

the geometric monoenoic FAME. Each fraction was analyzed by GC, as described above with the capillary column operated isothermally at 120°C. More than one hundred FAME from C4 to C26 were resolved in the GC analysis of total milk and cheese lipids. The qualitative separation and quantitative analysis of total FAME from cheese fat was greatly affected by the sample load applied onto the GC column. At least two and occasionally three different sample loads were required to separate and identify the minor and the major fatty acids in these samples. A combination of Ag<sup>+</sup>-TLC and GC was required to resolve and identify of the *trans* and *cis* isomers independently. Ten positional *cis* and *trans* 18:1 isomers were identified with 9c as the predominant isomer. The 10t-18:1 isomer, associated with milk fat depression, was the major *trans* isomer in DHA enriched milk and cheese, follow by the 11t-18:1. In addition, the n-3 FA of DHA cheese increased, i.e., DHA and EPA (eicosapentaenoic acid, 20:5n3). The CLA region showed that 9c,11t-18:2 was the major CLA isomer in these dairy fats on both diets, and the content was higher in the fish meal fed cows. The PUFA in cheddar cheese remained stable up to 18 months ripening at 8°C.

**Key Words:** docosahexaenoic acid (DHA), conjugated linoleic acid (CLA), gas chromatography

**485 Milks from cloned cows: rennet coagulation properties of five clones over a single lactation cycle.** J. A. Lucey<sup>\*1</sup>, S. Govindasamy-Lucey<sup>2</sup>, J. E. Romero<sup>2</sup>, M. M. Pace<sup>3</sup>, and M. D. Bishop<sup>3</sup>, <sup>1</sup>Department of Food Science, University of Wisconsin, Madison, Wisconsin, USA, <sup>2</sup>Center for Dairy Research, University of Wisconsin, Madison, Wisconsin, USA, <sup>3</sup>Infigen Inc., Deforest, Wisconsin, USA.

A group of 11 Holstein cows were derived from a single clonal line using somatic cell nuclear transfer technology. The coagulation properties of milks from five cows of this clonal group were determined using dynamic low amplitude oscillation on a Physica UDS 200 Rheometer. Milks were studied over one lactation cycle and each cow was sampled 6 times (apart from one cow which was sampled 4 times) at 2-month intervals. Coagulation was assessed at the natural pH of milk. Milks from each individual cow were obtained from the morning milking and collected separately, chilled with ice water to 4°C and tested that day. Control bulk milk samples (from a 200 cow herd of Holstein cows) were also tested at each sampling day. Milks from these cloned animals are not currently used for consumption. The large deformation properties of rennet-induced gels were determined using a low constant shear (0.01 s<sup>-1</sup>) test of the preformed gel made in the rheometer. The stress required to fracture the gel and strain at fracture were determined from this shear test, which was performed 40 min after rennet addition. Coagulation time, storage modulus value at 40 min after rennet addition, and fracture stress were all significantly influenced by stage of lactation (P < 0.05) but not by

the individual clones. Only the values for fracture strain for individual clones were significantly different (P < 0.05). Neither the coagulation properties nor the milk composition of the clones were exactly identical; however, the values were similar to that expected for normal milk samples. There were significant (r > 0.7) positive correlations between clotting time and the parameters pH and fracture strain. Clotting time was negatively correlated (r > 0.7) with storage modulus and fracture stress. Detailed analysis of the composition of all the milks in this clonal line is currently underway. In conclusion, it appeared that, apart from the highly significant influence of the stage of lactation, there were no significant differences in the coagulation properties of this clonal group.

**Key Words:** Cloning, Rennet coagulation, Rheology

**486 Stability of oil in water emulsions formed in presence of skim milk powder: effect of calcium salts and heat treatments.** Deepa Mathew\* and Phillip S. Tong, California Polytechnic State University.

Stability of oil in water emulsions made with soy oil, water and skim milk powder fortified with calcium salts was studied. Four salts - calcium carbonate, calcium phosphate, calcium citrate and calcium lactate were studied separately. The amounts of skim milk powder and calcium salts were adjusted so that the protein content in the final emulsion was either 3.5% or 1.75% (w/w) and calcium content was either 0.24% (w/w) (2 times the amount naturally present in milk) or 0.36% (w/w) (3 times the amount naturally present in milk). Skim milk powder and calcium salt were blended together. The dry mixture was reconstituted in the required quantity of water and was kept at 5°C for 18 hrs for proper hydration of the powder. The temperature was then brought up to 25°C; soy oil was added (10% (w/v) and homogenized with a two stage homogenizer (first stage pressure of 13.8 MPa and second stage pressure of 3.45MPa). The emulsions were subjected to either pasteurization (63°C for 30 minutes) or retorting (121°C for 16 minutes) and then were cooled to 25°C. Stability of emulsions was studied by measuring particle size distributions and fat analysis of the cream layer after centrifugation. Calcium phosphate caused immediate instability at both levels of calcium and protein. As a result, further studies were not pursued with calcium phosphate. It was observed that with the other three salts, instability of emulsions decreased as the protein content increased, for the same level of calcium. In all cases, retorted samples were more unstable compared to pasteurized samples. Emulsions containing calcium lactate and calcium citrate were more sensitive to heat treatments than emulsions containing calcium carbonate. The most stable emulsions were obtained when calcium carbonate was added (even more stability than control sample with no added calcium at 1.75% protein).

**Key Words:** Emulsion, Stability, Calcium

## Extension Education

**487 Pork processing inservice program for high school ag educators.** K. Kephart\*, R. Mikesell, and W. Henning, Penn State University.

The purpose of this educational program was to provide agriculture educators with technical knowledge and classroom materials for teaching the fundamentals of meat processing to high school students. Teachers from the 160 school districts in Pennsylvania with ag science programs were invited to attend; 42 individuals from 29 school districts participated. The concepts taught included methods of meat preservation, function of processing ingredients (salt, sugar, phosphate and nitrate), food safety, and examples of processed products. Written materials, including lesson plans, quizzes, laboratory instructions and data sheets were provided along with a laboratory teaching kit with sufficient materials for 45 students. Each teaching kit included cooking bags, sanitary equipment, a 50-cc syringe with attached meat injection needle, meat thermometer, and premixed and pre-weighed ingredients to be dissolved in a standard volume of water. The laboratory was designed to enable each student to inject one of three solutions into a two-pound cut of boneless pork: 1) marinate (salt, sugar, phosphate); 2) nitrite (marinate + nitrite); 3) water. After injection, students refrigerated the pork for a minimum of 24-hours, cooked each cut to an internal temperature of 71 C, and recorded color, flavor and juiciness scores. Seventy-three percent of the participants felt the inservice program was well organized, 92% like the lesson plan format, 100% were pleased with the materials in

the teaching kit, and program has been successfully used in 97% of the school districts represented. We plan to build on the success of this program to offer similar programs in quality assurance, agriculture science projects, and environmental stewardship.

**Key Words:** Meat Processing, Secondary Education, Teacher Inservice

**488 Third-party evaluation of proposed sites for swine operations and estimation of the risk of odor conflict.** R. Mikesell\* and K. Kephart, Penn State University.

The purpose of this program is to assess the potential for odor related complaints arising from the operation of proposed swine facilities. We provide the swine industry with cost-free site evaluations to prevent odor complaints associated with poorly sited swine operations. Criteria for evaluation include: 1) Nature of odor problems (both physical and personal factors affect odor perception); 2) Neighbor location (those at greatest risk are within one-half mile east or south of the proposed site); 3) Topography and vegetation (hills and vegetation help enhance odor plume dilution); 4) Physical size and orientation (overall facility size dictates odor plume width); 5) Animal inventory (number of animals dictates physical facility size and manure production volume); 6) Type of manure storage (outdoor storages are subject to wind stripping

and absorption of solar radiation); 7) Manure application system (location and type of application system affects odor emission); 8) Personal factors (preconceived expectations affect neighbor attitudes); 9) Special technologies (e.g. biofiltration of exhausted air reduces odor emissions). Each assessment includes a detailed letter describing the site and surroundings along with suggestions for reducing odor risk. Of the 28 sites evaluated, the following recommendations were made (number of sites): manure injection or incorporation (18), re-orient or move the building on existing property (11), visit and notify neighbors (9), reduce animal inventory (5), consider using special technology (11), or abandon the project (2). Of the 28 sites evaluated, six are in operation (with no apparent conflict), 10 projects did not proceed, and 12 are in the permit process. Of those in operation or in the permit process, 100% of those asked heeded our recommendation to move the site, but only one in five agreed to reduce the size of the operation. We are encouraged with the level of cooperation thus far and continue to encourage all companies to take advantage of the service.

**Key Words:** Odor, Evaluation, Swine

**489 Teaching environmental stewardship to commercial manure haulers through a certification program.** R. Meinen\*, K. Kephart, and L. Ressler, *Penn State University, University Park, PA.*

The purpose of this educational program is to strengthen environmental stewardship among commercial manure haulers. Participants who attend a classroom session and score an average of 80% on six exams, and attend a field demonstration qualify for certification. Participants are tested on the following: Pennsylvania's nutrient management laws, nitrogen management, phosphorus management, conservation practices, manure spreader calibration, and odor control. Other subjects taught, but not included in the exams include computerized record keeping, emergency preparedness, and equipment maintenance and appearance. Field demonstrations included hands-on exercises to teach manure calibration, utilization of GPS technology on manure application equipment, soil health and conservation concepts, compaction, and manure sampling. Since 2000, three classroom sessions, two commercial manure hauler field days, and four public field days have been held. Average scores (%) on each exam were: nutrient management laws (93.5), nitrogen management (85.3), phosphorus management (89.3), conservation practices (92.1), manure spreader calibration (92.9), and odor control (84.0). Fifty-three individuals have completed all certification requirements, 31 have completed the classroom phase only, 15 have completed the field day only, and four participated in both components, but have not scored high enough on the exams to earn certification. Over 60% of classroom participants listed themselves as commercial manure haulers or brokers. Approximately 150 people have attended the public field days, which were held to take advantage of the equipment and personnel available at each site. Public field day attendees consisted of local conservation district personnel, watershed specialists, interested public, farming community and agricultural business employees. We believe this voluntary approach helps improve environmental awareness and stewardship among individuals involved in commercial manure hauling.

**Key Words:** Nutrient Management, Manure, Environmental Stewardship

**490 Using animal waste management plans on dairies to increase productivity and reduce environmental impacts.** T.W. Downing\*<sup>1</sup> and T.T. Leonnig<sup>2</sup>, <sup>1</sup>*Oregon State University*, <sup>2</sup>*Oregon Dairy Farmers Association.*

Animal waste management plans (AWMP) have been written for the dairy industry for years with limited adoption by the industry. Most plans use estimates for manure produced and yields removed to design the nutrient balance part of the waste plan. As concerns for water quality have increased, so has the need to demonstrate that the nutrients applied are equal to what is removed. A two year trial was conducted on a pasture based dairy in Oregon to determine if implementing the AWMP would improve productivity and/or reduce the dairy's environmental impacts. This challenge was especially complex because grazing animals are constantly harvesting forage and depositing manure. A traditional AWMP was written as a starting point for the project. Detailed records of grazing yields, manure applications, commercial fertilizer application, forage analysis, manure analysis and fall soil testing were maintained. Nitrogen was applied in each field at a level no higher than the documented nitrogen removal that year. Soil analyses were conducted on all

nineteen fields in the fall for nitrate and ammonium. At the end of year one, the AWMP was adjusted to account for the soil test results. The first year total nitrogen application per field ranged from 226 to 490 kg/ha averaging  $382 \pm 73$ . Total dry matter yields ranged from 8761 to 20217 kg/ha averaging  $15949 \pm 2920$ . Year 2 nitrogen applications per field ranged from 303 to 664 kg/ha averaging  $531 \pm 105$ . Dry matter yields per hectare in year two ranged from 16623 to 25608 kg/ha averaging  $21296 \pm 2802$ . Soil nitrate nitrogen measured in the first 30 cm averaged  $111 \pm 29.5$  kg/ha, and ammonium nitrogen averaged  $61.4 \pm 19.3$  kg/ha in year one. Nitrate nitrogen in year two averaged  $59 \pm 25.8$  kg/ha and ammonium averaged  $37 \pm 11.1$  kg/ha. Forage production increased in year two over twenty percent from the first year, and residue nitrogen left at the end of the growing season decreased by over 40 percent. Active nutrient management plans that are adjusted annually can have significant economic as well as environmental benefits.

**Key Words:** Waste management, Nutrient balance, Animal waste management plan

**491 The development of an educational program to reduce the feeding of supplemental phosphorus on dairy farms in the Lake Champlain Basin.** W. C. Emerich, K. W. Cotanch\*, C. S. Ballard, E. D. Thomas, C. J. Sniffen, and P. Mandevbu, *W. H. Miner Agricultural Research Institute, Chazy, NY.*

The environmental threat of phosphorus (P) in the Lake Champlain Basin in Vermont and northeastern New York State has resulted in the development of a comprehensive management plan to reduce P inputs to Lake Champlain from dairy sources. Historically, P has been overfed in dairy rations due to the fact that dairy cattle only utilize a small proportion of the P they consume. Research has shown that lower levels of P may be fed to lactating cows without adversely affecting animal health and productivity. Although the feed industry is shifting toward lower P incorporation into dairy rations, educational efforts are needed for universal acceptance of the new P recommendations (NRC 2001: 0.32-0.38%). A survey of 11 dairy operations ranging from 80 to 2100 cows in the Lake Champlain basin was conducted to define current P feeding strategies in this region. The farms surveyed represented nine different feed companies. Seventy-three percent of the rations were formulated at levels higher than 0.38% P. In addition, analysis of TMRs mixed at the farms indicated that 81.8% had P levels higher than the nutritionist's formulation. Only 38% of the dairy producers surveyed believed reducing P levels in rations would result in reduced purchased feed cost. At Miner Institute, a comparison of milk yields and reproductive performance to P levels in the rations was made from 1997 to 2000. Over this time period, P was reduced from a high of 0.55% in 1997 to a low of 0.38% in 2000, while milk production increased from the 1997 rolling herd average of 22,189 on 92 cows to 2000 rolling herd average of 28,933 on 160 milking cows. Reproductive performance improved while ration P was reduced, indicating that 0.38% P was an acceptable level to maintain reproductive efficiency in the herd. By reducing ration P levels over this 4-year period, manure P levels were subsequently reduced from 0.79 to 0.59%. The economic as well as nutrient management benefits to reducing ration P in lactating and replacement rations should be emphasized to reduce the overfeeding of P in the dairy industry.

**Key Words:** Dairy cows, Phosphorus, Milk yield and reproductive performance

**492 A decade of change in the U.S. dairy industry.** K. E. Olson\*<sup>1</sup>, <sup>1</sup>*KEO Consulting.*

The tenth annual national survey of commercial dairy farms was completed in 2001. The survey includes farms that produce for fluid or manufacturing grade markets. It provides a tool for monitoring trends among producers. Substantial changes have occurred each year. Between July 2000 and July 2001 the number of dairy farms fell by 6,307, or 7.6%. It was the second largest percentage loss in the 10 years the survey has been conducted. Losses occurred in all regions, with the largest in the Midwest and Southeast with losses of 8.5% and 8.4%. The Northeast lost 6.2%, while the west was down 3.6%. A broad perspective of industry change over the ten years is provided in Table 1 where second quarter cow numbers, compiled by the National Agricultural Statistics Service (NASS) USDA are combined with herd data from the survey. Manufacturing grade herds declined dramatically over the ten years falling from 25,539 in 1992 to 9,614 in 2001, a drop of 62%. Grade A herds dropped 37% over the ten years. Rate of loss varied between regions with the largest in the Southeast and the least in the West.

Trends identified through this survey indicate the rapid rate of change that is occurring in the dairy industry. The changes impact not only producers, but also their communities, the industry infrastructure and business decisions that the support industry makes. While it is difficult to draw firm conclusions as to what has caused these trends, it is likely that they will continue to influence dairy policies in the future. Hopefully they will be helpful to the industry in developing sound policies and business strategies to meet the challenges of the future.

Table 1. Changes from 1992 to 2001

	1992		2001		Change (%)				
	Herds	Cows <sup>1</sup> (x10 <sup>3</sup> )	Cows/ Herd	Herds	Cows <sup>1</sup> (x10 <sup>3</sup> )	Cows/ Herd	Herds	Cows	Herd
South-east	14,165	1628	115	7485	1244	166	-47	-24	45
West	7450	2140	288	5218	2922	560	-30	37	95
North-east	29,785	1824	61	19,658	1650	84	-34	-10	37
Mid-west	80,135	4100	51	44,269	3308	75	-45	-19	46
US	131,535	9692	74	76,630	9124	119	-42	-6	62

<sup>1</sup>Cow numbers from NASS Milk Production Reports

**Key Words:** Dairy Trends, Herds, Infrastructure

**493 Results of a dairy herds person shortcourse conducted in the central valley of California.** G. E. Higginbotham<sup>1</sup>, J. D. Robison<sup>2</sup>, J. H. Kirk<sup>1</sup>, J. W. Merriam<sup>1</sup>, C. A. Collar<sup>1</sup>, S. L. Berry<sup>1</sup>, T. A. Shultz<sup>1</sup>, and B. A. Reed<sup>1</sup>, <sup>1</sup>University of California Cooperative Extension, <sup>2</sup>California State University-Fresno.

University of California Cooperative Extension (UCCE) personnel partnered with faculty from California State University - Fresno (CSUF) to conduct an 18 hour training program for dairy farm employees. The shortcourse was developed in response to the desire of dairy owners to increase the skills of their employees. UCCE personnel consulted with dairy producers during planning meetings to identify training needs. The program consisted of classroom and on-farm teaching sessions at the CSUF dairy over three consecutive days. Session topics included raising replacement heifers, reproductive management, milking management, nutrition, hoof care, labor management, dairy facilities, herd health and DHIA records. Material was presented in English with Spanish interpreters present if needed. To provide adequate training, attendance was limited to 40 participants. A 10 question multiple choice test was given to participants at the beginning and conclusion of the shortcourse. The test covered various basic aspects of dairy management. Overall mean test score for the pre-test was 55.3% while the mean post-test score was 72.3%. Over 70% of the students improved their scores on the post-test. An evaluation completed by participants rated the shortcourse by course topic. All topic areas were rated as excellent to very good. Comments will be used to plan future offerings of the shortcourse. Additional shortcourses are planned in the central valley of California due to the high level of interest among dairy owners and their employees.

**Key Words:** Dairy, Herds person, Training

**494 The relationship between disease occurrence, feeding management and return over feed in Ontario dairy herds.** C. J. McLaren<sup>1</sup>, K. D. Lissemore<sup>1</sup>, K. E. Leslie<sup>1</sup>, T. F. Duffield<sup>1</sup>, D. F. Kelton<sup>1</sup>, and B. Grexton<sup>2</sup>, <sup>1</sup>University of Guelph, Guelph, Canada, <sup>2</sup>Ontario Dairy Herd Improvement Corporation.

Dairy enterprises of most countries throughout the world are becoming increasingly concerned with global competition. Thus, it has become important to monitor the effect that management decisions have on profitability. The objective of this research is to examine the relationship between profitability as measured by Ontario Dairy Herd Corporation's (DHI) Return over Feed (ROF) index, and herd production characteristics (milk production, somatic cell count, and milk components), cow and herd-level disease occurrence (lameness, clinical ketosis, clinical mastitis, retained placenta, displaced abomasum and milk fever) and nutritional data (monensin use and forage particle size). Producers (n=104) were identified through the DHI ROF and Management Club groups. The ROF was calculated from the difference between milk revenue and feed cost each month. Percent dry matters were taken from provincial averages and individual cow dry matter intakes were calculated. These intakes were multiplied by fixed market prices to generate feed costs per cow per day. Revenue was calculated based on the Dairy Farmers of Ontario multiple component pricing formula for milk. There is a significant positive relationship between the Return

Over Feed values of the participants and their individual herd production levels (p<0.001). However, there are many factors such as disease and management that can affect the milk production of individual dairy cattle and the profitability of dairy herds. At the present, few studies have examined the complex interaction between management factors and profitability.

Study Quartiles and Averages	ROF/Cow (Dollars)	Herd Size	305Herd/ Cow (kg)
1st Quartile	11.43	47	9310
2nd Quartile	12.57	56	9509
3rd Quartile	13.46	48	9519
4th Quartile	15.24	52	10519
Study Average	12.77	62	9550
DHI Average	13.06a	54b	8300a

(a)-herd average for all(n=356) ROF and management club members  
(b)-average for all DHI recorded herds (n=4329)

**Key Words:** Return Over Feed, Disease, Particle size

**495 Evaluating 4-H dairy animals for a combination of type and genetic value for Net Merit dollars.** A. J. Seykora\* and B. J. Heins, University of Minnesota.

The highlight of the year for many Minnesota 4-H dairy exhibitors is showing their animal at the State Fair at which time their animals are evaluated for show ring type and awarded a purple, blue, or red ribbon. It has long been recognized that the genetics for show ring type are not correlated with the genetics determining profitability for commercial milk production. In fact, many of the most popular A.I. bulls for siring show ring type are relatively poor for PTA Net Merit dollars. Genetic Values for Net Merit dollars (GV\$) were calculated by summing the sire and dam PTAs for Net Merit dollars for heifers and young cows without USDA PTAs. GV\$ for cows with published PTAs were calculated by multiplying their PTAs Net Merit dollar values by two. GV\$ were available on 141 of the 148 registered Holsteins shown. Their GV\$ averaged \$231 with a range of -\$728 to \$1228. GV\$ were available for 45 of the 160 grade Holsteins with an average of \$371 and a range of -\$220 to \$822. GV\$ were available for 27 of the 39 Jerseys shown with an average of -\$106 and a range of -\$958 to \$420. After the animals in a class were judged for type and awards presented, those with GV\$ values remained in the ring and were reevaluated considering functional type and GV\$. First through tenth place ribbons as well as champion ribbons and plaques were awarded. Primary purpose for the initiation of the Total Merit class was to encourage 4-H members to select higher PTA Net Merit dollar bulls when doing sire selection.

**Key Words:** Net merit dollars, 4-H, Show ring

**496 Evaluation of back fat as a performance and carcass quality indicator among beef cattle sire breeds.** T. A. Gardner<sup>1</sup>, E. M. Willard, A. L. Bryant, W. B. McKinley, and A. R. Williams, <sup>1</sup>Mississippi State University.

The objective of the Mississippi State University Farm to Feedlot program was to evaluate correlation between back fat thickness (BF) with performance and carcass quality characteristics of calves produced in the state of Mississippi. Steers (n=3040) were grouped by breed composition into American Breed (AB) (n = 625), European Breed (EB) (n = 1058), and British Breed (BB) (n = 1357). Previous analysis of this data determined that sire breed significantly influenced all carcass traits with the exception of hot carcass weight (HCWT). Initial results of the current study indicated an overall negative correlation (P<.0001) between BF in contrast with REA, weight per day of age (WDA), and Quality Grade (QG). BF was positively correlated (P<.0001) with Yield Grade (YG), Final Weight (FWT), Final Test Gain (FTG), Final Average Daily Gain (FADG), HCWT, and marbling score (MS). Analysis between breed groups indicated no significant differences (P<.1) among REA, WDA, QG, FWT, FTG, FADG, HCWT, and MS. However, AB and EB were significantly different (P<.1) with respect to BF and YG correlation. Mississippi State University Farm to Feedlot was a six-year study in which various statistical analyses of performance and carcass quality data were analyzed to promote the retained ownership program as a marketing alternative.

**Key Words:** Carcass, Beef Cattle, Feedlot

**497 A web-based, economic selection index tool for terminal Charolais sires.** W. O. Herring\*<sup>1</sup>, M. D. MacNeil<sup>2</sup>, and R. E. Williams<sup>3</sup>, <sup>1</sup>University of Florida, North Florida Research and Education Center, Marianna, <sup>2</sup>USDA-ARS, Fort Keogh Livestock and Range Laboratory, Miles City, MT, <sup>3</sup>American-International Charolais Association, Kansas City, MO.

Beef breed associations compute EPD for production and carcass traits. However, there is a lack of guidance for identifying sires that produce the most profitable progeny in a specified production system. Therefore, a web-based tool that uses economic selection index theory combined with EPD was developed for the American-International Charolais Association. Potential users include commercial cattlemen contemplating using Charolais sires, Charolais seedstock producers, or animal science students. The user provides information describing their terminal beef system including costs, revenues and production variables. These variables are then passed to a modified version of SIMUMATE, a computer model used to estimate net returns for beef production systems. Rel-

ative economic values are defined as the marginal change in expected profit per progeny from increasing a particular trait by one unit. This derivation approximates the partial derivative of profit with respect to each parameter. The software estimates relative economic values for birth weight, weaning weight, post-weaning average daily gain, marbling score and yield grade. The EPD for birth weight, weaning weight, yearling weight, fat thickness, marbling score, ribeye area and carcass weight are currently computed for many Charolais sires. A linear transformation of the weaning and yearling weight EPD is used to calculate the EPD for post-weaning ADG. Another transformation is used to calculate a yield grade EPD from fat thickness, ribeye area and carcass weight EPD. Thereafter, the EPD and relative economic values are combined to rank Charolais sires based upon the economic selection index. This tool should provide valuable assistance to users of Charolais bulls attempting to maximize profit in their beef production system.

**Key Words:** beef, selection index, profit

## International Animal Agriculture

**498 Development of a sustainable sheep production system for the Mexican tropics.** P. Fajersson\*, S. Hernandez, E. Santacruz, A. Alonso, and E. Ocaña, *Colegio de Postgraduados, Campus Veracruz.*

Mexico imports 54% of the mutton consumed. Interest exist in expanding sheep production in the tropics. The common extensive grazing systems without supplementation are neither competitive nor sustainable. Intensive and sustainable production systems have not been developed. The objective of this study is to improve tropical sheep production through management, genetic and nutritional strategies, minimizing the use of resources outside the ranch and without damage to the environment. Campus Veracruz is located in the humid tropics with 1200 mm annual rainfall (May-October) and a temperature of 27.8° C. 104 Tabasco ewes and 3 Tabasco and 3 Katahdin rams are managed on 7 ha of African Stargrass in a semi-confined system with 8 h grazing, cut Taiwan grass and minerals. Additional supplementation, from breeding through lactation, includes Gliricidia Sepium, Taiwan silage, corn sprouts and multi-nutritional blocks. A rotational grazing system with Leaders and Followers are being used. The ewes are subjected to 10 days flushing, synchronization using the male-effect and a 1 mo breeding period using controlled mounts. A comparison is made with 52 of the ewes bred to Tabasco rams and 52 bred to Katahdin rams to evaluate reproductive performance of the ewes and growth rate and carcass characteristics of purebred and crossbred lambs. Results of the first of three cycles were: 102 (97%) pregnant ewes gave birth to 149 lambs. Restricted suckling and supplementation were used until weaning at 3 mo of age. No differences ( $P > 0.05$ ) were observed between birth and weaning weights of the purebred lambs and those crossbred with Katahdin (3.0 and 3.1 Kg) and (14.5 and 14.6 Kg). Breed differences ( $P < 0.05$ ) were observed with regard to twin births, which were 28.8% for purebred and 57.7 % for crossbred lambs. Death of twin lambs caused the 8.1% mortality until weaning. At weaning, the lambs were sold for 25 cents/kg, a very good price, followed by slaughter at 5 mo of age and 35 kg. In conclusion, results from the first cycle indicate that the sheep production system developed is viable and feasible for producers and compares favorably to extensive systems currently common in the region.

**Key Words:** sheep, sustainable system, tropics

**499 In vitro gas production and in situ degradability of four native species commonly consumed by grazing goats in North Mexico.** M.A. Cerrillo\*<sup>1</sup>, O.O. Lopez<sup>1</sup>, and R.A.S. Juarez<sup>1</sup>, *Universidad Juarez del Estado de Durango. Durango, Dgo. Mexico.*

The objective of this study was to determine *in vitro* gas production and *in situ* degradability from huizache (*Acacia schafnerii*), encino blanco (*Quercus grisea*), encino colorado (*Quercus eduardii*) and nopal (*Opuntia spp*). To measure *in vitro* gas production, 200 mg of samples were incubated in a mixed suspension of rumen contents obtained from three rumen cannulated goats; whereas *in situ* degradability was estimated in three rumen cannulated sheep. Both animal species were fed alfalfa hay. The gas volumes and *in situ* values were recorded at 0, 3, 6, 12, 24, 48, 72 and 96h after incubation. The *Opuntia* species produced more gas

and was degraded in a higher proportion than the other forages. The insoluble but fermentable fraction (b) of *Opuntia* was 51.7 ml of gas, the potential production (a + b) was of 67 ml and the fractional rate (c) was 11%/h. The degradability of b fraction of *Opuntia* was 35% and the a + b fraction was 91.5%; whereas the highest value for c was for the *Acacia* species (6.5%/h). The *Q. eduardii* was the forage with the lowest gas production (b = 27.1 ml and a + b = 32.5 ml). The *Acacia* was the forage that presented the lowest degradability (b = 14.4% and a + b = 36.9%). The high values of c in gas production and potential degradability of *Opuntia spp* may indicate the high energy content of this species and it could reflect an important nutritional role of the *Opuntia* species in the feeding of grazing goats, particularly during the dry season.

**Key Words:** Goats, *In vitro* gas production, *In situ* degradability

**500 Release of urea from the mammary gland of lactating cows during a humid tropical summer.** C. H. Lu<sup>1</sup>, C. J. Chang\*<sup>1</sup>, P. N. Lee<sup>1</sup>, C. P. Wu<sup>2</sup>, and X. Zhao<sup>3</sup>, <sup>1</sup>National Chung Hsing University, Taichung, Taiwan, <sup>2</sup>National Chia Yi University, Chia Yi, Taiwan, <sup>3</sup>McGill University, Ste-Anne-de-Bellevue, Canada.

Lactation performance of 6 primiparous Holstein cows, average DIM 90 days, during a humid tropical summer was characterized with selected milk traits and arteriovenous concentration (A-V) differences of some metabolites across the mammary gland. In the 3-month duration, the afternoon humidex value ranged from 44.6 to 53.5. Meanwhile, the rectal temperature of cow varied ( $P < 0.05$ ) from the highest 40.02 °C in mid summer to 39.36 and 38.26 °C for the beginning and end of summer, respectively. Milk yield declined from 29.2 to 22.2 kg/d in the first month of summer but remained indifferently thereafter. In the course of summer, lactose content decreased linearly ( $P < 0.05$ ) from 4.69 to 4.38 % and activity of milk N-acetylglucosaminidase (NAGase) increased linearly ( $P < 0.05$ ) for more than two folds, overall. A-V difference across the mammary gland indicated net uptake of glucose and net release of urea. The release of urea from mammary gland increased ( $P < 0.05$ ) with advancing summer from 1.54 to 7.76 mg/dl. It is suggested that experimental cows suffered from different extent of heat stress along the summer in the study area, as implied from rectal temperature. Decrease in lactose content and increase in NAGase activity indicate deterioration of mammary function. This deterioration is hypothesized to be initiated by elevated body temperature and become irreversible after mid summer. Increased urea release from mammary gland along the summer season implies accelerated amino acid turnover and decreased efficiency of protein utilization in the course of heat stress-induced malfunction of mammary gland. In perspective, increasing A-V difference of urea can be used for prognosis of suboptimal function of mammary gland.

**Key Words:** Heat stress, Urea, Mammary gland

**501 Withdrawn. . .**