25/lb	.50/lb
1	Grapefruit	1	**	**	6,000 lbs/ac	1	.30/lb	**	.55/lb
9	Grapes	4	2 tons/ac	6 tons/ac	6 tons/ac	7	350/ton	2,300/ton	1,175/ton
17	Grapes, wine	13	.25 ton/ac	13 tons/ac	4.5 tons/ac	14	200/ton	2,500/ton	1,200/ton
4	Grapes, table	2	.50 ton/ac	1 ton/ac	**	13	.47/lb	1.25/lb	1.00/lb
3	Kiwi	2	829 trays/ac	2,000 trays/ac	**	1	7.25/tray	9.00/tray	8.55/tray
3	Maple Syrup	3	**	**	**	3	6.25/qt	12.00/qt	8.50/qt
1	Marionberries	1	**	**	2 tons/ac	1	10.00/case	18.00/case	12.00/case
1	Nectarines	1	**	**	5 tons/ac	1	.75/lb	2.00/lb	**
2	Olives	2	2 tons/ac	3 tons/ac	**	2	296.00/ton	625.00/ton	500.00/ton
5	Oranges	1	**	**	15 bins/ac	2	5.00/box	23.00/box	2.00/box
9	Peaches	2	10 tons/ac	15 tons/ac	**	7	.55/lb	16.00/lb	1.50/lb
14	Pears	6	10 tons/ac	38 bins/ac	30 bins/ac		50.00/bin	650.00/bin	350.00/bin
2	Pears, Asian	--	**	**	**	2	.50/lb	1.00/lb	.95/lb
2	Persimmons	1	**	**	5 tons/ac	2	.15/lb	.80/lb	.50/lb
1	Pineapples	1	**	**	9,000 lbs/ac	1	.50/lb	.60/lb	.58/lb
3	Prunes	2	1 dry ton/ac	3 dry tons/ac	**	2	.38/lb	1.55/lb	1.20/lb
5	Raisins	4	6 dry tons/ac	3 dry tons/ac	2.9dry tons/ac	1	1,000.00/ton	1,200.00/ton	1,000.00/ton
18	Raspberries	4	2,000 lbs/ac	6,000 lbs/ac	6,000 lbs/ac	2	.75/lb	4.50/lb	1.30/lb
	*	4	500 pts/ac	5,500 pts/ac	5,000 pts/ac	14	1.00/pt	8.50/pt	3.00/pt
23	Strawberries	7	750 lbs/ac	15,000 lbs/ac	5,000 lbs/ac	8	.90/lb	2.00/lb	1.40/lb
	*	4	500 qts/ac	3,500 qts/ac	3,500 qts/ac	7	.90/qt	5.25/qt	2.75/qt
11	Walnuts	7	571 lbs/ac	3,000 lbs/ac	1,200 lbs/ac	9	.31/lb	4.00/lb	1.10/lb
1	Wine	--	**	**	**	1	50.00/case	60.00/case	55.00/case

Livestock and Animal Products
Table 4.6C Yields and Prices for 1997

Total Resp. #	Category	Yield Calc #	1997 Yield Lowest	1997 Yield Highest	1997 Yield Median	Price Calc #	Price received, 1997 (in dollars) Lowest	Price received, 1997 (in dollars) Highest	Price received, 1997 (in dollars) Median
30	Beef	--	**	**	**	15	.29/lb	16.00/lb	1.25/lb
	*	--	**	**	**	1	150.00/hd	900.00/hd	400.00/hd
2	Cheese	--	**	**	**	2	4.00/lb	11.00/lb	8.00/lb
3	Chickens	--	**	**	**	3	1.21/lb	2.35/lb	1.90/lb
10	Eggs	--	**	**	**	10	1.00/doz	3.00/doz	1.50/doz
2	Hogs	--	**	**	**	2	.29/lb	.65/lb	.55/lb
3	Honey	--	**	**	**	3	1.50/lb	3.10/lb	2.00/lb
7	Lamb	--	**	**	**	7	.70/lb	7.00/lb	2.75/lb
31	Milk	14	10,000 lb/cow	18,500 lb/cow	14,00 lb/cow	2299	10.00/cwt	35.00/cwt	17.10/cwt
7	Poultry	--	**	**	**	7	1.50/lb	4.00/lb	2.00/lb
2	Wool	--	**	**	**	2	1.00/lb	12.00/lb	8.00/lb
1	Yarn	--	**	**	**	2	5.00/skein	15.00/skein	12.00/skein

MARKETING REVIEW
ORGANIC AND CONVENTIONAL MILK

1.1 Motivation

Milk consumption patterns are changing in the U.S. as changing income levels, demographics and tastes have driven the marketplace to a more health discerning public. Sales of all organic food products grew from $847 million in 1991 to $1.95 billion in 1996. Sales of organic dairy products in 1999 totaled $171 million, with organic milk accounting for $75.7 million (Glaser and Thompson, 2000).

American consumers have increasingly shown interest in organically produced food and fiber products in recent years. Concerns about environmental degradation, pesticide and hormone residues in food products and animal welfare issues all are contributing factors in this consumer interest. Organic milk is derived from animals that have been under continuous organic management beginning no later than 1 year prior to the production of the milk that is to be sold. Organic management prohibits the use of animal drugs, including hormones, to promote growth, as well as prohibits the use of any animal drug other than vaccinations in the absence of illness.

Change in milk consumption patterns is not only limited to organic milk consumption. The consumer's desire to use milk products with less fat is well documented. For example, whole milk accounted for more than 81% of commercial fluid milk disappearance in 1970, but by 1993, this percentage was less than 39%. Whole milk consumption in pounds per capita was approximately 200 pounds per year in 1970, but dropped to approximately 65 pounds per person in 1993. For that same time period, consumption in pounds per capita for reduced fat milk (2%, 1%, fat-free or skim) increased from approximately 45 pounds per year to 110 pounds.

With this increasing production concentration within the dairy industry, concern has been raised regarding the competitiveness and viability of smaller dairy operations in Kansas. In response to this concern, the Agriculture Marketing Division of the Kansas Department of Commerce (Commerce) applied for and received a Rural Business Enterprise Grant from the United States Department of Agriculture. The division, charged by the Kansas Legislature with assisting and promoting value-added agricultural ventures in the state of Kansas, undertook this investigation. The purpose of this grant was to determine if demand was sufficient in the metropolitan areas within this region, such as Kansas City, for differentiated milk products, of which organic milk products was a main component of this research. In addition, an independent contractor for Commerce was retained to provide an analysis of the cost of transition to and production under an organic production system.

1.2 Previous Literature

The official electronic library of the American Agricultural Economics Association (AGECON Search) contains staff papers from more than 15 universities, selected paper abstracts from four professional associations, and two journals. A search of this database found 51 studies on organic foods. One of these was related to organic milk consumption.

Glaser and Thompson (2001) used national-level scanner data for mainstream markets to determine market share, price premiums, and demand elasticities of organic milk. They found several key results. First, container size is important and half-gallon containers are the principal size for organic milk with market shares in different markets ranging from 1.6% to 2.8% in 1999. Quart and gallon size containers had less than 0.5% market share. During the November 1996 to December 1999 time period, price premiums averaged 60% of branded prices and 75% of private-label prices.

As organic milk of various fat content increased market share during this time period, consumers were not as sensitive to price changes indicating some loyalty or preference for organic milk. The cross-price elasticities indicated that non-organic and organic milk were substitutes for one another. Finally, the authors noted that as the total consumer expenditure of milk declined, the tendency to purchase organic milk increased, suggesting that consumers with smaller households and less milk consumption were more likely to purchase organic milk.

1.3 Objective

The objective of this study is to determine attitudes of Kansas consumers towards organic milk. This study was implemented to provide information to fluid milk producers about current consumer preferences regarding milk products, either from conventional or organic production and consumer willingness-to-pay for organic milk. The results will provide producers with recommendations for positioning their milk product in retail supermarkets.

The organization of the study begins with an overview of the survey and procedures in Chapter 2. The consumer willingness-to-pay for organic milk is analyzed in Chapter 3. Finally, conclusions and implications are described in Chapter 4.

SURVEY DATA AND RESULTS

A survey was used to gather information from consumers at retail supermarkets that sell conventional, organic, and natural food products. Two groups of consumers were identified using transaction level data from a leading retail supermarket chain in Kansas City. The first category, 'milk drinkers,' included those consumers making the most weekly fluid milk purchases. The second category of consumers, which are labeled the 'organic-food' consumers, included those buying the most organic food products each week. The Kansas State Dairy Club administered the survey, which was based on a similar survey done by Givry (1998).

The top 500 consumers in each group were identified and a total of 1,000 questionnaires were mailed in July 2001. A brochure on organic milk was included in the survey. In addition, two $1 bills were included to help increase response rates. The overall response rate was 60.8%. Of the 608 questionnaires returned, 271 were from the milk drinkers (54%) and 337 were from the organic food consumers (67%). Complete data was available on 252 milk drinkers and 295 organic consumers.

2.1 Demographic Information

The survey instructions asked that the person most responsible for food purchases in each household complete the questionnaire. A majority of the consumers who responded were female, with 84 and 86% for the organic food group and milk drinkers, respectively. The average age of the female respondents was almost identical in the two categories with an average of 44.2 years old for the organic food group and 44.3 years old for the milk drinkers. The age distribution is shown in Figure 2.2.1.

Figure 2.2.2 shows the annual household income level for both consumer categories. The average annual income was greater for milk drinkers (ranging from $100,000 to $109,999) than for organic food consumers (ranging from $90,000 to $99,999). The education level mode, or the level that was most often answered, was 'B.S., B.A. completed' for both groups of consumers.

Figure 2.2.1. Age of Organic and Milk Drinker Consumers by Category

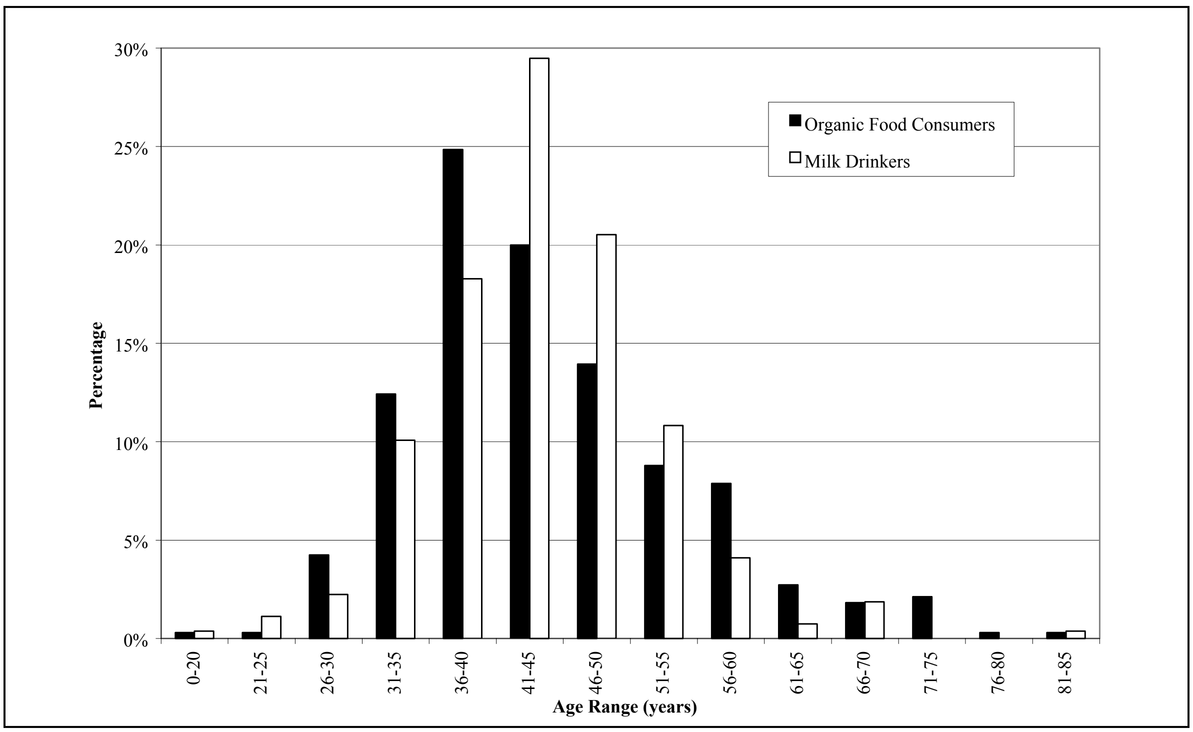
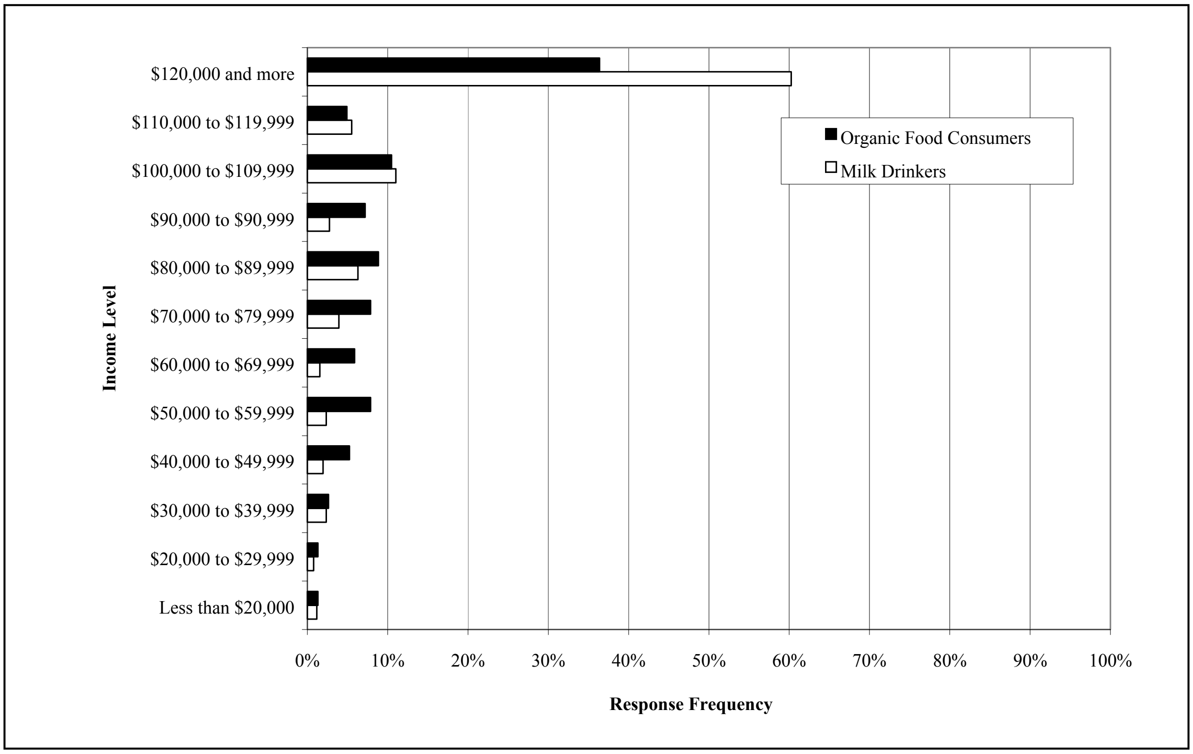


Figure 2.2.2. Income Levels of Organic and Milk Drinker Consumers by Category



2.3 Consumer Consumption Questions

Question 1: How often do you consume these drink products?
Milk, Juice, Diet soft drinks, Non-diet soft drinks

Respondents were asked to indicate how frequently they consume the various drink products using a scale of "never," "once per day," "twice per day," or "three times or more per day." The hypothesis is that organic consumers were biased towards "health conscious" consumption of various food products and would consume fewer soft drinks, both diet and non-diet soft drinks.

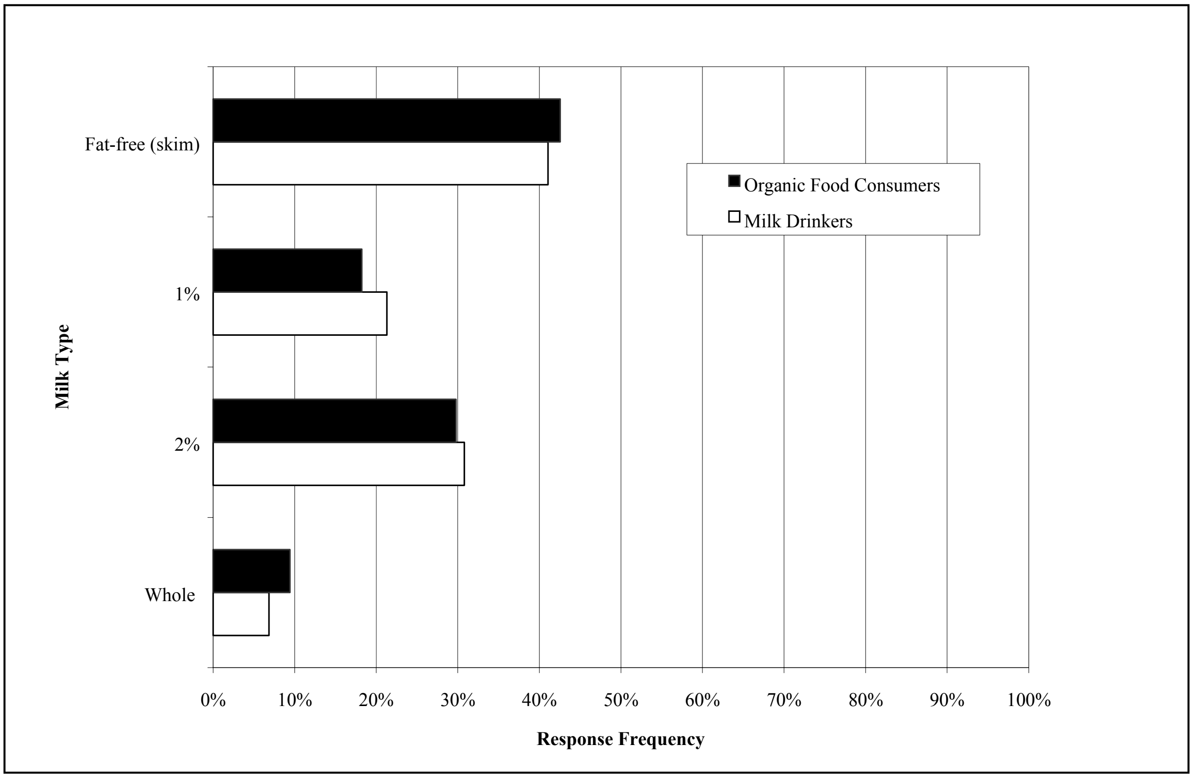
The results for this particular question, summarized in Appendix Table 2.3.1, showed that no significant differences in beverage consumption existed between the two populations in regards to milk and juice consumption. However, the results did show a statistically significant difference between the two groups on the consumption of both diet and non-diet soft drinks. This may be attributed to a preference towards "new age" beverages by organic consumers and that consumption of soft drinks, either in diet or non-diet formulations, is contrary to that preference. This tends to support the negative perception of soft drinks to organic consumers who were biased to health conscious consumption.

2.4 Choice of Preference Between Whole, 2%, 1% or Fat Free

Question 2: When you buy milk, which type do you most often buy?
Whole, 2%, 1%, Fat-Free (skim)

Most consumers (42%) reported that they most often buy fat-free or skim milk. Two percent milk was a close second with 30% buying that type most often (Figure 2.4.1).

Figure 2.4.1. Type of Milk Bought Most Often by Organic and Fluid Milk Consumers



The results of question two showed no statistically significant differences between the two sample groups. A value of 1 was given for whole milk, 2 for 2%, 3 for 1% and 4 for fat-free (skim) milk. Both groups tended to purchase fat-free (skim) and 2% above other milk offerings. Both groups purchased fat-free (skim) approximately 42% of the time and purchased 2% milk slightly more than 30% of the time.

2.5 Milk Consumption By Size of Package

Question 3: When you buy milk, which size do you most often purchase? Gallon, ½ gallon, Quart, Pint.

A large majority (79%) of consumers in the milk drinkers category preferred to buy milk in gallon containers. Since this group was made up of the top 500 weekly purchasers of fluid milk and they tend to consume more than one gallon per week, this result makes sense. The organic food consumers most often bought ½ gallon containers of milk. Many of these consumers, however, noted that they preferred to buy milk in a gallon size, but that it was difficult to find organic milk packaged that way.

For this survey question, the respondent was given the choice between one gallon, half gallon, quart and pint package sizes. The survey results show a statistical difference between the consumption preferences regarding packaging between the two groups. However, the results of this question may be skewed due to the unavailability of one-gallon containers of milk for organic products. Many organic consumer respondents indicated that they would prefer the one gallon size, if available. Therefore, the results may not reflect the true preferences of the organic group (Appendix Figure 2.5.1).

2.6 Ranking of Milk by Product Characteristics

Question 4: How would you rate milk on these product characteristics (1 equals very low content, 5 equals very high content)?
Content Characteristics: Cholesterol content; Calorie content; Sodium content; Artificial ingredients; Fat content

Consumers were asked to rate the above product characteristics on a scale from 1 to 5 for the following milk types: Whole, 2%, 1% and Fat Free (Skim). The hypothesis was that consumers view the above characteristics as a negative and that both milk drinkers and organic consumers prefer lower amounts of characteristics such as cholesterol and fat content in milk.

Consumers were asked to rank different factors that affected their purchasing decision, with a scale of 1 (very low content) to 5 (very high content). Appendix Table 2.6.1 indicated that there were statistical differences between milk drinkers and organic consumers on calorie content of whole milk, calorie content of fat-free (skim) and on sodium content of whole milk. For all characteristics, whole milk was considered highest in content for the particular characteristic and fat-free (skim) was considered lowest. Again, these product characteristics are hypothesized as negative to consumers, and the difference in health conscious consumption patterns may explain the statistically significant differences between the two groups.

The consumer may not necessarily perceive a correlation in product attributes for sodium and artificial ingredients regardless of the product being labeled whole, 2%, 1% or fat-free (skim) (Appendix Table 2.6.1).

2.7 Organic Milk Awareness

Question 5: Which of the following best describes your knowledge of organic milk before you read this leaflet. (1 = Never heard of organic milk until now, 2 = Had heard of it, but didn't know much about it, 3 = Knew a lot about it)

Consumers were asked about their awareness of organic milk before reading an informational brochure. The organic food consumer group had a significantly high level of familiarity with organic milk as would be expected with a mean response of 2.8 (Appendix Table 2.7.1). The milk drinkers group had a mean response of 1.729, indicating that on average, consumers had a relatively low level of familiarity with organic milk.

2.8 Attitude to Organic Milk Label

Question 6: Where had you heard or read about organic?
Newspaper, In-store product samples, Promotional materials at the store, Other (please identify)

Many consumers who were aware of organic milk at the awareness level of at least "had heard of it" learned about organic milk through newspapers. Consumers identified a variety of other sources of information by writing them in the "other" category. Some of the responses that were revealed most often in this category included health magazines, health food stores, friends, and family.

Question 7 (8): Prior to (After) reading this leaflet, how would you have characterized your attitude to an "organic" label? Positive, Negative, Indifferent

The survey asked consumers their attitude toward an organic milk label before and after reading an informational brochure that gave a general overview of organic milk. There were very few negative attitude responses even prior to reading the information provided. Consumer attitudes were mostly positive after reading the informational brochure. At least half of the consumers (50% of organic food consumers and 62% of milk drinkers) who previously had an indifferent attitude changed their attitude to positive after reading the enclosed information.

Figure 2.8.1. Attitudes to "Organic Milk" Label Prior to Reading Informational Brochure

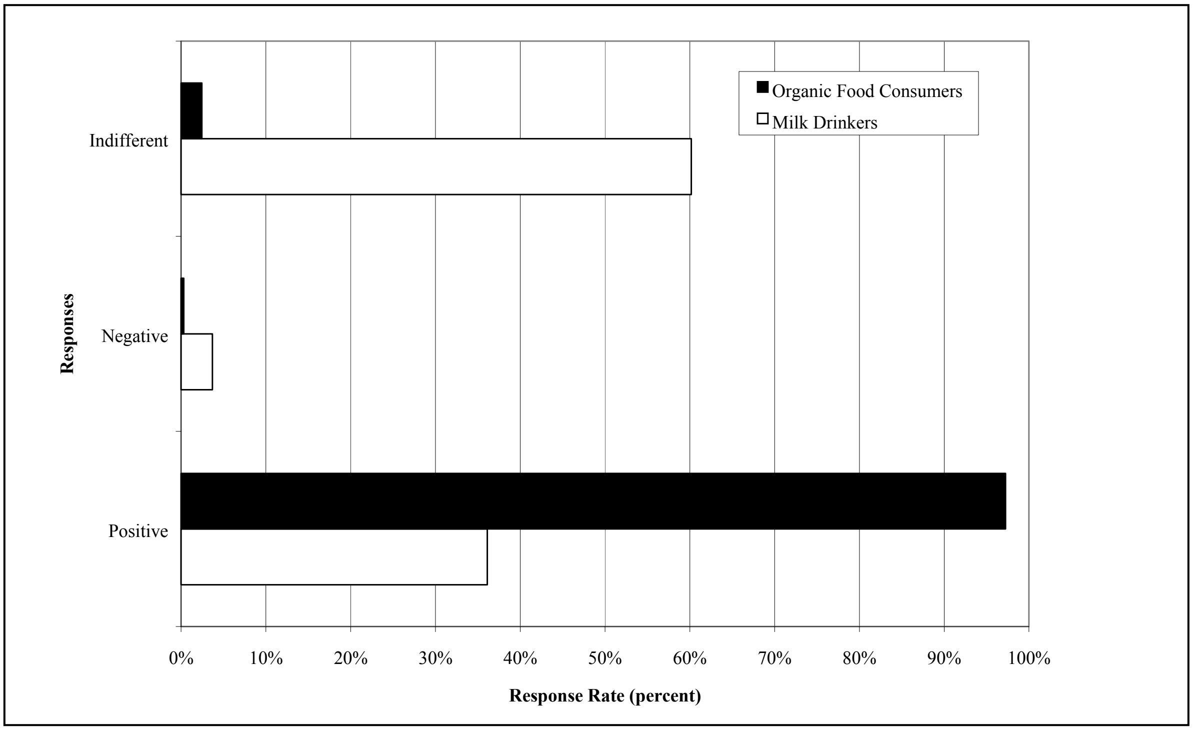
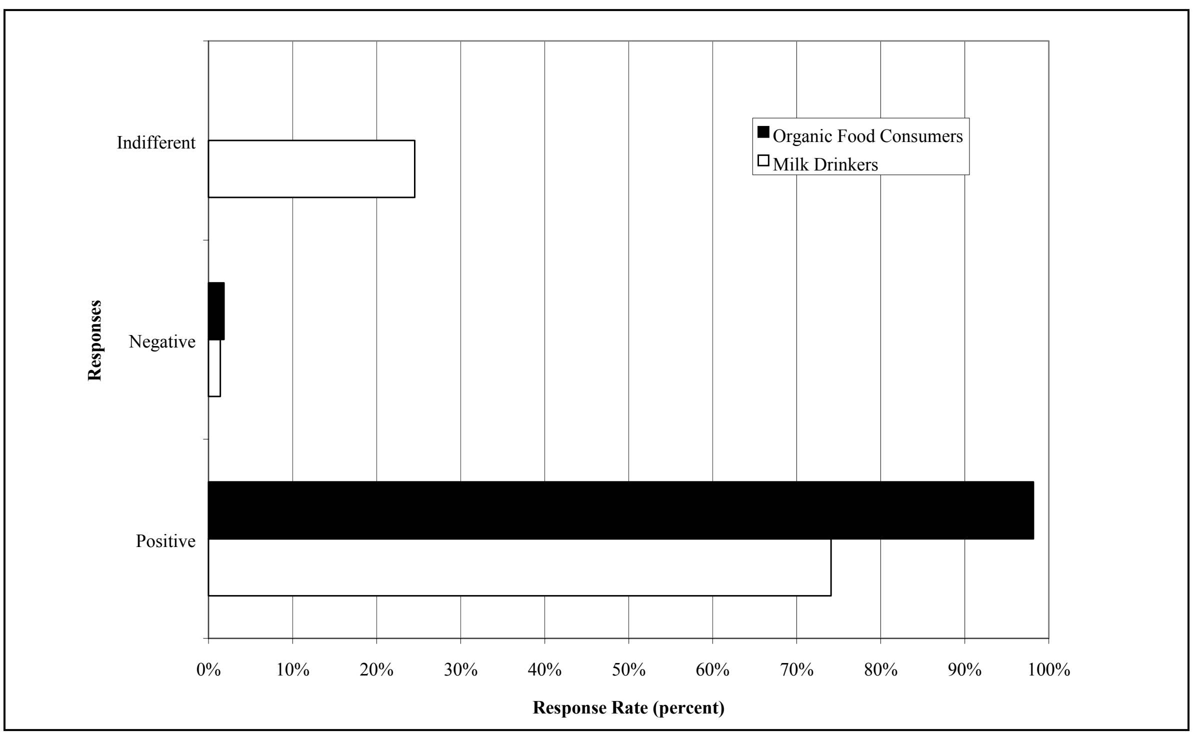


Figure 2.8.2. Attitudes to an "Organic Milk" Label After Reading Informational Brochure



2.9 Demographic Questions: Gender

Values of 1 and 2 were given in the data for male and female respectively. As seen in Appendix Table 2.9.1, most of the consumers were females (86% female for milk drinkers, 84% female for organic consumers); however, there was no statistically significant difference in the responses between milk drinkers and organic consumers. The large response by female consumers is not surprising, as the cover letter asked that the person in the household most responsible for groceries shopping, which are mostly women, complete the survey.

2.10 Demographic Questions: Age

These results suggest that both consumer types do not have significantly different mean ages (Appendix Table 2.10.1). The majority of consumers were between the ages of 30 and 60 as seen in Figure 2.2.1.

2.11 Demographic Questions: Education

Respondents were asked in this question to indicate their education level, from 1 (less than 12th grade) to 8 (Ph.D., etc.) (Appendix Table 2.11.1). This suggests that there are no significant differences in educational levels between milk drinkers and organic consumers.

2.12 Demographic Questions: Income

Consumers were asked to indicate their annual household income level on a range from 1 (less than $23,000) to 12 (more than $120,000). It was hypothesized that the organic consumer would be a higher income group than the milk-drinking group. While the difference between the two groups was statistically significant, the organic consumers, in fact, had lower incomes than the milk-drinking group, in contradiction of the hypothesis. As seen in Figure 2.2.2, the overwhelming majority of consumers had income levels of greater than $100,000.

2.13 Demographic Questions: Number of Children

Consumers were asked to respond to this question with a 1 for no children in the household or 2 for children in the household. The responses showed a statistically significant difference in the two populations with milk drinkers having more children on average than the organic group and the null hypothesis was rejected (Appendix Table 2.13.1).

2.14 Summary

This chapter summarized the survey data collected on the top 500 milk drinkers and the top 500 organic milk consumers. Several differences were found between both consumer groups. First, organic consumers purchased significantly fewer soft drinks (diet and non-diet) than the milk drinkers. Organic consumers were significantly more aware of the caloric content of milk. As would be expected, organic milk consumers were more aware of differences between organic milk and non-organic milk. Upon reading the informational brochure, 50% of the organic consumers and 62% of the milk drinkers were more inclined to purchase organic milk. Organic consumers had a significantly lower income and fewer children than milk drinkers.

CONSUMER WILLINGNESS TO PAY FOR ORGANIC MILK

Estimating a consumer's willingness-to-pay (WTP) is a common method for providing information to policymakers regarding the potential benefits and costs associated with a particular policy. Typically, this involves eliciting a consumer's WTP for a particular policy, which provides a marginal value for that decision.

3.1 Willingness-to-Pay Data

Appendix Figure 3.1.1 summarizes the data for the two consumer groups. Four versions of the survey were used, which differed only in the amount of the bid (Exhibit 20). The bid for the organic milk was higher in every instance. For example, in version 1, consumers were asked to choose between regular milk for $2.00 per gallon and organic milk for $2.50 per gallon. The consumers who selected the regular milk were then asked to choose between regular milk at $2.00 per gallon and organic milk at $2.20 per gallon. Consumers who selected regular milk in the first question were asked to choose between regular milk at $2.00 per gallon and organic milk at $2.50 per gallon. The four versions of these 1,000 (125 per group) surveys varied the prices at which consumers could purchase the regular and organic milk. In general, willingness-to-pay decreased from Version IV (highest prices) to Version I (lower prices).

CONCLUSIONS

Milk production and consumption is changing. This study summarized the survey data collected on the top 500 milk drinkers and the top 500 organic milk consumers for Kansas consumers. Several conclusions and implications were found.

4.1 Survey Summary

Several differences were found between both sets of consumer groups. First, organic consumers purchased significantly fewer soft drinks (diet and non-diet) than the milk drinkers. Organic consumers were significantly more aware of the caloric content of milk and were more aware of differences between organic milk and non-organic milk. Upon reading the informational brochure, 50% of the organic consumers and 62% of the milk drinkers were more inclined to purchase organic milk. Organic consumers had a significantly lower income and fewer children than milk drinkers. It was found that milk drinkers and organic consumers would increase their purchases of organic milk if its price decreased.

4.2 Implications

Clearly there is a market for organic milk, but its size is small. Glaser and Thompson (2000) found that organic milk was sold primarily in half-gallon containers. Some survey respondents expressed an interest in gallon containers. More than half of the consumers would consider purchasing organic milk after reading informational information about organic milk.

Likewise, it is clear that smaller-sized families were more likely candidates to purchase organic milk. Families with more children and greater consumption are less likely to purchase organic milk.

Household income was not a significant factor in determining who purchases organic milk, as milk drinkers had a significantly greater income than organic consumers. The fact that families with greater milk consumption are less likely to purchase organic milk suggests that a consumer's overall expenditure on milk is more important than the individual price of organic milk. Glaser and Thompson (2000) found similar results for milk drinkers using national data.

Organic consumers are significantly less likely to purchase soft drink beverages and were more concerned about the caloric and fat content of milk. This would suggest that organic consumers are more likely to consume more milk per day. Given a smaller family size, less income, and a greater willingness-to-pay a greater premium for organic milk would suggest that these organic consumers are less sensitive to price effects, which was also found by Glaser and Thompson (2000).

On average, an organic consumer would be willing to pay a $4.05 premium for organic milk compared to only $0.83 for milk drinkers after reading literature about organic milk. While it is not advisable to use these numbers as absolutes, it does suggest that organic consumers were willing to pay a premium that was four times that of milk drinkers. **It is important to note that these figures represent marginal values and not an economic premium.** Thus, if the cost of producing organic milk were greater than $0.83 then milk drinkers would not purchase organic milk because it would be priced greater than $0.83 per half gallon.

A producer or group of producers that seeks to enter the organic milk industry requires marketing expertise because these results suggest that it is important to know who purchases organic products. In addition, it is important to educate consumers about the products. However, consumer loyalty is likely to be greater for organic milk consumers.

4.3 Suggestions for Future Research

These results suggest that there is a small market for organic milk. Additional research is needed prior to advising a producer or group of producers to enter this industry. Organic production requires intensive management. Likewise, these investments may be large which would suggest that if a producer does not have economies of size, he would likely have to work with other producers. This study does not answer all the questions about marketing organic milk but it does provide some evidence of the consumer's marginal value for organic milk. This is helpful information to producers who have knowledge of their marginal costs of production.

Actual Milk Prices in Kansas

In an effort to determine actual price levels for fluid milk in Kansas, the Kansas Department of Commerce, Agriculture Marketing Division, undertook a survey using both Topeka and field staff. Conducted in late December of 2001 and early January of 2002, it shows averages of organic and conventional milk. One-half gallons of organic milk sell for 2.25 times the amount of conventional milk, averaged over all fat contents. Also, the amount and availability of one-gallon containers of organic milk are not readily available in Kansas, which was a common complaint in our survey of consumers.

Milk Prices January 2002

City	*Store*	*Size*	*Fat Content*	*Price*	*Brand*	*Type*
Lawrence	Community Mercantile	1 Gallon	Skim	$2.49	Roberts	Conventional
Lawrence	Community Mercantile	1 Gallon	1%	$2.59	Roberts	Conventional
Lawrence	Community Mercantile	1 Gallon	2%	$2.79	Roberts	Conventional
Lawrence	Community Mercantile	1 Gallon	Whole	$3.15	Anderson Ericson	Conventional
Lawrence	Community Mercantile	1 Gallon	2%	$3.09	Anderson Ericson	Conventional
Lawrence	Community Mercantile	1 Gallon	1%	$1.69	Anderson Ericson	Conventional
Lawrence	Community Mercantile	1 Gallon	Skim	$1.49	Anderson Ericson	Conventional
Lawrence	HyVee	1 Gallon	Whole	$3.15	Anderson Ericson	Conventional
Lawrence	HyVee	1 Gallon	2%	$2.88	Anderson Ericson	Conventional
Lawrence	HyVee	1 Gallon	1%	$2.69	Anderson Ericson	Conventional
Lawrence	HyVee	1 Gallon	Skim	$2.55	Anderson Ericson	Conventional
Lawrence	HyVee	1 Gallon	Vit D	$3.05	Roberts	Conventional
Lawrence	HyVee	1 Gallon	2%	$2.95	Roberts	Conventional
Lawrence	HyVee	1 Gallon	1%	$2.75	Roberts	Conventional
Lawrence	HyVee	1 Gallon	Skim	$2.59	Roberts	Conventional
Lawrence	HyVee	1 Gallon	Vit D	$2.99	HyVee	Conventional
Lawrence	HyVee	1 Gallon	2%	$2.88	HyVee	Conventional
Lawrence	HyVee	1 Gallon	1%	$2.65	HyVee	Conventional
Lawrence	HyVee	1 Gallon	Skim	$2.53	HyVee	Conventional
Average		**1 Gallon**		**$2.68**		**Conventional**
Lawrence	Community Mercantile	1 Gallon	Whole	$5.29	Organic Valley	Organic
Lawrence	Community Mercantile	1 Gallon	2%	$5.29	Organic Valley	Organic
Lawrence	Community Mercantile	1 Gallon	1%	$5.29	Organic Valley	Organic
Lawrence	Community Mercantile	1 Gallon	Skim	$5.29	Organic Valley	Organic
Average		**1 Gallon**		**$5.29**		**Organic**
Hays	Wal Mart	Half Gallon	Whole	$1.63	Hiland	Conventional
Hays	Wal Mart	Half Gallon	2%	$1.55	Hiland	Conventional
Hays	Wal Mart	Half Gallon	Skim	$1.42	Hiland	Conventional
Wichita	Wal Mart	Half Gallon	Whole	$1.58	Hiland	Conventional
Wichita	Wal Mart	Half Gallon	2%	$1.48	Hiland	Conventional
Wichita	Wal Mart	Half Gallon	Skim	$1.38	Hiland	Conventional
Wichita	Wal Mart	Half Gallon	Whole	$1.55	Great Value	Conventional
Wichita	Wal Mart	Half Gallon	2%	$1.48	Great Value	Conventional
Wichita	Wal Mart	Half Gallon	Skim	$1.33	Great Value	Conventional
Wichita	Wal Mart	Half Gallon	Whole	$1.64	Borden	Conventional
Wichita	Wal Mart	Half Gallon	Skim	$1.45	Borden	Conventional
Topeka	Dillons	Half Gallon	Whole	$1.61	Kroger/Dillons	Conventional
Topeka	Albertson's	Half Gallon	Whole	$1.79	?	Conventional
Lawrence	Community Mercantile	Half Gallon	Skim	$0.89	Roberts	Conventional
Lawrence	Community Mercantile	Half Gallon	1%	$1.39	Roberts	Conventional
Lawrence	Community Mercantile	Half Gallon	2%	$1.49	Roberts	Conventional
Lawrence	Community Mercantile	Half Gallon	Whole	$1.79	Anderson Ericson	Conventional
Lawrence	Community Mercantile	Half Gallon	2%	$1.69	Anderson Ericson	Conventional

Continued

Milk Prices **January 2002**

City	*Store*	*Size*	*Fat Content*	*Price*	*Brand*	*Type*
Lawrence	Community Mercantile	Half Gallon	1%	$1.69	Anderson Ericson	Conventional
Lawrence	Community Mercantile	Half Gallon	Skim	$1.49	Anderson Ericson	Conventional
Garden City	Dillons	Half Gallon	2%	$1.65	?	Conventional
Lawrence	HyVee	Half Gallon	Whole	$1.77	Anderson Ericson	Conventional
Lawrence	HyVee	Half Gallon	2%	$1.57	Anderson Ericson	Conventional
Lawrence	HyVee	Half Gallon	1%	$1.49	Anderson Ericson	Conventional
Lawrence	HyVee	Half Gallon	Skim	$1.45	Anderson Ericson	Conventional
Lawrence	HyVee	Half Gallon	Vit D	$1.69	Roberts	Conventional
Lawrence	HyVee	Half Gallon	2%	$1.69	Roberts	Conventional
Lawrence	HyVee	Half Gallon	1%	$1.49	Roberts	Conventional
Lawrence	HyVee	Half Gallon	Skim	$1.49	Roberts	Conventional
Lawrence	HyVee	Half Gallon	Vit D	$0.97	HyVee	Conventional
Lawrence	HyVee	Half Gallon	2%	$0.97	HyVee	Conventional
Lawrence	HyVee	Half Gallon	1%	$0.97	HyVee	Conventional
Lawrence	HyVee	Half Gallon	Skim	$0.97	HyVee	Conventional
Average		**Half Gallon**		**$1.47**		**Conventional**
Hays	Wal Mart	Half Gallon	Whole	$2.78	Organic Valley	Organic
Hays	Wal Mart	Half Gallon	2%	$2.78	Organic Valley	Organic
Hays	Wal Mart	Half Gallon	Skim	$2.78	Organic Valley	Organic
Wichita	Wal Mart	Half Gallon	Whole	$2.78	Organic Valley	Organic
Wichita	Wal Mart	Half Gallon	2%	$2.78	Organic Valley	Organic
Wichita	Wal Mart	Half Gallon	Skim	$2.78	Organic Valley	Organic
Wichita	Green Acres	Half Gallon	Whole	$4.29	Organic Valley	Organic
Wichita	Green Acres	Half Gallon	Skim	$4.29	Organic Valley	Organic
Wichita	Green Acres	Half Gallon	2%	$3.19	Organic Valley	Organic
Wichita	Whole Foods	Half Gallon	Whole	$3.86	Organic Valley	Organic
Wichita	Whole Foods	Half Gallon	2%	$3.86	Organic Valley	Organic
Wichita	Whole Foods	Half Gallon	Skim	$3.86	Organic Valley	Organic
Topeka	Akin Natural Food Market	Half Gallon	Whole	$3.28	Horizon	Organic
Topeka	Akin Natural Food Market	Half Gallon	Whole	$3.49	Organic Valley	Organic
Topeka	Albertson's	Half Gallon	Whole	$2.99	Horizon	Organic
Lawrence	Community Mercantile	Half Gallon	Whole	$3.39	Organic Valley	Organic
Lawrence	Community Mercantile	Half Gallon	2%	$3.39	Organic Valley	Organic
Lawrence	Community Mercantile	Half Gallon	1%	$3.39	Organic Valley	Organic
Lawrence	Community Mercantile	Half Gallon	Lactose Free	$3.89	Organic Valley	Organic
Lawrence	Community Mercantile	Half Gallon	2%	$3.29	Green Hills Harvest	Organic
Lawrence	Community Mercantile	Half Gallon	Skim	$3.29	Green Hills Harvest	Organic
Garden City	Nature's Way Health Food	Half Gallon	2%	$3.89	?	Organic
Lawrence	HyVee	Half Gallon	Skim	$2.99	Green Hills Harvest	Organic
Lawrence	HyVee	Half Gallon	2%	$2.99	Green Hills Harvest	Organic
Lawrence	HyVee	Half Gallon	Whole	$2.99	Green Hills Harvest	Organic
Lawrence	HyVee	Half Gallon	Skim	$2.29	Organic Valley	Organic
Lawrence	HyVee	Half Gallon	2%	$3.39	Organic Valley	Organic
Average		**Half Gallon**		**$3.30**		**Organic**

FINANCIAL NUMBERS IN DAIRY PROCESSING

General

Financial projections for dairy processing are very difficult. As with any industry from agriculture to retailing, there is a wide range in the costs and profitability between individual firms within the industry. An accepted profitability level within the industry is a number equal to 1% of the value of the Assets. Of course, that number varies dramatically based on size and on market penetration in particular markets.

It is important to understand the concepts and principals involved, as well as the relationships in dairy processing. Useful, accurate financial projections cannot be made until a number of decisions have been made. The industry ranges from extremely large, low-cost processors to small, specialty cheese makers—from capital-intensive, low-margin production to time and labor intensive, high margin products. The smaller specialty processors have generally developed a particular marketing niche through packaging, taste preference, or some other type of product differentiation that allows the processor to receive significantly larger gross margins than the large processors. Large processors work on the principle of large volume and tighter margins. The large volume decreases their fixed costs per unit of production and provides them their competitive advantage. Volume is so critical that large processors have moved away from developing their own label and are much more interested in packaging under other private labels for marketing firms that do not have processing facilities. In addition, the large processors involved in Fluid Milk Processing have begun to utilize their production lines for products other than milk. In order to lower their production costs per unit, they have become involved in the bottling of water, fruit juice concentrates and sports drinks.

Of course the above describes the processors on each end of the spectrum, and in-between there is a large range of margins and costs. In addition, these ranges vary from product to product. In general, processors who market retail products have made strides to increase the number of lines of dairy products that they sell. This has been caused somewhat by the requirement by retailers that dairy processors offer a full line of products to their dairy case.

The financial numbers presented are an attempt to represent small-to-moderate-sized plants. Because milk and product prices are constantly changing, the financial projections are based on gross margin—the difference between the cost of the milk and revenue for the products on a unit basis. For example, if a fluid processor (bottler) sells milk for $1.75 per gallon (wholesale) and buys it for $12.00 per cwt (1.39 per gallon); the gross margin is 36 cents per gallon. Wholesale and farm prices are not perfectly correlated. Retailers do not like to move retail milk prices up and down; therefore retail prices lag wholesale price moves. The farm price might move 50 cent to $1 per cwt during a month, while the wholesale and retail price may remain unchanged during that same month. But over time, prices will adjust so the correlation between the two is relatively high. By using gross margin, we have tried to eliminate the effects of price level from the profitability of dairy processing.

Data from Cornell University studies of the cheese and fluid milk processing industries documents the tremendous economies of scale in dairy processing. Costs drop sharply as volume of processing increases (Figure 11). Consequently, there is wide range of costs. Smaller operations, as a rule, have much higher per unit costs. Therefore, smaller processors must find market opportunities that provide substantially larger gross margins. The increased margin must come from the ability to sell the product at a higher price level. The cost of raw milk will be approximately equal for any operation. To the extent milk prices vary, the larger operations will benefit from volume discounts or lower priced freight.

Fluid Milk Processing

The fluid milk processing financial projections presented represent two different sized operations. The smaller operation is based on sales of 300,000 gallons per month and would require milk procurement from approximately 1700 cows.

The range in gross margin used for this projection ranged from $.44 to $.90 per gallon. Therefore, total revenue for the month is determined by multiplying the monthly sales of 300,000 gallon times the gross margin. In addition, a projection of sales of total excess milk fat (1% of the raw milk purchased) is included in the monthly revenue.

Expenses are based on per gallon cost for this size of facility. Costs such as enrichments, flavoring, supplies and packaging will not vary dramatically with the size of the operation. Costs such as labor, utilities and depreciation will vary on a per unit basis based on the amount of volume that moves through a plant.

In addition, a cost of delivery has been added to expenses, which includes labor and depreciation on delivery equipment. Delivery and distribution costs are extremely variable depending on the market area that is served. Therefore, it is critical to evaluate a new operation and determine whether or not there would be economic benefits to contracting the distribution and delivery to another company rather than being a single line distributor. This is another advantage of processing multiple lines of products.

It is also critical to evaluate the costs of equipment for a processing facility. The use of used equipment can significantly reduce depreciation costs and other fixed plant costs. It may reduce plant efficiency as some used equipment may require more maintenance and labor, but that must be evaluated against the total cost of the equipment.

The cost of plastic bottles is a major factor in evaluating the size of the facility. If the facility is large enough to justify a bottle blower, the cost of the bottle will be decreased by as much as 50 percent versus buying the bottles already blown. The major cost is the difference in freight.

The evaluation of the 300,000 gallon per month facility results in an indication that an expectation of an average gross margin near $.90 per gallon would be needed to result in a reasonable return on investment. A gross margin below $.80 per gallon would result in a significant loss.

The larger processing facility that was evaluated was based on monthly sales of 1.2 million gallons, which would require milk procurement from approximately 6800 cows. Labor costs, supplies and packaging, utilities and other plant costs were reduced on a per unit basis because of the larger volume. The larger facility would require a much larger up-front investment, but it would also vary dramatically based on the amount of new and used equipment purchased.

The net result of these projections indicates that the break-even gross margin for this operation would be $.50 per gallon.

The following is a summary of information that was used to develop the financial numbers presented. It is provided as a guide for the development of financial projections.\

The financial projections presented assume fluid milk sales are made up of the following mixture:

Whole Milk	35%
2% Milk	32%
1% Milk	16%
Skim	15%
Half & Half	2%

Labor cost per gallon of milk varies from $.07 to $.17 per gallon in modern medium to large plants. The projection was based on $.12 per gallon in the larger facility and $.18 in the smaller facility. Labor costs per gallon are affected by two variables—the hourly wage rate and the efficiency of the plant. Plant efficiency has more effect on the cost per gallon than the hourly rate. Labor costs might be very low or zero for a small bottling plant run by family labor, which without the bottling operation would be under-employed.

Supplies and packaging vary from $.07 to $.10 for container. Small operations will likely have even higher costs due to cost of shipping containers, as opposed to blowing the containers on site.

Utilities usually vary from $.0175 to $.0425 per gallon. This number will vary depending on the plant and location.

Plant costs are extremely difficult to estimate for a document of this type. Plant costs—building and equipment—for a small to moderate plant could range from $250,000 to $30 million dollars. Industry average plant costs vary widely due to different depreciation methods. In addition, the age of the plant and equipment have a big impact on overhead costs. The higher the overhead costs, the larger, more capital-intensive a plant becomes. The increasing overhead is offset by better labor efficiency.

Lastly, a fluid plant must have a delivery system. This is a fairly costly part of the business, especially for the smaller processors. Large processors serve big accounts and make large deliveries to relatively few points and use efficient equipment to handle the milk containers. Smaller facilities will likely face delivery costs as high as $.30 per gallon compared to large plants which can have costs as low as $.04 per gallon.

Cheese Processing Numbers

The cheese processing numbers are presented based on a plant that sells 1.032 million pounds of cheese annually. This would require 10.320 million pounds of raw milk.

This analysis starts with gross margin per pound of cheese produced. Approximately 10 pounds of milk is used per pound of cheese; therefore, the margin is the price of cheese less the cost of the raw milk. The cost of raw milk will be 10 percent of the cost of Class III milk. A $10 raw milk price results in a milk cost of $1 per pound of cheese produced.

Once again, the financials are presented with a range of gross margins. The range presented is from $.30 to $.60 per pound of cheese sold. Overall evaluation indicates that a gross margin of at least $.33 per pound would be needed to break even. A gross margin of $.50 per pound would be needed to provide a reasonable return on investment.

The following parameters were used in developing the costs in the presentation:

The range of labor costs in a cheese processing facility will be $.035 to $.125 cents per pound. Some specialty cheeses or very small operations would have even higher costs. If a producer/handler was making cheese, they might be using under-employed family labor. This should be considered when estimating labor costs.

- Utility costs will likely range from $.01-$03 per pound.
- Plant costs for medium to large plants are $.01 to $.05 per pound, but would be significantly higher for a labor-intensive specialty product.

General Budget Principals for Milk Processing

In starting a dairy processing business, the dairy must have a competitive advantage. Most producer-owned processing in Kansas would be expected to be moderate- to small-sized. Therefore, the competitive advantage is not likely to be the fact that it would be a low cost producer, since the larger operations would likely have lower costs due to significant economies of scale in the industry.

The primary economic variables between processing companies are labor efficiency, overhead costs, delivery efficiency, and gross margin. The large operations generally have a competitive advantage in labor and delivery efficiency. Overhead costs could be an area in which smaller processors entering the market might be able to develop a cost advantage.

The biggest potential for competitive advantage for small processors is in the gross margin. Small dairy processors' best opportunity is to develop a differentiated, high quality product that commands a premium. While there are some small dairies selling fluid milk successfully, this market is probably limited. There is some concern that consumers will switch back to cheaper milk after the fad of "glass bottles" or "locally grown and processed" wears off.

The best opportunity for smaller processors to develop a competitive advantage is most likely in a processed product such as ice cream or cheese. These products offer the best opportunities for differentiation, as well as being more competitive from a freight standpoint in most areas of Kansas. While higher valued specialty cheeses or ice cream appears to offer the best opportunity in dairy processing in Kansas, they also have the most marketing risk. Niche markets must be developed through a combination of a good product and an effective advertising and promotion program. It is an expensive proposition to develop a new product. Moreover, the development and promotion expenses will be incurred before any revenue can be realized. If the product never gains acceptance, these investments will be lost.

Many of the input items are expected to have similar costs among all operations (large and small). There is some difference in packaging costs, but this area will not likely be the biggest factor in gaining or losing a competitive advantage between various processing operations.

The primary point is that size of the operation has little impact on the cost of raw milk. The cost of raw milk used by processors for the same end use will have virtually the same price, no matter what the size of the operation.

FLUID MILK PROCESSING
Projected Income from Operations
Monthly
Based on Annual Sales of 3.6 million gallons
(Approximately 1,700 cows)

Income Statement										
Gross Margin per Gallon			**$**	**0.44**	**$**	**0.54**	**$**	**0.75**	**$**	**0.90**
Revenue			$	132,000.00	$	162,000.00	$	162,000.00	$	162,000.00
Excess Milk			$	27,606.00	$	27,606.00	$	27,606.00	$	27,606.00
Total Revenue			$	159,606.00	$	189,606.00	$	189,606.00	$	189,606.00
Expenses	$	/gal								
Labor	$	0.18	$	54,000.00	$	54,000.00	$	54,000.00	$	54,000.00
Enrichment	$	0.02	$	6,000.00	$	6,000.00	$	6,000.00	$	6,000.00
Flavoring	$	0.01	$	3,000.00	$	3,000.00	$	3,000.00	$	3,000.00
Supplies & Packaging	$	0.20	$	60,000.00	$	60,000.00	$	60,000.00	$	60,000.00
Utilities	$	0.04	$	12,000.00	$	12,000.00	$	12,000.00	$	12,000.00
Other Plant Costs	$	0.16	$	48,000.00	$	48,000.00	$	48,000.00	$	48,000.00
Depreciation	$	0.08	$	24,000.00	$	24,000.00	$	24,000.00	$	24,000.00
Delivery										
Labor	$	0.14	$	42,000.00	$	42,000.00	$	42,000.00	$	42,000.00
Equipment (Depreciation)	$	0.10	$	30,000.00	$	30,000.00	$	30,000.00	$	30,000.00
Total Expenses			$	279,000.00	$	279,000.00	$	279,000.00	$	279,000.00
Net Income			$	(119,394.00)	$	(89,394.00)	$	(26,394.00)	$	18,606.00

Bottled Milk			**Gallons**		
Whole	35%	105,000	105,000	105,000	105,000
2%	32%	96,000	96,000	96,000	96,000
1%	16%				
Skim	15%	45,000	45,000	45,000	45,000
Half & Half	2%	6,000	6,000	6,000	6,000
			Pounds		
Excess Milk Fat	0.01	25,800	25,800	25,800	25,800

Operating Parameters

Gallons per Month	300,000	300,000	300,000	300,000

Margin Calculation

		Per Cwt		Per Gallon
Purchased Milk Price	$	12.00	$	1.40
Sale Price of Milk	$	15.82	$	1.84
Gross Margin	$	3.82	$	0.44

FLUID MILK PROCESSING
Projected Income from Operations
Monthly
Based on Annual Sales of 14.4 million gallons
(Approximately 6,800 cows)

Income Statement										
Gross Margin per Gallon			**$**	**0.35**	**$**	**0.44**	**$**	**0.52**	**$**	**0.60**
Revenue			$	420,000.00	$	528,000.00	$	624,000.00	$	720,000.00
Excess Milk			$	110,424.00	$	110,424.00	$	110,424.00	$	110,424.00
Total Revenue			$	530,424.00	$	638,424.00	$	734,424.00	$	830,424.00
Expenses	$	/gal								
Labor	$	0.12	$	144,000.00	$	144,000.00	$	144,000.00	$	144,000.00
Enrichment	$	0.02	$	24,000.00	$	24,000.00	$	24,000.00	$	24,000.00
Flavoring	$	0.01	$	12,000.00	$	12,000.00	$	12,000.00	$	12,000.00
Supplies & Packaging	$	0.10	$	120,000.00	$	120,000.00	$	120,000.00	$	120,000.00
Utilities	$	0.03	$	36,000.00	$	36,000.00	$	36,000.00	$	36,000.00
Other Plant Costs	$	0.12	$	144,000.00	$	144,000.00	$	144,000.00	$	144,000.00
Depreciation	$	0.08	$	96,000.00	$	96,000.00	$	96,000.00	$	96,000.00
Delivery										
Labor	$	0.07	$	84,000.00	$	84,000.00	$	84,000.00	$	84,000.00
Equipment (Depreciation)	$	0.05	$	60,000.00	$	60,000.00	$	60,000.00	$	60,000.00
Total Expenses			$	720,000.00	$	720,000.00	$	720,000.00	$	720,000.00
Net Income			$	(189,576.00)	$	(81,576.00)	$	14,424.00	$	110,424.00

Bottled Milk			**Gallons**		
Whole	35%	420,000	420,000	420,000	420,000
2%	32%	384,000	384,000	384,000	384,000
1%	16%				
Skim	15%	180,000	180,000	180,000	180,000
Half & Half	2%	24,000	24,000	24,000	24,000
			Pounds		
Excess Milk Fat	0.01	103,200	103,200	103,200	103,200

Operating Parameters

Gallons per Month	1,200,000	1,200,000	1,200,000	1,200,000

Margin Calculation

		Per Cwt		**Per Gallon**
Purchased Milk Price	$	12.00	$	1.40
Sale Price of Milk	$	15.82	$	1.84
Gross Margin	$	3.82	$	0.44

CHEESE PROCESSING
Projected Income from Operations
Annual
Based on Annual Sales of 1.032 million pounds cheese
(Approximately 600 cows)

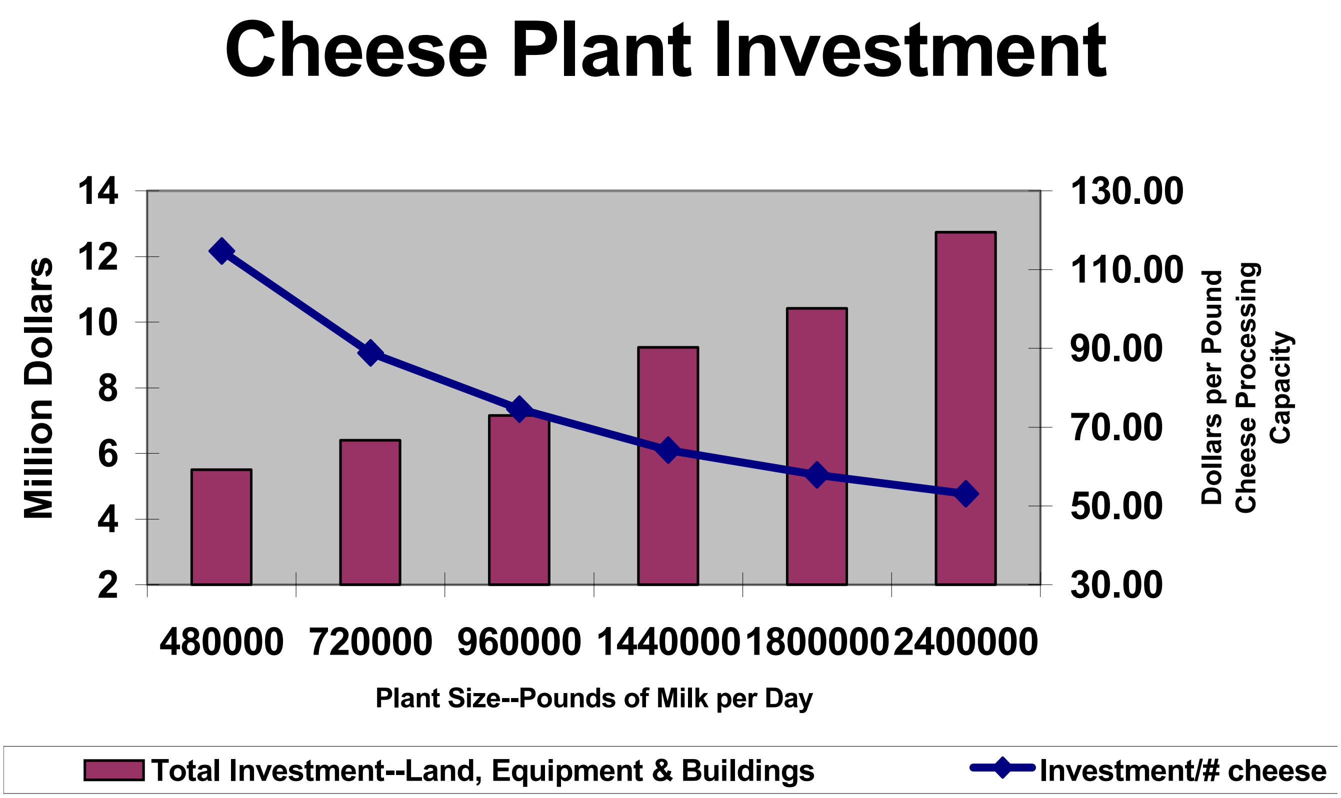
	Beginning Balance				
Income Statement					
Gross Margin per Gallon		**$ 0.30**	**$ 0.40**	**$ 0.50**	**$ 0.60**
Revenue		$ 309,600.00	$ 412,800.00	$ 516,000.00	$ 619,200.00
Total Revenue		$ 309,600.00	$ 412,800.00	$ 516,000.00	$ 619,200.00
Expenses					
Labor	$ 0.12	$ 127,968.00	$ 127,968.00	$ 127,968.00	$ 127,968.00
Cultures & Enzymes	$ 0.03	$ 29,928.00	$ 29,928.00	$ 29,928.00	$ 29,928.00
Supplies & Packaging	$ 0.02	$ 20,640.00	$ 20,640.00	$ 20,640.00	$ 20,640.00
Utilities	$ 0.03	$ 30,960.00	$ 30,960.00	$ 30,960.00	$ 30,960.00
Other Plant Costs	$ 0.05	$ 51,600.00	$ 51,600.00	$ 51,600.00	$ 51,600.00
Depreciation	$ 0.07	$ 72,240.00	$ 72,240.00	$ 72,240.00	$ 72,240.00
Total Expenses	$ 0.32	$ 333,336.00	$ 333,336.00	$ 333,336.00	$ 333,336.00
Net Income		$ (23,736.00)	$ 79,464.00	$ 182,664.00	$ 285,864.00
Physical Assumptions	0				
Operating Parameters					
Pounds of Milk Per Year		10,320,000	10,320,000	10,320,000	10,320,000
Cheese Produced		1,032,000	1,032,000	1,032,000	1,032,000
Margin					
Sell Price of Cheese		$ 1.50			
Milk (10 lbs)		$ 1.10			
Gross Margin		$ 0.40			

COST OF EQUIPMENT

Dairy processing equipment costs per pound of milk decrease quickly as the size of a plant increases. A cheese plant that can process 480,000 pounds of milk per day was estimated to cost $5.508 million including land, building and equipment. A plant with a daily capacity of 2,400,000 pounds of milk per day, five times larger, costs $12.743 million or 2.5 times more. The capital cost (land, building, equipment) on the basis of 1 pound of cheese processing capacity is $115 compared to $53 for the largest sized plants. This is a calculated cost based on research published by Cornell University research in 1987. The estimated costs were adjusted by a 2% annual inflation rate that was compounded annually (34.5% over 15 years). (Figure 32)

Multi-line plants, those producing more than one dairy product, can gain some efficiencies. Every processing plant must have receiving facilities, storage for raw milk, pasteurizing, cleaning equipment and coolers for finished products, as well as office space. Many products may also have additional equipment in common. To the extent that common equipment can be shared and not duplicated in separate plants, the overhead cost can be reduced. This efficiency is in addition to the fact that multi-line plants gain efficiencies from more even seasonal use of milk and facilities (see section on Balancing).

Most small dairies that process their own production (producer/handlers) build their plants using used processing equipment. It is technologically inferior to the new automated plants, but is extremely serviceable for operations of this type. Many have under-employed family labor, so a labor-intensive process does not increase costs. Often these operations have equipment with capacity to double or triple output with little additional investment. The limiting factor for these operations is rarely processing capacity. While production may be a limiting factor, most often the size of the processing operation is limited by marketing. Developing market share, whether conventional or organic, is probably the most important function affecting size of the operation. In the smaller sized, used dairy processing market, capital costs are fairly constant over a wide range of production.



PRIVATE LABEL VERSUS PROPRIETARY LABEL

In the final evaluation of the business marketing strategy, a new entity involved in dairy processing will need to evaluate whether they will concentrate primarily on private label work for other entities or develop their own label. Of course, developing a new company label and doing private label work is a reasonable marketing strategy.

The development of a new label can require significant capital depending on the following items:

1) The size of the distribution area and the size of the spectrum of distribution.
2) The advertising campaign that is planned to introduce consumers to the new label and to maintain the consumer awareness.
3) The number of items that will be marketed under the new label.

Advantage of Developing a New Label

1) Margins will be larger because the entity will have the ability to capture increased values for the product lines.
2) Create a company identity, which allows the company to control its own destiny (success or failure) compared to private label contract work that can disappear because of another company's ability to market.
3) Much easier to add other product lines in the future under a label owned and established by the entity.

Disadvantages of Developing a New Label

1) The cost to develop a new label or purchase an existing label can be very high.
2) Developing a new label can take a large amount of time, and that can result in a very low plant utilization percentage in the early stages of the label development.

Advantages of Private Label Processing

1) Reduces the costs of entry into the market place.
2) Can increase plant utilization in the early stages of the new company, as the private label will likely require a substantial amount of production.

Disadvantages of Private Label Processing

1) Reduced margins per unit, as private label work will be done on a contracted per-unit basis.
2) Inability to create an identity in the marketplace.

Generally, large dairy processing facilities will find it advantageous to do a large amount of private label work, as it is imperative that the facility utilize a large percentage of the plant capacity. Smaller processing facilities will generally work to develop their own label and capture larger margins per unit. There are certainly exceptions to this statement, but it is a trend in the entire food industry.

Legal Structure

The traditional legal business structures are all reasonable structures to use in developing a dairy processing business. Those considered workable are:

Limited Liability Company (LLC): This structure would be very useful for a small processing company that would not need a large number of owners. It provides the corporate protection and can be organized rather easily. Typically, this structure results in a "pass through" of tax liability to the individual owners based upon their percentage ownership in the LLC. The LLC will have no tax liability, as it will all be passed to the individual owners.

Corporation: If there is a need to put a large amount of capital in the processing facility or there is a need for a large number of owners, then the traditional C Corporation is the desirable structure. This structure would allow for a large number of owners and a more liquid market for the "trading" of stock. The formation of the C Corporation will be more expensive than an LLC or an S Corporation. C Corporations do pay corporate income taxes, and then individual stockholders would pay taxes on any dividends distributed.

Cooperative: If a group of producers decide to be the owners of a dairy processing facility, they would likely find that a Cooperative structure could be beneficial. The limitations are that the Cooperative would have to purchase over 50% of their milk from members, which could be a limitation. Any milk purchased from a non-member would be considered non-member business, which would mean that a portion of the net income (portion equal to the portion purchased from non-members) would be taxable to the Corporation. The tax structure would be an advantage in that the Cooperative would not pay taxes, but the tax liability would be "passed through" to the individual members of the Cooperative.

There is no distinct advantage to any of the legal structures listed above for dairy processing. The most desirable structure for a new dairy processing entity would most likely be evaluated based upon the amount of capital needed, the number of owners desired, the need for liquidity in the stock, and whether or not obtaining a captive supply of milk is important to the business strategy of the entity.

If the new entity is interested in processing milk and also marketing milk, there is an advantage in forming a cooperative that is owned by member producers. In addition to the fact that a captive supply of milk would be obtained through the cooperative arrangement, the entity would also find it much easier to receive the milk "pooling" funds that are generated through the sale of Class II, III, and IV milk (see Federal Milk Orders).

Example: If three milk producers decided to form an entity to process milk into cheese, the entity formed would have the ability to receive "pooling" funds, but the individual producers cannot receive those pooling funds. Of course, the entity would take the pooling funds and use those funds to offset the cost of milk, which is indirectly a benefit to the producer/owners of the processing entity.

Dairy Processing Reference Section

Contacts

Henry Schaffer
Milk Marketing Order – FO 30
USDA – AMS Dairy Programs
4570 W. 77th Street, Suite 210
Minneapolis, MN 55435-5037
Phone: (952) 831-5292 Ext 208

Karen Schmidt
Associate Professor
Kansas State University
224 Call Hall
Manhattan, KS
Phone: (785) 532-1216

Chris Hackman
Central Dairy Company
610 Madison
Jefferson City, MO 65101
Phone: (573) 635-6148

Dr. P. D. Courtney
Food Science and Technology Department
Ohio State University
2121 Fyffe Road
Columbus, OH 43210
Phone: (614) 292-9621
E-mail: courtney.25@osu.ed

Gary G. Frank
UW-Center for Dairy Profitability

Ed Reznicek
Kansas Organic Producers
Rt. 2, Box 23
Goff, KS 66428

Organizations and Publications

International Dairy Foods Association
1250 H Street, NW, Suite 900
Washington, DC 20005
Main Telephone: (202) 737-4332
Fax: (202) 331-7820 (all staff)
Website: http://www.idfa.org

USDA Guidelines for the Sanitary
Design and Fabrication of Dairy Processing Equipment

USDA-Dairy Accepted Equipment List

U.S. Department of Agriculture
Agricultural Marketing Service
Dairy Programs
Dairy Grading Branch
P.O. Box 96456
Washington, DC 20090-6456

Introduction to Cheese making
Web Page: http://www.geocities.com/Heartland/Cottage/1288/intro/Intro.htm

Seasonal Dairy Grazing: A Viable Alternative for the 21st Century
Jonathan R. Winsten & Bryan T. Petrucci
American Farmland Trust
National Office
1200 18th Street, N.W.
Washington, DC 20036
Phone: (202) 331-7300
Web Page: http://www.farmland.org

Agricultural Marketing Service
USDA
Web Page: http://www.ams.usda.gov/nop/facts/standards.htm

Final rule for the National Organic Standard

An Analysis of Processing and Distribution Productivity and Cost of 35 Fluid Milk Plants

Eric M. Erba, Richard D. Aplin & Mark W. Stephenson
Cornell Program on Dairy Markets and Policy
Department of Agricultural, Resource and Managerial Economics
College of Agriculture and Life Sciences
Cornell University
Ithaca, NY 14853-7801

Economic Performance of 11 Cheddar Cheese Manufacturing Plants in Northeast and North Central Regions – Part One of a Research Effort on Cheddar Cheese Manufacturing

Cheddar Cheese Manufacturing Costs Economies of Size and Effects of Different Current Technologies

Part Two of a Research Effort on Cheddar Cheese Manufacturing
Department of Agricultural Economics
Cornell University Agricultural Experiment Station
New York State College of Agriculture and Life Sciences
Cornell University
Ithaca, NY 14853

Questions You Should Answer Before Starting a New Dairy Processing Enterprise
Brian M. Henehan
Senior Extension Associate
Department of Agricultural, Resource and Managerial Economics (ARME)
Cornell University
Ithaca, NY 14853

Central Milk Marketing Order – FO 32
Donald R. Nicholson
USDA – AMS Dairy Programs
P.O. Box 14650
Shawnee Mission, KS 66285-4650
Phone: (913) 495-9300
Web Page: http://www.fmmacentral.com

Street address:
10801 Renner Boulevard
Lenexa, KS 66219

Bob Vanderliden	Ext 9313
Bob Schoening	Ext 9319
David Stukenberg	Ext 9326
Bruce Adams	Ext 9314

Milk Facts – 2001 edition
Cheese Facts – 2001 edition
The Latest Scoop – 2001 edition
International Dairy Foods Association
1250 H Street, N.W., Suite 900
Washington, DC 20005
Phone: (202) 737-4332
Web Page: http://www.idfa.org
Web Page: http://www.egr.msu.edu/~steffe/handbook/tbl21.html

Illustrations from this site were used in discussions of cheese, ice cream and NFDM. Most of the illustrations were taken from:
Dairy Processing Handbook
Tetra Pak Processing Systems AB
S-221 86 Lund
Sweden

Processing Equipment and Other Suppliers

Hartter Feed & Seed
903 Oregon
Sabetha, KS
Phone: (785) 284-2220
Certified organic feed processing

International Machinery Xchange
214 N Main Street
Deerfield, WI 53531-9644
Phone: (608) 764-5481

Garrity Equipment Company
31 Georgia Trail
Medford, N.J. 08055-8938
Phone: (609) 953-0007

Rowland Sales Company
P.O. Box 552
Hazelton, PA 18201-0552
Phone: (570) 455-5813

CHR Hansen
9015 W Maple Street
Milwaukee, WI 53214
Phone: (414) 607-5700
Cheese culture, rennet, all types of dairy supplies

REFERENCE FOR ORGANIC MARKETING SURVEY

Boland, M.A. and J.A. Fox. “Consumer Willingness-to-Pay for Natural Beef.” Unpublished manuscript, Kansas State University, 2001.

Cameron, T. and J. Quiggin. “Estimation Using Contingent Valuation Data From a ‘Dichotomous Choice with Follow-up’ Questionnaire.” *Journal of Environmental Economics and Management* 24(1994): 218-234.

Carson, R. “Three Essays on Contingent Valuation.” Unpublished Ph.D. dissertation, University of California, Berkeley, CA, 1985.

Givry, S. “Consumers Preferences for Natural Beef Products.” Unpublished M.S. thesis, Kansas State University, Manhattan, KS, 1998.

Glaser, L.K. and G.D. Thompson. “Demand for Organic and Conventional Beverage Milk.” Selected paper presented at Western Agricultural Economics Association annual meeting, Vancouver, Canada, June 29-July 1, 2000.

Hanneman, W. “Some Issues in Continuous- and Discrete Response Contingent Valuation Studies.” *North East Journal of Agricultural Economics* 14(1985): 5-13.

Hanneman, W. and W. Kanninen. “The Statistical Analysis of Discrete-Response CV Data.” Working Paper No. 798, Department of Agricultural and Resource Economics, University of California, Berkeley, 1996.

Hanneman, W., J. Loomis, and B. Kanninen, B. “Statistical Efficiency of Double-Bounded Dichotomous Choice Contingent Valuation.” *American Journal of Agricultural Economics* 73(1991): 1255-1263.

Herriges, J. “Measuring Goodness of Fit for the Double-Bounded Logit Model: Comment.” *American Journal of Agricultural Economics* 81(1999): 231-234.

Herriges, J. and J. Shogren. “Starting Point Bias in Dichotomous Choice Valuation with Follow-up Questioning.” *Journal of Environmental Economics and Management* 30(1996): 112-131.

APPENDIX
SUMMARY STATISTICS OF REGRESSION ANALYSIS
ORGANIC MILK SURVEY

Table 2.3.1. Summary Statistics for Beverage Consumption by Each Population

	Milk Drinkers		Organic Consumers		Two Tail		One Tail	
	Mean	Std	Mean	Std	P	t-test	P	t-test
Milk	2.75	0.862	2.8	0.84	0.513	0.654	0.257	-0.652
Juice	2.00	0.766	2.21	0.703	0.914	0.108	0.457	0.107
Diet Soft Drinks	1.99	1.071	1.48	0.822	0.000*	6.230*	0.000*	6.077
Non-Diet Soft Drinks	1.59	0.944	1.42	0.696	0.021*	2.314*	0.011*	2.251

Where: Std is the standard deviation, P is the probability associated with the t-test and * denotes statistically significant (HO is rejected)

Table 2.3.2. Summary Statistics for Beverage Consumption Comparison

	Milk Drinkers		Organic Consumers	
	Mean	P	Mean	P
Milk Products > Juice Products	2.75 > 2.22	0.000*	2.80 > 2.21	0.000*
Juice Products > Diet Products	2.22 > 1.99	0.004*	2.21 > 1.48	0.000*
Diet Products > Non-Diet Products	1.99 > 1.59	0.000*	1.48 > 1.42	0.156

Table 2.4.1. Difference in Product Characteristics

Consumer Type	Mean	Std	Two-tailed t-test	One-tailed T-test
Milk Drinkers	2.97	1.00	P:0.754, t:0.31	P:0.377, t:0.315
Organic Consumers	2.94	1.05		

Figure 2.5.1. Package Size Preferences for Milk Drinkers and Organic Consumers

Consumer Type	Mean	Std	Two-tailed t-test	One-tailed T-test
Milk Drinkers	1.24	0.49	P:0.000, t:13.968*	P:0.000, t:-13.918
Organic Consumers	1.79	0.48		

Table 2.6.1. Summary Statistics for Milk Purchasing Factors

	Milk Drinker		Organic Consumers		t-test Probabilities	
Product Characteristics	Mean	Std	Mean	Std	Two tailed	One tailed
Cholesterol: Whole	4.08	1.09	4.03	1.08	0.647	0.324
Cholesterol: 2%	2.91	0.89	2.98	0.80	0.327	0.164
Cholesterol: 1%	2.14	0.73	2.13	0.72	0.868	0.434
Cholesterol: Fat-free	1.35	0.68	1.38	0.73	0.647	0.323
Calories: Whole	4.42	0.78	4.29	0.85	0.123*	0.061*
Calories: 2%	3.15	0.67	3.12	0.74	0.656	0.328
Calories: 1%	2.28	0.66	2.24	0.72	0.538	0.269
Calories: Fat-free	1.43	0.71	1.56	0.85	0.066*	0.033*
Sodium: Whole	2.70	1.38	2.48	1.07	0.070*	0.035*
Sodium: 2%	2.37	1.01	2.31	0.93	0.534	0.267
Sodium: 1%	2.11	0.89	2.16	0.92	0.597	0.298
Sodium: Fat-free	1.81	0.89	2.00	0.99	0.028*	0.014*
Artificial Ingredients: Whole	2.11	1.25	2.21	1.37	0.450	0.225
Artificial Ingredients: 2%	2.02	1.02	2.07	1.22	0.658	0.329
Artificial Ingredients: 1%	1.92	0.92	2.01	1.20	0.352	0.176
Artificial Ingredients: Fat-free	1.77	1.02	1.88	1.23	0.293	0.147
Fat Content: Whole	4.59	0.75	4.51	0.77	0.318	0.159
Fat Content: 2%	3.12	0.80	3.15	0.73	0.661	0.331
Fat Content: 1%	2.17	0.69	2.13	0.63	0.496	0.248
Fat Content: Fat-free	1.13	0.51	1.16	0.64	0.566	0.293

Table 2.6.2. Summary Statistics for Ranking Milk Purchasing Factors

Alternative Hypothesis tested	Milk Drinker two-tailed t-test, P	Milk Drinker One-tailed t-test, P	Organic Consumers Two-tailed t-test, P	Organic Consumers one-tailed t-test, P
Cholesterol: whole > 2%	0.000*	0.000*	0.000*	0.000*
Cholesterol: whole > 1%	0.000*	0.000*	0.000*	0.000*
Cholesterol: whole > fat-free	0.000*	0.000*	0.000*	0.000*
Cholesterol: 2% > 1%	0.000*	0.000*	0.000*	0.000*
Cholesterol: 2% > fat-free	0.000*	0.000*	0.000*	0.000*
Cholesterol: 1% > fat-free	0.000*	0.000*	0.000*	0.000*
Calories: whole > 2%	0.000*	0.000*	0.000*	0.000*
Calories: whole > 1%	0.000*	0.000*	0.000*	0.000*
Calories: whole > fat-free	0.000*	0.000*	0.000*	0.000*
Calories: 2% > 1%	0.000*	0.000*	0.000*	0.000*
Calories: 2% > fat-free	0.000*	0.000*	0.000*	0.000*
Calories: 1% > fat-free	0.000*	0.000*	0.000*	0.000*
Sodium: whole > 2%	0.007*	0.004*	0.059*	0.039*
Sodium: whole > 1%	0.000*	0.000*	0.002*	0.001*
Sodium: whole > fat-free	0.000*	0.000*	0.000*	0.000*
Sodium: 2% > 1%	0.008*	0.004*	0.149	0.074*
Sodium: 2% > fat-free	0.000*	0.000*	0.004*	0.002*
Sodium: 1% > fat-free	0.000*	0.000*	0.147	0.074*
Artificial Ingredients: whole > 2%	0.449	0.224	0.331	0.166
Artificial Ingredients: whole > 1%	0.076*	0.038*	0.133	0.067*
Artificial Ingredients: whole > fat-free	0.003*	0.001*	0.015*	0.008*
Artificial Ingredients: 2% > 1%	0.262	0.131	0.567	0.284
Artificial Ingredients: 2% > fat-free	0.012*	0.006*	0.122*	0.061*
Artificial Ingredients: 1% > fat-free	0.133	0.066*	0.334	0.167
Fat Content: whole > 2%	0.000*	0.000*	0.000*	0.000*
Fat Content: whole > 1%	0.000*	0.000*	0.000*	0.000*
Fat Content: whole > fat-free	0.000*	0.000*	0.000*	0.000*
Fat Content: 2% > 1%	0.000*	0.000*	0.000*	0.000*
Fat Content: 2% > fat-free	0.000*	0.000*	0.000*	0.000*
Fat Content: 1% > fat-free	0.000*	0.000*	0.000*	0.000*

Table 2.7.1. Summary Statistics for Organic Milk Awareness

Consumer Type	Mean	Std	Two-tailed t-test probability
Milk Drinkers	1.729	0.564	0.000*
Organic Consumers	2.811	0.436	

Table 2.9.1. Summary Statistics for Gender

Gender	Mean	Std	t-test probabilities Two-tail	t-test probabilities One-tail
Milk drinkers	1.86	0.35	0.633	0.316
Organic consumers	1.84	0.36		

Table 2.10.1. Summary Statistics for Age

Age	Mean	Std	t-test probabilities Two-tail	t-test probabilities One-tail
Milk drinkers	44.05	8.30	0.665	0.332
Organic consumers	44.38	10.48		

Table 2.11.1. Summary Statistics for Education

Education	Mean	Std	t-test Probabilities Two-tail	One-tail
Milk drinkers	4.46	1.73	0.721	0.361
Organic consumers	4.51	1.83		

Table 2.12.1. Summary Statistics for Income

Income	Mean	Std	t-test probabilities Two-tail	One-tail
Milk drinkers	10.35	2.68	0.000*	0.000*
Organic consumers	8.95	3.09		

Table 2.13.1. Summary Statistics for Number of Children

Children	Mean	Std	t-test probabilities Two-tail	One-tail
Milk drinkers	1.89	0.41	0.000*	0.000*
Organic consumers	1.64	0.48		

SUMMARY STATISTICS OF WILLINGNESS TO PAY MODEL

Table 3.1.1. Prices Offered to Consumers in Willingness-to-Pay Question

Version	First Outcome (B)	Second Outcome (if they chose $2.00 as first outcome), B^d	Second Outcome (if they chose the higher price as the first outcome), B^u
I	$2.00 or $2.50[a]	$2.00 or $2.20	$2.00 or $3.00
II	$2.00 or $3.00	$2.00 or $2.50	$2.00 or $3.60
III	$2.00 or $3.60	$2.00 or $3.00	$2.00 or $4.50
IV	$2.00 or $4.50	$2.00 or $3.60	$2.00 or $5.50

[a]For example in version 1, if the consumer chose $4.00 (“No”) as the first outcome, then their second outcome would be either $4.00 (“No”) or $4.20 (“Yes”).

Table 3.4.1. Marginal Effects Evaluated at The Mean and Selected Statistics for the Single Bound Logit Model with Whether a Milk Drinker would Purchase Organic Milk

Variable	Milk Drinkers	Organic Consumers
Intercept	2.006	4.065
Price	-1.96* (.03)	-33.631* (.004)
Pseudo R^2	0.67	0.14

*denotes significance at the .10 level for the parameter estimate used to calculate the marginal effects.

Table 3.4.2. Parameter Estimates and Selected Statistics for the Double-Bounded Models

Variable	Milk Drinkers	Organic Consumers
Intercept	3.34 (0.34)	5.99 (0.72)
Bid expressed in e^B	1.18* (0.1)	0.99* (0.17)
Pseudo $R^{2,a}$	0.13	0.09

[a]The pseudo R^2 for the double-bounded is Herriges’ modification of McFadden’s pseudo R^2.
*denotes significance at the .10 level for the parameter estimate.