UW Dairy Pipeline

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Getting started with specialty cheeses:

Strategies for a successful transition

by Jim Path, CDR cheese outreach specialist

Trying to keep up with the giants in the commodity cheese market is a proposition that has driven a number of medium-sized and small cheese plants out of business in recent years. Despite this tough business climate, a growing number of smaller-scale cheesemakers are becoming aware of the solid, and potentially lucrative, opportunities available in the specialty cheese market. The demand for high-value specialty cheeses is growing faster than is total cheese consumption, and production for small-scale niche markets allows smaller plants to avoid head-to-head competition with major manufacturers.

Cheesemakers who are considering entering the specialty cheese market for the first time usually have questions regarding the nature of the market, what it takes to be successful, and how to develop a new product. In response to this need, CDR and the Wisconsin Milk Marketing Board have initiated a Specialty Cheese Program designed to help Wisconsin cheesemakers expand into the specialty arena through marketing support and technical assistance. But, whether a cheese plant is participating in our program or developing its specialty cheese business independently, the strategies for success are the same.

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What's Inside:

Dr. Rusty Bishop named CDR director

The UW Department of Food Science and the Center for Dairy Research are pleased to announce the appointment of Dr. Rusty Bishop to the post of CDR director.

Formerly an associate professor of Food Science and Technology at Virginia Polytechnic Institute and State University, Dr. Bishop will officially take over the top CDR slot as of January 1, 1993. He succeeds Dr. Norm Olson, the Center's founder and only previous director, who plans to return to full-time research and teaching.

"It is with great enthusiasm that I take over the reins from Norm to become director," Bishop says. "I look forward to melding the needs of the dairy industry with the research talents of the CDR staff and affiliated faculty.

"There are great opportunities for growth and success ahead, and I am thankful to be a part of it," he adds.

After earning a Ph.D. in Dairy Science from Louisiana State University, Dr. Bishop began his professional career as a research microbiologist with Diversy Corporation. In 1986 he joined Virginia Tech, where he was charged with developing a dairy foods program within the Department of Food Science and Technology. As a result, the Department now has in place the Virginia Dairy Foods Research Program, which has provided critical assistance to dairy processors in the area of

see Bishop, next page ...

...Bishop named director, continued

dairy microbiology and has earned considerable industry support.

Among the accomplishment of the Virginia program under Dr. Bishop's direction was the development of the Virginia Tech Shelf-life Program (VTSLP), which involves a new test method for rapid quality assessment. The test is more rapid and accurate than conventional methods, and is designed to help identify and correct potential quality problems while extending the shelf-life of dairy products by at least two days. VTSLP has been adopted by more than 200 dairies in 30 states for an estimated annual savings to the dairy industry in excess of $83 million.

Dr. Bishop has served in numerous committees and organizations for academia, industry, and government. He has been invited to work on special projects with organizations such as the FDA, the International Dairy Foods Association, and the House Subcommittee on Agriculture. In 1991, he was a U.S. delegate to the International Dairy Federation in Tokyo, Japan, where he was a member of the commission dealing with analytical standard and laboratory techniques.

Thus far, his work has resulted in 106 scientific publications, 106 invited talks, 39 research contributions at scientific meetings, and improved procedures for the 16th edition of *Standard Methods for the Examination of Dairy Products.*

A job well done — Norm Olson steps down as CDR director

The beginning of a new year is a time to plan for the goals of the future, but it is also a time to reflect on the successes of the past. In keeping with the season, the beginning of 1993 finds CDR not only welcoming Rusty Bishop as its new director, but also remembering the accomplishments of it founding director, Dr. Norm Olson. When Dr. Olson officially returns full-time to his duties as a professor of Food Science in January, he will be stepping away from an organization he brought up from its infancy, and leaving his successor with the fruits of an dedicated career.

Establishing a dairy research center at UW-Madison has always been among Dr. Olson's goals, but it was not until 1976 that his efforts began to pay off and the UW College of Agricultural and Life Sciences established the Walter V. Price Cheese Research Institute (CRI) with Dr. Olson as director.

Olson continued to pursue his dream of creating a major dairy research center when the National Dairy Promotion and Research Board and the Wisconsin Milk Marketing Board were established in 1983. By early 1986, CDR was founded with initial funding from WMMB, and in 1987 NDPRB designated the Center as one of its six national dairy research centers. Within a year, the rapidly maturing Center moved its offices to their present location on the second floor of Babcock Hall.

Despite his personal successes, it is the support of his colleagues and staff that Dr. Olson says are the most satisfying elements of his years as CDR director. He cites his role in bringing about a renewed interest in dairy research among the UW faculty and in building a strong Center staff as his proudest accomplishments.

Throughout its history, CDR has undergone constant evolution. According to Olson, that evolution will continue under the leadership of new CDR Director Rusty Bishop. In particular, the Center will interact and cooperate more closely with private industry in the future.

"The ability to interact constructively with private industry is among the strengths that Rusty Bishop brings to the Center," Olson says. "Rusty was hired and appointed specifically to focus on CDR rather than teaching. As a result, the Center will thrive and grow under his leadership."

...Specialty cheese, from page 1

A common question about the specialty cheese business is what makes specialty cheese "special." A specialty cheese can be described as a unique cheese of high quality that may also have unusual characteristics giving it a higher value than typical "commodity" cheeses.

Specialty cheeses are premium cheeses, the Cadillacs, Porsches, and BMWs of the cheese world. As such, the importance of product quality is magnified. Consumers of specialty cheeses are willing to pay extra, but they expect a quality product with no short cuts or inferior ingredients. As a practical rule, most specialty cheeses have total annual volumes of less than 50 million pounds and are labor intensive.

Is there room for growth in the specialty cheese market? The International Dairy Federation lists 395 varieties of cheese made in 27 countries. The Agricultural Handbook, U.S. Department of Agriculture, describes more than 400 cheeses. Using these numbers as a conservative estimate, it would seem that the opportunities are abundant for cheese plants to individually market a unique variety. Moreover, sales of many non-standard cheeses are increasing rapidly. A classic example of growth in the specialty cheese market is string cheese, which was introduced about 10 years ago and has already reached an annual production of 70 million pounds (which technically exceeds our definition of specialty cheese). It still continues to grow at 6 percent per year. Sales figures for some other promising specialty cheeses are shown in Table 1.

Table 1. *Market estimates for selected domestic specialty cheeses.*

Domestic variety	Market size, lbs	Yearly Growth rate
Parmesan	102,000,000	+ 8%
String	70,000,000	+ 6%
Specialty jack	34,000,000	+ 5%
Hispanic	33,000,000	+ 14%
Blue	32,000,000	- 5%
Aged Provolone	30,000,000	+ 5%
Romano	28,000,000	+ 14%
Feta	28,000,000	+ 12%
Triple Creme/Gournay	9,000,000	+ 4%
Brie/Camembert	5,000,000	+ 10%
Havarti	3,000,000	+ 11%
Fontina	3,000,000	+ 6%
Goat cheese	2,500,000	+ 50%
Gorgonzola	500,000	+ 12%
Ricotta (spec. ricotta)	212,400	+ 7%
Manchego	100,000	+ 17%

Source: Dan Carter, Inc., August 1992

However, shifting production from a bulk commodity cheese to a specialty item is no simple task. A successful transition requires considerable research and planning. This is true for both the marketing aspects of the product and the technical aspects of its production.

Marketing assistance

Effective market planning includes identifying a market niche **before** choosing a product to manufacture, i.e., choosing a product that will sell rather than trying to sell the product you have chosen. Identifying products that are ripe for growth is therefore the first step in the development of a specialty cheese line. Another critical marketing-related task is the development of attractive and unique packaging and labeling. Most cheesemakers will need help with these aspects of selecting and selling a new product. For Wisconsin cheesemakers, WMMB can be a valuable source of market information and marketing assistance.

Technical preparation

When developing a new specialty cheese, technical research starts early. The foundation for successful product development is a thorough examination of the literature. Visit an appropriate library, Steenbock Memorial Library at UW-Madison for example, and gather as much information as possible on the cheeses being considered. Articles on specific cheeses and make procedures can be located using databases and indexes such as Food Science and Technology Abstracts (FSTA) and Dairy Science Abstracts. These indexes contain references to a multitude of articles published around the world — FSTA alone lists nearly 19,000 references to cheese. Also, buy and analyze three or four commercial samples of each cheese variety. These samples provide targets for flavor, texture, and composition, as well as a demonstration of the variation that may be found within a specific type. Manchego cheese, for example, can span a range of subtypes from fresh to medium to aged.

Even before a cheese variety has been selected for production, a general knowledge of the make procedures and manufacturing requirements of the cheeses under consideration is needed to evaluate the limitations of existing plant facilities and to estimate the degree of plant modification necessary to accommodate production of a given cheese. In general, select a cheese that utilizes existing facilities with minimal modifications. Some specific factors to consider when selecting a cheese variety include:

1. Does the cheese variety under consideration require a brining system? Do brine tanks currently exist at the plant or is their installation feasible?

2. Shelf-ripened and Swiss-type cheeses usually require multiple coolers maintained at different temperatures. Do current facilities have more than one cooler, or is there extra space in the plant that can be converted to a warm room or cooler?

3. Mold-ripened cheeses such as blue cheese may present contamination problems for other varieties manufactured in the same plant. Attempting to manufacture mold-ripened cheeses in the same plant with non-mold-ripened varieties is usually not recommended.

4. Will the plant's existing press handle smaller-sized or round forms? In general, vertical presses handle small or odd-shaped forms with less difficulty than horizontal presses. Lack of a appropriate press may prohibit the manufacture of cheese sizes of less than about 10 pounds.

However, certain expenses can be expected regardless of the variety of cheese selected for manufacture. Plants undertaking specialty cheese manufacture should be prepared to invest in a first-rate quality assurance program, and any existing quality problems must be corrected. Also expect to invest in new forms and in packaging. Packaging expenses are certain to include the development and use of more sophisticated labeling, and may also involve purchasing line equipment such as a waxing tank.

After a cheese variety has been selected and actual production approaches, thorough research becomes even more critical. It takes between three and six months from the time the first trial vat is manufactured before the results can be evaluated, so cutting corners on preliminary preparation can cost months later.

The CDR Specialty Cheese Program

The role of CDR in its joint Specialty Cheese Program with WMMB is to develop specialty cheese technologies suitable for use by the Wisconsin cheese industry, to provide training and technical support to the cheese plants that adopt these technologies, and to assist Wisconsin cheesemakers in addressing their technical questions. WMMB's role in the Program includes providing participating cheese plants with various forms of marketing support and business planning assistance.

To date, our program has either developed or begun development of a Sweet Swiss, Wisconsin Style Havarti, a Port Salut-type, a Stilton-type, a Manchego-type, and a Dry jack-type cheese. One of these cheeses is currently in commercial production and others are scheduled to be transferred to private industry during the first half of 1993. Cheeses under consideration for future development are a bufala or fresh mozzarella, and possibly some Hispanic cheeses. We are also open to input and ideas from the industry. One of the program's strengths is its incorporation of the talents of the 200 or more cheesemakers in Wisconsin.

For more information on the CDR/WMMB Specialty Cheese Program, contact Cathy Hart, WMMB manager of technology information systems, at (608) 836-8820.

This and that...

CDR Cheese Outreach Specialist **Jim Path** traveled to Poland last July as part of an international program to help agricultural industries in Eastern Europe adjust to the free-market system. Path volunteered to spend two weeks of his vacation time working as a consultant at the Wysokie Mazowieckie dairy plant, Poland's largest dairy cooperative. The plant, located about 80 miles northeast of Warsaw, manufactures cheese, butter, and powdered milk. Winrock International, a non-profit organization for agricultural development, arranged the visit as part of its Farmer to Farmer Program. In November, Path presented a slide show of his Polish visit at the Northeast Dairy Tech Society meeting in Appleton.

CDR Cheese Research and Technology Conference

April 13-14, 1993
Holiday Inn-West Towne, Madison, WI

April 13 — Dairy food safety — always paramount

co-sponsored by the UW Food Research Institute

A review of the status of dairy foods pathogens; Joe Madden, Director, Division of Microbiology, Food and Drug Administration
Research developments in Listeria control and testing; John Luchansky, Assistant Professor, UW Food Research Institute
Biofilms — significance, detection, and control; Marc Mittelman, Director, Centre for Infection and Biomaterials Research, University of Toronto, Canada
Luncheon presentation: Future markets for cheese — taking the volatility out of prices; James J. Bowe, Senior Vice President for Market Development and Planning, Cocoa, Sugar and Coffee Exchange, Inc.
Animal viruses destroyed by pasteurization; Ron Schultz, Professor, UW College of Veterinary Medicine
Setting up an environmental monitoring system and rapid methods of pathogen detection; Chuck Kaspar, Assistant Professor, UW Food Research Institute

Future directions in cheese research

Effect of genetic selection and rotational grazing on milk composition and cheese yield; Dennis Funk, Assistant Professor, UW Dept. of Dairy Science
Use of biotechnology to improve starter cultures; Michael Teuber, Professor, Institute for Food Science, Switzerland
Factors affecting the physical properties of cheese; P. Zoon, NIZO, The Netherlands
Dinner banquet: Dairy foods megatrends in the 1990s; Alex Woo, Director of Research, Griffith Laboratories, Inc.

April 14 — Lowfat cheese — limitations and promise

Don't compromise quality with shortcuts; Mark Johnson, Senior Scientist, CDR
Impact of non-starter bacteria on flavor; Robert Lindsay, Professor, UW Dept. of Food Science
Achieving quality lowfat cheese — use of spray drying to improve starter cultures; Mark Etzel, Assistant Professor, UW Dept. of Food Science
Focus on CDR/FRI research
Use of bioinhibitors in lowfat cheese; Eric Johnson, Associate Professor, UW Food Research Institute
Luncheon presentation: UW College of Agricultural and Life Sciences Dean Roger E. Wyse

Doing business in a changing regulatory environment

co-sponsored by the UW-Extension

Water and waste management in dairy plants; W. James Harper, Emeritus Professor, The Ohio State University
Methods for reducing phosphorus — treatment systems; Jerry Berg, Senior Project Manager, Foth and van Dyke, Inc.
What the plant inspector looks for; Everett Johnson, Technical Specialist, Food Division of the Wisconsin Department of Agriculture, Trade, and Consumer Protection
Drug residues in milk; Rusty Bishop, Director, CDR

To register call the CALS Conference Office at (608) 263-1672. Cost for the conference is $90. Registrations received after March 30, 1993, will be assessed a $10 late fee.

Dairy exports to Mexico projected to grow under North American Free Trade pact

by Dr. Bill Dobson, distinguished professor, UW Department of Agricultural Economics

In 1993, the United States, Mexico, and Canada will consider ratifying the North American Free Trade Agreement (NAFTA), which would lower trade barriers between the three countries during the next 10 to 15 years. Under this agreement, Mexico in particular is likely to become a substantially more important market for U.S. products.

For the U.S. dairy industry, this looks like good news. Mexico is already the world's leading importer of milk powder. It is also a country with both a growing demand for dairy products and a dairy industry that will probably be unable to increase milk production significantly in the near future. While parts of Mexico's dairy industry will become more efficient during the next 15 years, it will be difficult for the Mexican industry to effectively defend major portions of its markets against U.S. competition.

The NAFTA and milk powder

Mexico is a major consumer and importer of milk powder — at times during the late 1980s, the country accounted for up to one-quarter of world imports of milk powder. Mexico's large milk powder imports presently are made by a government organization called Compania Nacional de Subsistencias Populares (CONASUPO) under an import licensing arrangement. However, dissatisfaction with CONASUPO among private dairy processing firms, along with the trend toward liberalizing Mexican markets, will probably result in changes that will allow U.S. exporters of milk powder to sell directly to private industry in Mexico within the next few years. This should contribute to expanded opportunities for the export of U.S. milk powder to Mexico.

If the NAFTA is approved, the United States would initially be permitted to sell 40,000 tons of milk powder — about 95 percent of average yearly U.S. exports of milk powder to Mexico during 1989-91 — to Mexico free of tariffs (3). The amount of milk powder that could be sold with no tariff would grow at a three-percent annual compounded rate over a 15-year transition period (3). The tariff imposed on exports of milk powder in excess of the quota would initially be 139 percent, then decrease at a rate of four percent per year during the first six years of the agreement. After the sixth year, the tariff would be reduced using a straight-line formula that would reach zero at the end of the 14th year (Figure 1).

The U.S. Department of Agriculture forecasts that Mexican imports of U.S. milk powder will increase to between 55,000 and 65,000 metric tons by the end of the 15-year transition period. The Agency predicts that the NAFTA would increase the annual value of U.S. milk powder exports by $36 million (50 percent) during the same time period (4).

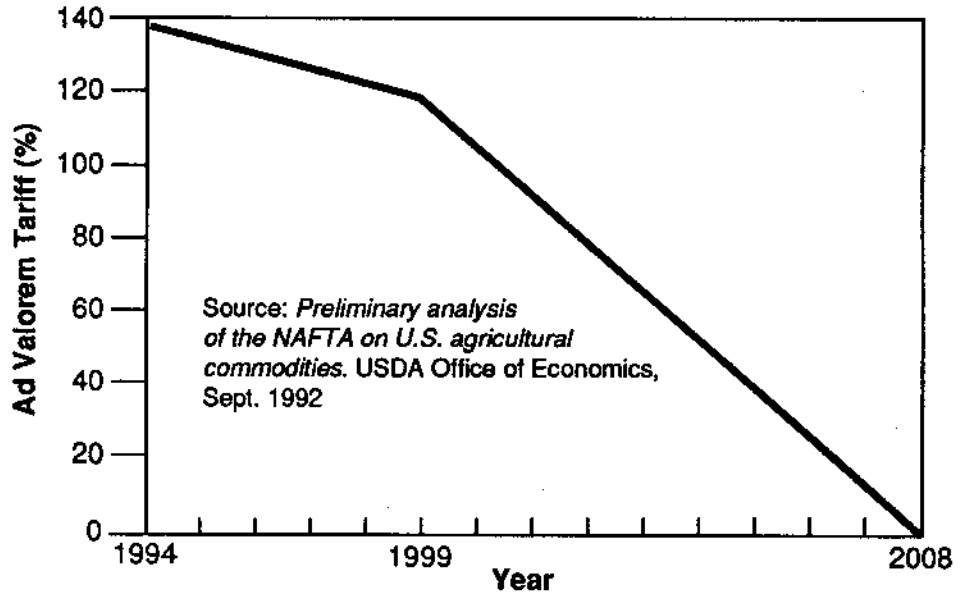
While per capita consumption of milk powder in Mexico exceeded U.S. consumption by at least 25 percent in 1991, per capita consumption of fluid milk and cheese were only about 47 percent and 41 percent, respectively, of the comparable U.S. figures. However, cheese consumption and the consumption of imported fluid milk and cheese in Mexico is increasing. Also, Mexico's decision to remove domestic price controls on canned, powdered, and sweetened condensed milk products has already contributed to an uptrend in imports of these items. For dairy products other than milk powder, the U.S. Department of Agriculture speculates that the NAFTA would cause U.S. exports to Mexico to increase by 15 percent (4).

Mexican milk production

Mexico's ability to increase its domestic milk production over the next few decades will have a large impact on the success of U.S. dairy products in the Mexican market. Mexican milk production has shown a recent increase, partly due to favorable weather. How much Mexico's domestic milk production will expand during the next few years is difficult to forecast. This analyst's view is that Mexican milk production will not increase much in the near future. The obstacles to increased production in Mexico are substantial, and much of the country's agricultural land seems better suited to producing vegetables, fruit, and beef.

Mexico has three main types of dairy farming systems: confined, pastoral, and dual purpose (1). Mexican farms using a confined system are similar in many respects to large-scale dairy farms in California. Modern technologies, including bovine somatotropin, are used on some of these farms, which have an average herd size of about 230 cows. However, in many cases, milk cooling facilities are inferior to those found on U.S. farms, and hand milking is still common. Farms using a pastoral system of dairy production are found throughout Mexico's central and northern regions. Technologies used on these farms, which average about 40 cows in herd size, are much less advanced than on the confined-systems farms.

Figure 1. *Tariff to be levied by Mexico under the NAFTA on U.S. milk powder exceeding zero-tariff quantities.*



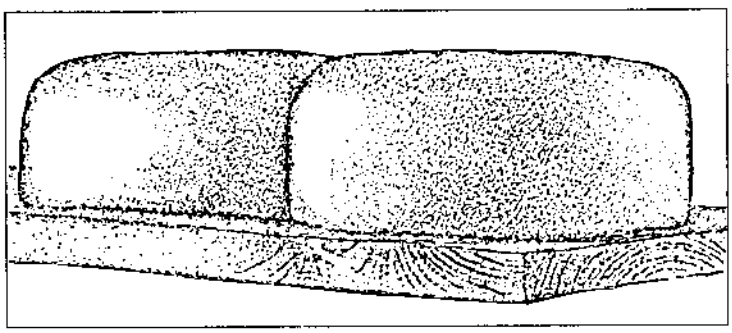
Dual purpose systems, where the technologies are least advanced, produce milk as a by-product of beef production. These farms are found primarily in the Mexican tropics. The bulk of the cows in Mexico (63 percent) are kept on these less-efficient dual purpose farms, which account for only 28 percent of Mexican milk production. Mexican milk processors are currently attempting to foster additional milk production and sales in the tropics by providing milk collection and cooling facilities that neighboring farmers can use. The success of these efforts will be influenced by the price of milk compared to the price of beef. High milk prices relative to beef prices will induce farmers to market the milk rather than let it be consumed by beef calves.

Challenges facing U.S. exporters

In addition to opportunities, U.S. companies will confront some important challenges when attempting to export dairy products to Mexico. Among them are:

- U.S. exporters have complained about excessive regulation, credit difficulties, and extended liability for products after those products reach Mexico. These problems will be reduced but not eliminated by the NAFTA.
- The tariff imposed by the Mexican government under the NAFTA on milk powder imported from the United States will decline slowly.
- Economic uncertainty will exist in the Mexican milk powder market following any decision by the Mexican government to phase out CONASUPO as the monopoly importer of milk powder.
- Mexico's cheese consumption is increasing, but the cheeses commonly consumed are white cheeses not usually produced and consumed in the United States. Firms wishing to get expanded shares of the Mexican cheese business will have to produce to specification for that market.
- A National Dairy Board survey of upper income and middle class consumers in Mexico revealed that many of these consumers believe that U.S. cheeses are of inferior quality (2). This lack of knowledge about the quality of U.S. cheese will impede U.S. cheese exports to Mexico.
- Many Mexican consumers prefer beans, not cheese, as their primary source of protein (1).

see Mexican free trade, page 10...



In addition to expelling moisture, acid produced by the starter bacteria dissolves calcium from the protein matrix of the curd. Excessive calcium loss due to too much acid production can lead to a brittle body and poor eye formation in eyed cheeses such as Gouda and Swiss (see "The Curd Clinic," *UW Dairy Pipeline*, Fall 1992).

The Curd Clinic

Question: I make a brined Gouda cheese. My problem is that, a week or two after the cheese has been vacuum-packed, moisture collects on the cheese surface under the plastic film. This happens even though I let a rind develop before packaging. The cheese develops off-flavors where the moisture collects, but has no apparent body defects. Does this problem have something to do with the type of packaging I'm using?

Answer: No, moisture collecting inside the package is a result of problems with your make procedure, not your packaging. Generally, cheese exhibiting this type of defect contains excess moisture and/or residual lactose at the time it is packaged. A few weeks later, as the residual lactose slowly ferments and cheese pH drops, the excess moisture is expelled. Off-flavors caused by growth of non-starter bacteria may develop where the moisture collects. There are many possible causes (and solutions) for this situation, but in this case the problem is most likely related to a lack of adequate acid development at pump-over or before brining.

Manufacturing quality Gouda cheese depends on precise pH control to remove sufficient moisture and lactose from the curd while retaining the high calcium content needed for curd elasticity. During stir-out, factors such as acid development, heat, and mechanical agitation combine to drive moisture and lactose out of the curd. If the pump-over pH is too high or if the cheese is brined before reaching its final pH, excess moisture and lactose will be retained in the curd. Wheying-off in the package will then be likely.

Consequently, Gouda cheese is made at a relatively high pH — typically with a pH of 6.20 to 6.30 at pump-over. Some cheesemakers may be tempted to pump-over at an even higher pH, 6.4 for example, to ensure high calcium retention. This is a mistake, but an easy one to correct. Try stirring-out longer to allow curd pH to drop to the recommended level. Pay attention to the curd firmness at pump-over to be sure that the increased stir-out time has not caused the curd to become too dry.

If you are already pumping over at the proper pH, or if adjusting pump-over pH fails to correct your problem, you need to look at acid development during pressing, brining, and ripening. Check cheese pH after pressing, before it is placed in the brine. Then check the final pH of the cheese, using a sample from a four- or five-day-old cheese. (In this context, final pH refers to the lowest pH reached by the cheese, immediately after lactose fermentation is complete. For Gouda cheese, final pH should be in the neighborhood of 5.2. Later, during aging, protein breakdown eventually causes the pH to rebound to about 5.4.)

The pH at brine should already be near its final level, i.e., no higher than 5.25. Brining the cheese before lactose fermentation is complete can directly lead to wheying-off in the package. The cold brine stops further fermentation and seals the cheese surface so that both excess moisture and residual lactose are retained in the cheese. Later, continued fermentation converts the remaining lactose to lactic acid. The resulting drop in pH stimulates renewed syneresis, and additional whey is expelled. Even when the pH at brine is at 5.2, wheying-off will occur if pH continues to drop to an abnormally low final level. However, that is probably not the case here, as the cheese described in the question does not exhibit the short-body defects expected in an acid cheese.

Assuming the final pH of the cheese is where it should be, the solution to this problem is to press longer to allow complete lactose fermentation before brining. However, complete fermentation should not require more than about six hours. Slow acid development in the press not only interferes with plant productivity, it also gives non-starter organisms an opportunity to grow. If your cheese takes too long to reach its final pH in the press, you need to speed up acid development during this stage of cheesemaking. One factor that can influence press time is the temperature of the room where pressing takes place. Is it cooler than normal room temperature? If so, the low temperature may be inhibiting acid development. Keeping the room warmer may be all that is necessary to boost the rate of acid production to an acceptable level. As a last resort, you may need to use slightly more starter when inoculating your cheesemilk. Keep in mind, however, that changing the amount of starter may make it necessary to adjust other factors in your make schedule. For example, you may need to cook at a slightly higher temperature to avoid substantially changing the rate of acid development during stir-out.

Cheese may also whey-off if its final pH is too high. Curd of high pH traps more moisture in its protein structure, and that moisture may be released when proteins break down during aging. Whenever the final cheese pH is higher or lower than the recommended level, it may be helpful to adjust the whey-dilution step that is part of the normal Gouda make procedure. Depending on other variables, the volume of water used for whey dilution can range from 30 percent to 50 percent of the original volume of cheesemilk. To raise the final pH, use a greater proportion of water to wash out more lactose and lactic acid. To lower the final pH, use less water. ■

Curd Clinic Doctor for this issue is Carol Chen, CDR researcher.

Questions for the Curd Clinic?
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1605 Linden Dr.
Madison, WI 53706
FAX: 608/262-1578

Resource center

Pilot-scale facilities

CDR pilot plant. Production facilities, as well as the expertise of CDR staff, are available for industry pilot-scale cheesemaking trials in the Center's dairy pilot plant. Located in the Babcock Hall Dairy Plant, the CDR pilot plant offers a variety of cheesemaking equipment that can accommodate all types of cheese. Four 600-pound steam-jacketed stainless steel cheese vats with variable speed stirrers are available for cheesemaking. The plant also has a Stoelting pressing vat for manufacturing eyed cheeses such as Swiss and Gouda, and a SSF small-scale mixer molder for pasta filata varieties such as mozzarella and Provolone. The Center maintains a saturated brine tank and five cheese-aging coolers set at a range of temperatures. Additional equipment includes a horizontal press, a vacuum press, and a VC999 Vacuum Packer. Center researchers are experienced with traditional cheeses, as well as many reduced-fat and specialty varieties. For more information on CDR pilot-scale cheese trials contact Carol Chen at (608) 262-3268.

UW Dairy Plant. Facilities at the Babcock Hall Dairy Plant are also available for short-term projects through the Department of Food Science. Home of Babcock Ice Cream and other UW Dairy Store products, the plant is well suited for testing processing parameters or new product formulations. Laboratory support is provided for routine products testing, and follow-up sensory evaluation is available. Call Tom Blattner at (608) 263-5144.

At UW-River Falls. In operation since 1984, the Dairy Pilot Plant at UW-River Falls is rented to various businesses for small-scale research, trouble shooting, and new product development. Available equipment includes a 3,500-pound cheese vat, a high-temperature short-time pasteurizer, a homogenizer, an ice cream freezing system, a spray dryer, and a Stephen processor. In addition to its industry trials, the pilot plant routinely manufactures ice cream and cheeses for the River Falls campus. Food Science faculty use the plant for a number of classes and training sessions for the University and industry. One such workshop is the Basic Cheesemaker's License Short Course. For more information on the River Falls pilot facilities call Ranee May at (715) 425-3702.

see Resources, page 11...

UW dairy research projects: Cheese technology

Numerous dairy foods research projects are underway at UW-Madison. The following are only those involving cheese technology.

1. Rheological and thermal properties of different cheeses. Dr. Sundaram Gunasekaran, Depts. of Agricultural Engineering and Food Science. (NDPRB) 4/93
2. Effect of post-processing on cell viability, cell permeability, and enzyme activity of *Lactobacillus helveticus* cheese starter culture adjunct. Dr. Mark Etzel, Dept. of Food Science. (NDPRB) 9/93
3. Development of a systematic approach for producing cheese as a food ingredient. Dr. Norm Olson, CDR/Dept. of Food Science. (WMMB) 12/93
4. Effect of fat, moisture and salt on the freezing qualities of Cheddar-type cheeses. Dr. William Wendorff, Dept. of Food Science. (NDPRB) 6/93
5. Development of an economic engineering microcomputer model for analysis of cheese plant operation. Dr. Brian Gould, CDR/Dept. of Agricultural Economics. (WMMB)
6. Genetically-modified bacteriocinogenic lactic starter cultures and associated bacteriocins for control of pathogenic bacteria in unpasteurized high-moisture cheese products. Dr. John Luchansky, Food Research Institute. (NDPRB) 6/93
7. Characterization of the thermolytic response by strains of *Lactococcus lactis* ssp. *cremoris*. Dr. James Steele, Dept. of Food Science and Finn Vogensen, Royal Veterinary and Agricultural University, Denmark. (WMMB-WITEP) 6/93
8. Characterization of the X-prolyl dipeptidyl aminopeptidase gene and its influence on milk protein degradation. Dr. James Steele, Dept. of Food Science. (NDPRB) 6/93
9. Development of new starter adjunct strategies for improved quality and intensity of flavors in Cheddar-type cheeses. Dr. Robert Lindsay, Dept. of Food Science. (NDPRB) 1/93
10. Enhancing flavor characteristics and maturation rate of cheese by selected enzymatic and microbial treatments. Dr. Norm Olson, CDR/Dept. of Food Science. (NDPRB) 6/93
11. Demand analysis of a variety of cheeses using cross-sectional data. Dr. Brian Gould, CDR/Dept. of Agricultural Economics. (WMMB) 6/93
12. Systematic evaluation of peptidolysis during cheese maturation. Dr. Norm Olson, CDR. (CRI) 7/93
13. Identification of bacteriocins active against heterofermentative or racemace positive lactobacilli. Dr. John Luchansky, Food Research Institute and Dr. Mark Johnson, CDR. (NDPRB) 6/93
14. Development of process technology to reduce the potential for light-induced pink discoloration of annatto-colored cheeses. Dr. William Wendorff, Dept. of Food Science. (NDPRB) 6/93
15. CDR cheese research applications program. Jim Path, CDR. (WMMB) 6/93

...*Mexican free trade, from page 7*

While the preference for beans may erode as incomes in Mexico increase, this preference will slow cheese sales in the Mexican market.

- While the Mexican market can be served by truck or rail, lack of adequate transportation facilities and inferior refrigeration may restrict U.S. dairy exports.

References

1. Hallberg, M.C., J. R. Cranney, S.M. Smith and C.M. Valdes. 1992. The Mexican dairy economy and potentials of liberalized trade for the U.S. dairy industry. *A.E. & R.S.* # 236, Pennsylvania State University.
2. Suber, T. Comments made at Dairy Exporting Mini-Conference, sponsored by the Wisconsin Federation of Cooperatives. Madison, WI, Nov. 15, 1992.
3. *NAFTA agricultural fact sheets: milk powder and cheese.* 1992. U.S. Department of Agriculture.
4. *Preliminary analysis of the effects of the North American Free Trade Agreement on U.S. agricultural commodities.* 1992. U.S. Department of Agriculture, Office of Economics.

Project Profile:

Effect of post-processing on cell viability, cell permeability, and enzyme activity of Lactobacillus helveticus *cheese starter culture adjunct; Dr. Mark Etzel, Depts. of Food Science and Chemical Engineering*

This project explores the production and use of spray-dried *Lactobacillus helveticus* cheese starter culture adjuncts. Addition of heat-treated and freeze-treated *L. helveticus* during cheesemaking has previously been shown to reduce bitterness and improve cheese flavor development, particularly in lowfat cheeses. However, conventional culture preparation methods are time consuming and costly. Spray drying is considerably more economical, especially on a large-scale basis. In addition, spray-dried cells are stable and easily shipped.

Etzel's group first examined the impact of spray drying on cell viability and on the activity of selected intracellular enzymes important for cheese flavor development. The researchers used a range of spray-dryer outlet air temperatures to obtain spray-dried *L. helveticus* cells with a wide range of residual viabilities. They found that changes in outlet air temperature caused cell viability to vary by almost four orders of magnitude, while intracellular enzyme activity changed only slightly.

Cheesemaking trials were conducted to assess how differences in adjunct cell viability influence cheese quality. *L. helveticus* cells spray-dried in condensed skim milk at outlet air temperatures of 80° and 125°C were used as adjuncts in the manufacture of 33-percent reduced-fat Cheddar cheese. Panels consisting of 10 to 12 experienced cheese tasters evaluated the cheeses after 1.5, three, six, and nine months of aging. In all categories, cheeses made with adjuncts were preferred over the controls. High-viability, low-heat cultures produced the greatest improvements in cheese quality, particularly within the first three months of ripening.

A second cheesemaking trial compared cheeses made with the spray-dried cultures with cheeses made with freeze-shocked and freeze-dried adjuncts. Taste panels indicated that the adjuncts enhanced cheese flavor and texture without causing bitterness. Cheeses made with the high-temperature spray-dried adjuncts were the most preferred.

...Resources, from page 9

Software

Cheese plant managers can access a new tool for evaluating and improving plant efficiency while participating in an on-going CDR research project. A team of researchers headed by CDR Associate Scientist Brian Gould is developing a computer program that will enable plant managers to track and predict the impact of changes in processing methods and raw materials on profitability. The program, called *Cheese-Eco*, is designed for use with IBM-compatible personal computers.

Copies of *Cheese-Eco* are available to industry personnel who wish to use the program in their day-to-day decision making. For example, the software could be used to determine how variations in the fat content of milk affect cheese yield and production costs. Milk standardization routines are included as part of the program. In return, the program development team requests that data compiled by the program be returned to CDR for confidential use in a research project analyzing the economic impacts of cheese processing variables. For information call Dr. Brian Gould at (608) 263-3212 or fax (608) 262-1578.

Insect control

Dairy plant personnel can find practical instructions for managing insect pests in *Insect control in food handling facilities and dwellings*, a new booklet offered by the UW-Extension. Written by UW entomologist Walter Gojmerac, the publication offers pointers on insect identification, management practices to reduce the need for chemicals, rules and regulations, the safe use of pesticides, and more. It is available through most county Extension offices.

NEDFRC publication

A publication evaluating the economics of concentrating or fractionating milk prior to Cheddar cheesemaking is available from the Northeast Dairy Foods Research Center. In this publication, entitled *Comparison of the economics of Cheddar cheese manufacture by conventional and fractionation/ concentration technologies*, authors R.D. Aplin, D.M. Barbano, and S.J. Hurst compare the costs of evaporation, reverse osmosis, and ultrafiltration with the costs of conventional methods for preparing milk for Cheddar cheesemaking. To request a copy, call Pat Curran at the NEDFRC, (607) 255-2889.

Calendar of Events

Jan. 4-8 *Ice Cream Maker's Shortcourse,* Madison, WI. Call Bob Bradley (608/263-2007) for information, or the CALS Conference Office (608/263-1672) to register.

Jan. 11-14 *Milk Pasteurization and Process Control School,* Madison, WI. Call Bob Bradley (608/263-2007) for information, or the CALS Conference Office (608/263-1672) to register.

Feb. 2-3 *Wisconsin Dairy Field Reps Conference,* Holiday Inn-West, Madison, WI. Call the CALS Conference Office (608/263-1672) to register.

March 16-18 *Cheese Industry Symposium,* Green Bay, WI. Sponsored by the Wisconsin Cheesemaker's Association and the U.S. Cheesemaker's Association. For information call John Umhoefer at (608)253-2027 or Linda Leger at (608)277-8501.

March 22-26 *Wisconsin Cheese Technology Short Course,* Madison, WI. For information call Bill Wendorff at (608) 263-2015.

April 13-14 *CDR Cheese Research and Technology Conference,* Holiday Inn-West Towne, Madison, WI. For details call the CALS Conference Office at (608) 263-1672.

April 20-23 *Basic Cheesemaker's License Short Course,* River Falls, WI. Call Ranee May at (715) 425-3702 for information.

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Bill Wendorff, Asst. Professor, Dept. of Food Science

April 26-29 *ADPI Annual Meeting and Dairy Products Marketing Conference,* Chicago Hilton & Towers Hotel, Chicago, IL. For details call Dr. Warren Clark, Jr., at (312) 782-4888.

May 11 *Lowfat Processed Cheese: Processing and Ingredients Technology,* InnTowner Hotel, Madison, WI. For more information call the CALS Conference Office at (608) 263-1672.

June 3-4 *Wisconsin Cheese Grading Short Course,* Madison, WI. For information call Bill Wendorff at (608) 263-2015.

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