

the top percentiles over several generations to focus on the desirable traits that they are selecting for in their herd. Unfortunately, most of the top ranking bulls available in AI are even more or very closely related to each other since the top ranking bulls of one generation sire most of the next generation of bulls sampled in AI programs. Consequently, herds utilizing only top-ranking AI sires become increasingly inbred with each passing generation. Many producers are beginning to realize the drawbacks caused by inbreeding depression. This occurs when the genetics in a line of cattle becomes so focused that not only the desirable traits become more emergent but so do the non-desirable recessive traits. This often is expressed as negative consequences on performance parameters such as health, fertility, and longevity. Implementing crossbreeding into a dairy herd, ensures the prevention of inbreeding depression, and also incorporates into the herd traits from outside the current breed. Producers need to develop a crossbreeding strategy which maximizes heterosis, is easy to implement, and allows for long-term success.

Key Words: Heterosis, Crossbreeding

192 Waste milk vs. milk replacer. J. Downing* and C. C. Williams, *Louisiana State University, Baton Rouge.*

Two methods of raising dairy calves include feeding waste milk and feeding milk replacer. Waste milk is non-saleable milk such as excess colostrum, transition milk, mastitic milk, or antibiotic treated milk. Milk replacer is a powder which is mixed with water and resembles

milk. Some of the common ingredients of milk replacer include whey, whey protein concentrate, animal and vegetable fats, vitamins, minerals and amino acids. Both practices have recommendations and guidelines to follow once a method of feeding has been selected. Disadvantages of feeding waste milk include microbial infections, antibiotic residues and resistance, higher calf mortality and increased veterinary costs. The most common microorganisms found in waste milk are *Streptococcus*, *Enterobacter*, *E coli*, *Listeria*, *Salmonella*, Bovine Viral Diarrhea, and Bovine Leukosis Virus. Organisms responsible for mastitis and Johne's disease can also be found in waste milk. If waste milk is going to be fed, pasteurization is a good idea. Pasteurization of waste milk can reduce the microbial load, decrease mortality and vet costs, and increase body weight gain of calves, but it does not remove antibiotic residues from the milk. There are guidelines for feeding waste milk which can help prevent disease causing microorganisms from being spread to calves. If milk replacer is fed, its nutritional quality should be evaluated before using. Milk replacers should contain a minimum of 20% protein and 15% fat. Vegetable oils should not be used in the milk replacer because they are poorly utilized by calves. Advantages of feeding milk replacer include disease prevention, convenience, increased performance, and economics. Beneficial additives can also be incorporated into the milk replacer which aid in growth and preventing calf-scours. Many farmers consider waste milk to be cheaper than milk replacer, but this is not the case when looking at opportunity cost. Waste milk can be a good source of nutrition for calves but negative factors such as antibiotic residues and infectious pathogens may impact your calves' health and decrease performance. Management practices are key factors in deciding which method is best in raising dairy calves.

Key Words: Calves, Waste Milk, Milk Replacer

Dairy Foods: The Dairy Management Inc. National Dairy Foods Research Center Program: Responding to Industry Needs for New Technologies, Products and Markets

193 The Dairy Management Inc.™ National Dairy Foods Research Center Program: responding to industry needs for new and improved technologies, products and ingredients. J. K. Kondo*, *Dairy Management, Inc., Omaha, NE.*

Successful dairy and dairy-based product innovations rely on research. While customer and market insights fuel the product concepting process, the latest science and technologies can transform those concepts from ideas into successful products and ingredients. Through its Product Innovation Program, Dairy Management Inc.™ (DMI) provides industry with leading-edge dairy product and ingredient research and technical resources. The National Dairy Foods Research Center Program, a unified coordinated national research program conducted through six research centers, three applications labs and other universities, helps industry innovate to address unmet consumer demand for dairy and dairy-based products by providing the science for innovation as well as the knowledge to address product challenges. Presentations by center directors and scientists, representing each research center, will review current research under way in their facilities. The research covers technologies and processing methods for extended shelf-life products, high-value whey ingredients and co-product utilization, cheese with improved functionality and performance, and ingredients with enhanced functionality and performance.

Key Words: National Dairy Foods Research Centers, Dairy Centers, Dairy Research

194 Manufacture and application of casein concentrates. L. E. Metzger*, *South Dakota State University, Brookings.*

Milk protein concentrate (MPC) is extensively used as an ingredient in process cheese product formulations. In MPC approximately 20% of the total protein is whey protein and 80% is casein. In process cheese product applications casein provides a desirable firm un-melted texture and stringy, elastic melted texture, whereas whey protein forms a thermo-irreversible gel and produces a process cheese product that has restricted melt characteristics. Consequently the casein portion of milk protein is more valuable for use in process cheese product applications as compared to whey protein. The objective of this research was to develop a microfiltration process utilizing spiral wound membranes that is capable of producing a casein enriched protein concentrate (CEPC). Subsequently the performance of CEPC in process cheese product formulations was compared to conventional MCP. Three replicates of skim milk were processed into MPC using ultra/diafiltration and CEPC using micro/diafiltration. The mean total protein, casein, whey protein, ash, and lactose of the MPC and CEPC respectively were 74.3, 60.4, 13.1, 7.60, 11.9% and 73.2, 65.6, 6.6, 7.8, 6.1%. The MPC and CEPC were then utilized in process cheese product formulations. The process cheese product formulations were standardized to contain 15 and 25% MPC or CEPC (corrected to 75% protein). Each formulation was processed at 80 and 95°C. The process cheese products produced using CEPC had a significantly ($P < .05$) higher apparent

viscosity after manufacture and TPA-hardness as compared to those produced with from MPC. These results indicate that CEPC will have added value as compared to conventional MPC when used as an ingredient in process cheese product applications.

Key Words: Casein Concentrate, Microfiltration, Process Cheese Product

195 Creating new dairy ingredients uses – getting beyond the dairy case. P. S. Tong*, *California Polytechnic State University, San Luis Obispo.*

A large portion of dairy ingredients have been historically utilized in the manufacture of dairy foods. In such applications the dairy ingredients were utilized because they provided the desired sensory profile, nutrient composition and/or functional ingredient performance in a convenient and/or economical fashion. These dairy ingredient attributes continue to be important for their use in many food systems. However, as the food industry grows increasingly sophisticated in response to consumer expectations and the competitive market environment, getting beyond the dairy case will be a growing market opportunity and it will require recognition that more specific or customized ingredient solutions and associated service/support may be needed. One successful approach has been to maximize the functionality per unit of the dairy ingredient to provide the necessary economic advantage to the end-user. This has been an effective way to compete against other potentially lower cost, highly functional food ingredients. Dairy center research and applications programs have helped to characterize and optimize dairy ingredient functionality that has been one key foundation of the strong demand for dairy ingredients around the world today. However, increasing scientific evidence on the beneficial health effects of dairy protein consumption and other dairy components are creating new avenues to get us beyond the dairy case. Looking at how the other popular food ingredients are positioned and utilized in the food industry may shed some valuable insight on how dairy ingredients can get beyond the dairy case and how the national dairy centers and applications programs can help play a vital role.

Key Words: Dairy Ingredients, Dairy Protein, Food Applications

196 Defining the flavor of dairy products. M. A. Drake*, *North Carolina State University, Raleigh.*

Flavor plays a crucial role in customer and consumer purchase decisions. Trends come and go in the food industry but a desirable and consistent flavor is always required for market success. Defined sensory languages to describe flavor are fundamental tools which can serve as platforms to document flavor and to understand flavor chemistry and consumer perception. Sensory languages to document flavor characteristics were applied to cheese, dried dairy ingredients, butter, and fluid dairy products. Collected flavor information was used to document flavor variability and stability, to identify chemical sources of flavors and understand flavor carry-through in ingredient applications, and to construct consumer preference maps. Specific examples with cheese, dried dairy ingredients, butter, and fluid dairy products will be addressed.

Key Words: Flavor, Dairy Foods, Sensory Analysis

197 Improving the quality of low fat cheese. D. J. McMahon*, *Western Dairy Center, Nutrition & Food Sciences Department, Utah State University, Logan, UT.*

With the renewed interest in low fat foods, a DMI-funded collaborative project was undertaken to systematically study the differences between full fat and low fat cheddar cheese, with the aim of providing a basis for improving the flavor and texture of low fat cheeses. A method that included pre-acidification of milk to pH 6.25 and washing curd with cold water was developed to make a low fat cheese with 52 to 54% moisture and pH 5.15 to 5.25. A 50%-reduced fat cheese and a full fat Cheddar cheese were made without preacidification but with curd washing. A full fat Cheddar cheese without curd washing was also made. These cheeses were aged at 8 C and tested at 2 wk, 3 and 6 mo of aging. This presentation will present findings from analysis of these cheeses comprising sensory flavor, flavor chemistry, rheology, sensory texture, melting, bacterial microflora, and cheese biochemistry.

Key Words: Low Fat Cheese, Flavor, Texture

198 Process techniques to enhance the utilization of whey ingredients. J. A. Lucey*¹, S. Damodaran¹, and K. Smith², ¹*University of Wisconsin, Madison,* ²*Wisconsin Center for Dairy Research, Madison.*

Various types of whey ingredients, including sweet whey, whey protein concentrates (WPC) and whey protein isolates (WPI), are popular food ingredients due to their excellent functional and nutritional properties. Some of the key developments over the past 20 years have included increasing purification of the protein fraction and the isolation of individual fractions. Membrane filtration techniques, such as microfiltration (MF), ultrafiltration and diafiltration, are now used for the production of WPI and polymeric spiral-wound MF membranes are also becoming popular. Currently, research is being conducted to enhance the functionality of whey powders so that they can be successfully used in applications such as nutritional bars, crispy snacks, and beverages. New processing approaches to enhance the functionality of whey ingredients include methods to reduce the residual lipids in WPC, exploring process conditions to alter the interactions between whey proteins and polysaccharides, crosslinking of whey proteins, incorporation of other proteins fractions with WPC, and the use of MF to fractionate caseins from whey prior to cheesemaking. These novel processing techniques could improve the clarity, flavor stability, heat stability, emulsification and foaming properties of whey ingredients. The goal of these research topics is to extend the functional range for existing whey ingredients into more challenging environments, e.g. clear, low pH beverages that have a high protein content and are also heat stable. Another key goal is to reduce the variability in functional performance (e.g. flavor, clarity, color) that can be observed in whey ingredients.

Key Words: Whey Ingredients, Functionality, Membrane Filtration

199 Breaking the 21 to 28 day shelf-life barrier on refrigerated HTST pasteurized milk. D. M. Barbano* and K. J. Boor, *Cornell University, Northeast Dairy Foods Research Center, Department of Food Science, Ithaca, NY.*

While ultra-high temperature (UHT) non-refrigerated shelf-stable milk has a long shelf-life, the U.S. consumer has not accepted the

sensory quality of this product. The refrigerated shelf-life of HTST pasteurized fluid milk has increased over the last 20 years as improved post-pasteurization milk handling and packaging systems have decreased post-pasteurization contamination. Improvements in raw milk quality have also contributed to increased shelf-life and flavor quality. Enclosed fillers with filtered air environments have allowed the best fluid milk processors to achieve 21 to 28 days of shelf-life. The organisms that typically spoil HTST milk after 17 d are psychrotolerant *Bacillus* spp. and closely related genera. These spores are present at low levels in high quality raw milk supplies, they survive HTST

processing, and then grow rapidly after 17 d of refrigerated storage. In the last two years, fluid milk processors have increased HTST temperatures to improve the safety of fluid milk but this has stimulated outgrowth of spore formers and in some cases decreased shelf-life of HTST fluid milk. Alternative approaches, using removal of bacteria and spores are being explored in combination with HTST at minimum temperature and time, are being developed that will allow processors to break the 28 d shelf-life barrier.

Key Words: Fluid Milk, Shelf-Life, HTST

ADSA Southern Branch Symposium: Keeping Dairy Going and Growing

200 Structural shifts in the dairy industry. G. A. Benson*, *North Carolina State University, Raleigh.*

Dairy farm and cow numbers are declining, milk per cow is trending up, and milk production is increasing in the West and is flat or decreasing elsewhere. Understanding the factors causing these shifts can lead to more informed business decisions by farmers and allied industries, and is useful to policy makers. Causes include changes in product demand, technology, input availability and cost, and profitability. Government policies affect the general business climate, transportation costs, trade, and agricultural programs. There is little published work that quantifies the relative importance of each one for the dairy industry. Increased specialization has occurred to take advantage of economies of scale and size and capital has been substituted for labor. Technology has created increases in farm level productivity, both per cow and per acre. Trade and dairy policies create US prices that are above world prices and shield US producers from international competition. Productivity gains have outstripped the growth in sales, creating pressure on farm prices and reductions in cow numbers. The combined effect is the observed reductions in the size of the national dairy herd and farm numbers. Consumers are the primary beneficiaries, in the form of lower prices for dairy products. Regional changes are driven by differences in financial performance. Differences in input availability and cost affect production costs. Regional price differences are the result of local supply and demand conditions, transportation costs and, to some extent, federal and state milk pricing rules. Structural change also has occurred at the dairy cooperative, processor and retailer level. In general, the main changes have been a reduction in the number of business entities, increasing size, and greater concentration. Dairy farmers can only react to structural change as they make business plans but policy makers, new technology developers (including research and extension) can influence the direction and speed of change. Specific activities include changing the relative prices of milk in the various regions and initiatives that target specific regional rather than national issues.

Key Words: Structural change, Dairy

201 Problems associated with a dairy expansion effort. J. F. Keown*, *University of Nebraska, Lincoln.*

Over the years, many states have initiated projects to expand their dairy operations as a way to increase economic activity, increase employment, utilize the by-products generated by the expanding ethanol industry and revitalize rural portions of their states. To be successful, these activities take a concerted effort from all groups

within the state, the Governor's Office, State Legislature, Department of Agriculture, as well as aligned dairy industries. In Nebraska, an effort to get local dairies to expand was not really successful until an effort was made to attract dairies from other parts of the country. The advertisements and promotional brochures produced discussing the Nebraska Advantage showed local producers the benefits that their own state offered the industry. Having other producers visit and discuss the opportunities that were available within the state helped local producers take a second look at the resources available to them for local and regional expansion. There are many obstacles to overcome when attempting to attract producers from other states such as climate, infrastructure, Department of Environmental Regulations for obtaining permits for easements and manure disposal, feed resources and costs, availability of multiple milk markets and local acceptance of large animal operations are all major concerns that must be considered. All of these obstacles have been encountered when working on the Nebraska effort and are common to all areas that are attempting to attract animal operations to their state. Many of these concerns cannot be addressed on a statewide basis but must be addressed individually, as each project is unique. The ability to address these issues and have all elements working in unison will result in successful or unsuccessful expansion efforts.

Key Words: Economic, Ethanol, Expansion

202 Adopting a management focus. R. A. Milligan*^{1,2}, ¹*Dairy Strategies, LLC., St. Paul, MN,* ²*Cornell University, Ithaca, NY.*

Every business needs a workforce with at least one person filling three roles as workers, managers, leader/chief executive. Over the last several decades an increasing number of dairy farms have developed expertise in the manager role. The challenge to keep the dairy industry going and growing is for each business to develop the expertise to successfully execute the chief executive role. The chief executive (CE) role is very different from the worker and manager roles. The CE is focused on strategy and people. The CE must have a greater external focus to understand what is happening in the global business environment including the quality movement, the markets for the business product, labor markets, and public policies impacting their industry. This information must then be utilized to develop and implement strategies to enable the business to thrive in our ever changing business environment. The chief executive must then assemble, inspire and develop a winning workforce team including:

1. Articulating the dairy businesses inspirational mission/vision/compelling vision.