

Although several organic acid levels were elevated in the goat cheeses, prolonged frozen-storage upto 6 months may be feasible because no apparent deterioration in sensory scores were observed in other companion studies.

Key Words: Goat Cheese, Frozen-Storage, Organic Acids

549 Interaction of emulsifying salts with milk proteins. R. Mizuno^{1,2} and J. A. Lucey², ¹*Food Research & Development Laboratory, Morinaga Milk Industry Co., Japan*, ²*Department of Food Science, University of Wisconsin, Madison*.

Emulsifying salts (ES) are used for process cheese production, however, it is not completely understood how ES influence the physical and chemical properties of process cheese. The purpose of this study was to understand the interactions between ES and milk proteins using a simple model system. In this system, milk protein concentrates (MPC) solution was used as the source of milk protein and the effects of addition of ES upon milk protein were estimated by measuring the area of acid-base titration curves, turbidities, and the amount of soluble calcium. Various concentrations (0 to 0.7% (w/w)) of ES (trisodium citrate or sodium phosphates (ortho-, pyro-, or poly-)) were added to MPC solution (5% (w/w) solids). The pH of all solution was adjusted to 5.8 using hydrochloric acid after addition of ES (to be in the typical pH range of process cheese). The area of the titration curves was measured using the acid-base buffering method to observe changes in the amount and type of colloidal calcium phosphates (CCP). Turbidity measurements were made at 600 nm and the amount of soluble calcium was determined by measuring the calcium concentration that was ultrafilterable. An increase in the concentration of trisodium citrate brought about a decrease in the buffering capacity contributed by CCP, a decrease in the turbidity, and an increase in the amount of soluble calcium. Orthophosphates had little effect on the titration curves, turbidity, and the amount of soluble calcium. With increasing addition of pyrophosphates, the buffering capacity, turbidity, and amount of soluble calcium decreased. With the addition of a small amount polyphosphates, the effects were similar to those of pyrophosphates but when excessive amounts were added, there was a shift in the pH where the peak of the titration curve caused by CCP occurred, and an increase in the amount of soluble calcium. These results suggest that each ES influences milk proteins with different mechanisms.

Key Words: Emulsifying Salt, Milk Protein, Colloidal Calcium Phosphates

550 Impact of type of concentrated sweet cream buttermilk on the manufacture and functionality of pizza cheese. T. Y. Lin¹, S. Govindasamy-Lucey², J. J. Jaeggi², C. J. Martinelli², M. E. Johnson², and J. A. Lucey¹, ¹*Department of Food Science, University of Wisconsin, Madison*, ²*Wisconsin Center for Dairy Research, University of Wisconsin, Madison*.

Sweet cream buttermilk (SCB), a by-product of buttermaking, is a rich source of phospholipids, which could assist in fat emulsification. Most SCB is sold concentrated and it is not clear how the different concentration processes affect the behavior of SCB as an ingredient in cheese. SCB was concentrated by cold (<7C) ultrafiltration (UF), cold reverse osmosis (RO) or evaporation (EVAP). A washed, stirred-curd cheese was manufactured from the three different types of concentrated SCB. Cheesemilks of CN:fat ratio of 1.1 and final CN content 2.7% were obtained by blending UF-SCB retentate (19.5% TS), RO-SCB retentate (22.0% TS) or EVAP-SCB retentate (37.6% TS) with partially-skimmed

milk. Control cheese was made with partially-skimmed milk (11.3% TS). Cheese functionality was assessed using dynamic low-amplitude oscillatory rheology (DLAOR), UW Melt Profiler (extent of flow after heating to 60C) and on pizza. Initial trials with SCB fortified cheeses resulted in 4% higher moisture (51-52%) than control cheese (46-47%). In subsequent trials procedures were altered to obtain similar moisture content in all cheeses. Fat recoveries in cheeses were lower with SCB fortified milks than with control milks. Nitrogen recoveries in cheeses made with control milks were slightly higher than in cheeses with RO-SCB and EVAP-SCB milks; but lower than UF-SCB milk cheeses. Total phospholipids recovered in SCB-cheeses (28-34%) were lower than control (42%). From DLAOR test, the loss tangent curves at temperatures > 40°C increased as cheese aged up to a month and were lower in SCB-cheeses than control. Extent of flow was higher for control cheese than SCB-cheese and as cheese ripened, it increased for all cheeses. TCA-soluble nitrogen levels were slightly lower in SCB fortified cheese than control. On baked pizza, UF-SCB fortified cheese had lowest amount of free oil but flavor attributes of all cheeses were similar. Addition of concentrated SCB to standardize cheesemilk for pizza cheese lowers free oil without adversely affecting functional properties of cheese but could increase cheese moisture, unless corrected.

Key Words: Sweet Cream Buttermilk, Pizza Cheese, Melt

551 Effect of fat content on rheological and melting properties of Mozzarella cheese. C. Udayarajan* and J. Lucey, *Department of Food Science, University of Wisconsin, Madison*.

Melting properties of Mozzarella cheese are influenced greatly by its chemical composition. The objective of this study was to evaluate the influence of various fat levels on rheological and melting properties of Mozzarella while maintaining similar moisture content. Mozzarella cheeses with low (30%), medium (40%) and high (50%) fat in dry matter (FDM) were manufactured. Cheeses properties were analyzed on day 2, 7, 14, 21 and 28. Rheological properties were studied using Fourier Transform Mechanical Spectroscopy (FTMS), which is a type of small amplitude oscillatory rheometry. Using FTMS the data for a wide range of frequencies (0.08-8 Hz) were collected in real time while cheese sample was heated over a temperature range from 10 to 90°C at 1°C/min. Storage modulus (*G'*) and loss modulus (*G''*) increased with frequency for all cheeses and the differences between frequencies were more evident at higher temperatures. Both *G'* and *G''* were lower with an increase in fat content and their values at high temperatures decreased with increasing cheese age. During heating all three cheeses exhibited a maximum in loss tangent (*Max_{tan}*) and the value of *Max_{tan}* decreased as the frequency increased. *Max_{tan}* increased with an increase in fat content and ripening period. Melting properties like extent of flow at 60°C and melt area were analyzed using UW Melt profiler and Schreiber test, respectively. Meltability improved as the fat content increased. Extent of flow increased for all cheeses from day 2 to 21 and then hardly changed. There was a significant correlation between extent of flow and *Max_{tan}*. Melt area was higher for medium and high FDM cheeses compared to low FDM cheese. Melt area increased with age for medium and high FDM cheeses up to day 14 and then declined. Melt area did not change during ripening for low FDM cheese. Rheological results correlated well with the pizza bake test in which the low FDM cheese blistered and blackened and did not flow. Excessively strong protein interactions in the high protein (low FDM) cheese were responsible for its poor meltability. Strategies are needed to reduce the strength of protein interactions if improved meltability is required.

Key Words: Mozzarella, Rheology, Melt

Extension Education - Animal Science

552 Beef development costs. W. Ellis*, *Southeast Missouri State University, Cape Girardeau*.

The objective of the study was to determine the cost of beef heifer development from weaning to her first parturition. The study was conducted at Southeast Missouri State University Farm. Data were obtained from thirty-one Angus or Angus cross heifers born in the fall of 2000. Heifers were weaned in April of 2001, bred in November of 2001, and calved in fall of 2002. Heifer development followed the guidelines of the Missouri Show-Me-Select Replacement Heifer Program, which is an educational program involving comprehensive guidelines for beef replacement heifer

development and marketing. Program development included pasture, feeds, labor, vaccinations, pre-breeding reproductive tract score, estrus synchronization, artificial insemination (AI), clean-up bull, pregnancy testing, and cost of open heifers. Mean weight and age (Mean SE) of heifers at weaning and at beginning of the breeding season were 203.7 ± 2.9 kg, 205.6 ± 3.2 days, 370.4 ± 4.9 kg, and 405.6 ± 3.2 days, respectively. Mean pre-breeding reproductive tract score was 4.9 ± .04 indicated 31/31 (100%) of the heifers reached puberty and cycling before breeding season. First AI service pregnancy rate following estrus synchronization treatment was 22/31 (71%) and pregnancy rate after

the breeding season (AI and clean-up) was 29/31 (94%). The cost of the development program was \$400.23 per beef heifer. The worthiness of this cost is acceptable based on heifer sale price from the Show-Me-Select sale. The average sale price per heifer for nine of the 29 pregnant was \$1125. The remaining 20 pregnant heifers were retained in the herd. The combination of the development cost and heifer value at weaning yields a cost of \$889.32. The net profit of the heifers was \$235.68 per heifer sold.

Key Words: Beef, Development, Cost

553 Elements influencing cattle buyers to participate in preconditioned certified calf sales. M. D. Corro*, D. Lalman, J. D. White, R.P. Wettemann, and J. P. Key, *Oklahoma State University, Stillwater.*

The Oklahoma Quality Beef Network (OQBN) was organized in 2001 with the primary objective of adding value to weaned calves and capturing a portion of this value for both the cattle producer and the cattle buyer. The OQBN provides a process verification system relative to management practices applied to beef calves around the time of weaning. The fundamental concept is that by reducing costs associated with sickness, improving animal performance; and improving beef product quality, additional value can be achieved in beef cattle production. Livestock market owners cooperate with producers by assembling OQBN process verified calves and marketing them in certified calf sales. Survey data were collected from OQBN participants during the fall of 2001 and 2002 to determine elements which influenced cattle buyers to participate in certified preconditioned calf sales. A total of 291 stakeholders that either bought or sold cattle through the OQBN during the fall of 2001 and 2002 were identified. One hundred eighteen stakeholders (40.5 %) responded to the survey. The chi-square test was used to evaluate differences between groups of stakeholders. Livestock market operators, Cooperative Extension and OCA meetings were the most frequent source of awareness for buyers regarding the OQBN program and sponsored auctions. The majority of buyers (86%) that responded to the survey purchased the cattle for their own operation. A total of 72% of buyers indicated they normally purchased more than 500 head annually. The majority (85%) of buyers in 2002 indicated that they had to treat less than 10% of the cattle they purchased, while 33% of 2001 buyers indicated less than 10% treatment or pull rate. The percentage of buyers paying a premium price of \$4 cwt. or more above the regular market, was greater ($p < 0.05$) in 2001 than in 2002. No statistical difference ($P > 0.05$) was found among the perceived premium price received by producers and the perceived premium price paid by buyers. The benefits related to preconditioned cattle, convenience, and other benefits were the main elements for buyers purchasing cattle in certified calf sales.

Key Words: Preconditioning, Certified Calf Sales, Beef Cattle

554 Selected management practices of beef cows on cow-calf operations in Oklahoma. M.D. Corro*, D. L. Lalman, K. Barnes, and J. L. Evans, *Oklahoma State University, Stillwater.*

A total of 3000 cow-calf operators were identified by the Oklahoma Cooperative Extension Services in the Northeast District of Oklahoma. A sample of 323 cow-calf operators participated in a study to describe selected management practices that may influence cow-calf operators to adopt preconditioning practices. Information was gathered on demographic characteristics preferred calving season, perceived return over costs needed for applying preconditioning management, perceived costs of running beef cows, perceived limiting factors for preconditioning practices and major obstacles to profitability. The chi-square test was used to evaluate differences between groups of cow-calf producers. A total of 69.7 % of the operators had more than 15 years in the beef business. A majority (68.5%) of operators had less than 100 cows. Only a portion (13 %) of cow-calf producers indicated they currently apply preconditioning practices. Almost half (49.3 %) of producers indicated they would accept less than \$30 profit per head for preconditioning. Similarly, half of the operators indicated they had \$350 annual costs for running a beef cow. Among the elements that limiting the use of preconditioning practices, 51.2 % of operators ranked time and labor as the major limiting factor for preconditioning; facilities (fences, pens, etc) were ranked as the second most limiting factor, and know-how as the third limiting factor. Collectively, these management practices, higher production costs, and lower market price were indicated as the major

obstacles for profitability that may contribute to a lower adoption of preconditioning practices among cow-calf operators.

Key Words: Beef Cattle, Management Practices, Preconditioning

555 Maximizing extension efforts by multi-county horse programs. O. F. Harper*, J. Hall, J. Goddard, J. Rhea, and B. Slinger, *University of Tennessee, Knoxville.*

In the fall of 2001, a major focus on Extension education adult horse programs was initiated in the Smoky Mountain Extension District, which encompasses 24 counties in Eastern Tennessee. In 2001, one multi-county adult horse program was conducted in the district. This was expanded to seven multi-county horse programs in 2002 and eight in 2003. Two new programs, Horse Ownership Course and a Horse Round Table, were initiated and additional programs expanded in two key metropolitan areas, the centers of program focus. Extension agents in the Knox-Metro area and upper East Tennessee and Southwest Virginia counties joined the horse specialist in forming leadership teams in coordinating the programs in these two metro-areas. The programs include Horse Management Courses, Horse Ownership Courses and Horse Round Tables. All programs are multi-county and the Horse Management and Horse Ownership Courses are fee-based programs. The Horse Ownership Courses provide 10-hours of continuing education meeting one-night per week (2 hours) for five weeks, focusing on basic topics of ownership: facilities, feeding, management, health care and selection. The Horse Management Courses are also one night for five weeks (10-hours of continuing education); however, topics are generated from exit-evaluations from the previous years attendees plus input from the Extension agent and horse specialist. Other major differences are the Ownership Courses have a limited enrollment of 30-35; whereas, Management Courses are limited only by available facilities. Ownership Courses are designed as a one-time course while participants are encouraged to attend the Management Courses each year. The Horse Round Table is a one night with five to six 15-20 minute current topic presentations are followed by a question and answer session. In the fall/winter of 2002/2003, 318 individuals attended seven programs. The average program rating was 4.7 out of 5 with 99 percent stating they would attend another Extension horse program and 99.7 percent would recommend these programs. Pre and post-test from six programs showed a 39 percent increase in knowledge.

Key Words: Horse, Multi-County Outreach, Extension Programs

556 Expanding extension horse programs by the internet. O. F. Harper* and E. L. Tipton, *University of Tennessee, Knoxville.*

New scientific information and technology transfer is the mission of the Extension Service. Rapid advance of the Internet provides an innovative and challenging methodology to reach new, broader and often diverse audiences. It provides an opportunity to showcase impacting research, field data and specific focused Extension programs. The web site highlights seven Extension species programs: Beef, Dairy, Horse, Poultry, Sheep and Swine, in addition to 4-H programs. The Department's horse web page (<http://animalscience.ag.utk.edu/horses/horse.htm>) has been used to augment, broaden awareness and provide articles while marketing new educational horse programs. The horse page begins with Hot Topics and Events. This area marquee: video releases, Extension Horse Course and a West Nile Virus (WNV) Information web page. The 4-H Horse Program, Publications and Educational Materials, News Letter (Tennessee Horse Express), Horse Links and Calendar of Events rounds out the directory. The occurrence of WNV promoted the posting of periodic reports of WNV positive horse and bird activity during the year and the development of an interactive state map showing the number of positive horses and birds by county. Listing of varied educational horse programs is a marketing initiative and industry promotional effort. This user-friendly site is easily navigated from current issues and programs to relevant educational materials. Web-based publications include 23 fact sheets and Horse Information Series which are categorized as Genetic, Health Care, Management, Nutrition or Reproduction. Articles appear in more than one category to assist one-time users. Reviews of Extension horse programs and activities aid in marketing future programs, documents the department's educational horse impact and provides recognition for involved Extension agents. E-mails, telephone calls and letter requesting additional information indicates the web page is viewed by

horse owners, breeders, agribusiness, government agencies and the general public. Agricultural/equine press usage of articles from the web site indicates the value of these materials and its easy and rapid access.

Key Words: Horse, Internet, Extension Programs

557 **Holey Cow—The inside story of why cows eat grass—a model for youth agricultural education.** D. J. R. Cherney*, B. Berggren-Thomas, and A. W. Bell, *Cornell University, Ithaca, NY.*

Less than 2% of the U.S. population is currently involved in agriculture and many young people have little or no experience with farm animals. We need young people to continue to chose agricultural careers, but also, as adult consumers, to make intelligent choices and policies about issues involving the use of animals for food and fiber. We have developed a program that begins with a PowerPoint slide show describing ruminant animals. The Powerpoint includes images of a variety of ruminant animals that the students may have seen on television or in zoos. We describe how a ruminant is able to use grass with the aid of slides and other props. The presentation is geared to the level and experience of the youth group. These groups range in age from 6 to 18 years and from no animal experience to farm youth. Because these audiences learn best from hands-on experiences, they are invited to handle a rumen-fistulated cow, offer her feed, and explore the rumen. The youth are given lab coats and gloves and can place their arm inside the cow. The program includes the use of a microscope for viewing rumen microflora and a feed demonstration. In this way, participants can see, feel and smell what we have talked about, reinforcing their learning experience. When appropriate, the program also includes discussion of possible careers in animal biology and production. Last year 10 demonstrations were conducted for approximately 350 young people and their chaperones. The program has Institutional Animal Care and Use Committee Approval. Many of the groups bring new students each year. The cow is a critical component of the success of this program.

Key Words: Agricultural Education, Youth

558 **Healthy farms—healthy agriculture: A new approach to biosecurity education.** J. M. Smith*, *University of Vermont, Burlington.*

The University of Vermont entered into a special cooperative agreement with the United States Department of Agriculture's Animal and Plant Health Inspection Service in 2002 to distribute biosecurity materials relevant to ruminant livestock production. The original objectives were to develop, produce, and distribute information on (1) biosecurity measures that all personnel, salespeople, consultants, and visitors should follow when entering farm animal premises and (2) measures to follow when bringing animals, especially those of unknown origins, onto existing farms. These objectives were modified during the planning process involving various stakeholders. The stakeholders helped identify our target audiences and the types of information they needed. We concluded that farm owners are responsible for the biosecurity measures practiced on their farms by themselves and their employees, as well as by the agri-service personnel, salespeople, and others who enter the premises. So the materials were designed to be distributed to and used by farmers. In addition to biosecurity procedures for people and

new or returning animals, we decided to cover measures to reduce the biosecurity risks posed by wildlife. The title was chosen so as to not be alarming. The main outputs of the project were a professionally-printed, 3-ring binder with about 100 pages of information, a compact disk of the same information adhered inside the back cover, and a web site (www.uvm.edu/~ascibios/) where the information was posted. Tabbed dividers were labeled introduction, assessment, new animals, visitors, wildlife, biosecure practices, diseases, and appendix. Our goal was a well-organized collection of existing information, reformatted to make it easy for farmers to understand and apply. Sixteen reviewers, who included veterinarians, extension faculty, agri-service personnel, and farmers, made comments on drafts of the materials. The finished binder was distributed to all ruminant and dairy farms listed with the Vermont Agency of Agriculture, Food, and Markets in fall of 2003. A video was also planned but not completed by the end of the one-year project period.

Key Words: Biosecurity, Extension

559 **An environmental assessment tool for poultry farms developed as part of environmental management systems.** P. H. Patterson*¹, L. E. Lanyon², and A. H. Mende³, ¹*Department of Poultry Science, The Pennsylvania State University, University Park,* ²*Department of Crop and Soil Sciences, The Pennsylvania State University, University Park,* ³*PennAg Industries Association, Harrisburg, PA.*

Environmental Management Systems (EMS) for the poultry industry address environmental policy with continuous improvement to ultimately achieve regulatory compliance and pollution prevention. As part of the 9-state Partnership for Livestock Environmental Management Systems project, a team of industry, government and university stakeholders developed an assessment tool for the commercial layer, broiler and turkey industries in Pennsylvania (PA). The goal of the tool was to set environmental priorities, to evaluate environmental protection measures, and to communicate and monitor environmental performance. It was adapted from national and existing PA Farm*A*Syst materials, and field-tested on 10 layer, 10 broiler and 10 turkey farms. Eleven priority areas were evaluated for risk on a scale from 1-low to 4-high risk including: drinking water supply, septic design and operation, run-off issues, mortality management, farm nutrient balance, emergency action planning and more. Example average scores for drinking water supply were: 1.7 layers, 1.7 broilers, 1.4 turkeys, however, the range of scores were 1-2.3, 1-4 and 1-4, respectively, indicating improvement opportunities. Other opportunities were identified for pest, odor and dust management (broilers), mortality management (turkeys) and farm nutrient balance (layers). Survey responses by producers indicated the tool was helpful to their operation, the experience raised awareness, 75% preferred the 3rd party assessment to self-assessment, and 1/3 were interested in pursuing an EMS. An important lesson from the pilot was that producers have little time and a concise, timely assessment was essential. The tool was effective in documenting performance and identifying opportunities. It has been proposed for adoption as the poultry component of PEACCE, a state-wide certificate program for environmental excellence and stewardship in animal agriculture.

Key Words: Poultry, Environmental Assessment, EMS

Forages and Pastures: Harvesting and Grazing Management of Forages

560 **The effects of total non-structural carbohydrates (TNC) on voluntary intake of goats and digestibility of gamagrass (GG) harvested in the morning (AM) or afternoon (PM).** A. Sauve*¹, G. Huntington¹, and J. Burns^{1,2}, ¹*North Carolina State University, Raleigh,* ²*USDA, ARS.*

The objective was to evaluate the differences in TNC of Iuka GG (*Tripasacum dactyloides L.*) harvested at 0530 (AM) or 1730 (PM), and to measure how TNC concentration and CP supplement affect the voluntary DMI and digestible DMI (DDMI) of GG field-cured and stored in square bales. Boer X Spanish wethers (24 ± 3 kg) were randomly assigned to supplement (SP, 31% CP, fed at 11% of DMI, 14 goats) or no supplement (14 goats). Within SP or no SP, goats were randomly assigned to a crossover design of AM GG (7 goats) or PM GG (7 goats). Goats were individually housed in metabolism crates with free access

to water and mineral blocks. They were fed twice daily, with SP being offered once a day 30 min before morning feedings. After a 7-d adaptation, voluntary intake (goats were fed 110% of previous days intake) was measured for 14 d, followed by a 4-d adjustment (to equalize DM offered between periods) and a 5-d digestion trial to measure DM digestibility (DMD). After Period 1 the goats were switched to their new diets, and the protocol was repeated. GG concentrations are g/kg DM and intakes are g/d. Means differ at $P < 0.03$. Compared to AM, the PM harvest had greater TNC (72.5 vs. 59.1), monosaccharides (37.3 vs. 27.5), and di- and polysaccharides (15.4 vs. 13.3). The DMD was greater for PM vs. AM (56.0 vs. 53.6%) and for SP vs no SP (57.0 vs. 52.7%). Crude protein (92) and starch (19.1) were similar ($P = 0.98$) for PM and AM. Compared to no SP, SP increased total DDMI (DMI times DMD from the digestion trial) during the voluntary intake phase (344 vs. 305) and