

ABSTRACTS
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*** Author Presenting Paper**

Animal Behavior, Housing, Well Being

1 Effect of recorded calf vocalizations on milk production with an automatic milking system. C. Jones*¹, E. Pajor¹, S. Donkin¹, J. Marchant-Forde², and M. Schutz¹, ¹*Purdue University*, ²*USDA Livestock Behavior Research Unit*.

Ninety-three Holstein cows were milked with an Automatic Milking System (AMS) and used to evaluate the effects of calf vocalizations on milk production and behavior. Cows were balanced for lactation number and days in milk and randomly assigned to two treatment groups. Digitally recorded calf vocalizations (RCV) were played for 2 minutes at 60 dB then silenced for 12 minutes in a continuous loop through speakers mounted at the front of two AMS stalls. Speakers were active when cows in the RCV treatment group were present in the AMS stall; but speakers were inactive while control cows were milked in the same stalls. Daily 24-h milk production, milking time and number of milkings per day were recorded for seven d to establish a baseline. Then treatments were imposed for 10 consecutive days. Four video cameras, taping 24 h/d for the entire 17 d period, recorded an image once every 10 s to determine the effect of treatment on behavior defined as number of cows in the holding area, in the outside courtyard or at waterers. Video recordings were processed through a quad splitter and monitored to assess changes in where cows spent time following introduction of calf vocalizations. The RCV-exposed cows tended ($P < .09$) to have greater daily 24-h milk production for d 4, 3, and 2 before vocalizations were introduced, but no statistical differences on 24-h milk production were observed during playback of RCV. When analyzed as repeated observations, 24-h milk ($P < .211$), milking time ($P = .429$), and number of milkings ($P = .683$) were not significantly affected by RCV. No difference was noted in cow behavior after the start of the RCV. This data showed no significant difference in milk production or number of milkings between the control

and RCV-exposed cows within the milking system and unique RCV used in this experiment.

Key Words: Calf vocalization, Automatic milking system, Milk production

15 Evaluation of low input dairy farming systems by on-farm research, prototyping, and simulation modelling with emphasis on grazing management, seasonal calving, crossbreeding and outwintering. D. Johnson*, E. Ballinger, J. Linn, M. Rudstrom, L. Hansen, A. Seykora, and B. Heins, *University of Minnesota*.

There is a need for an evaluation of the components of successful low input dairy production systems so farmers can design low input systems with an appropriate blend of old and new technologies. Our approach obtains dairy systems information from a diverse set of reduced input, moderate size dairy farms and a more intensively managed prototype farm. This system analyzes production and management information, consolidates the results to identify the range of performance on working farms, and tests the results by simulation modelling. Data collected from ten low input farms spanning the Minnesota dairy belt includes pasture characteristics, grazing efficiency, supplementary feeding, animal health and fertility, milk sales, other inputs. Farms are visited twice monthly during the grazing season and monthly during winter. The institutional prototype herd provides intensive data collection related to seasonal calving, pasture utilization, crossbreeding, outwintering, and rearing replacements. Data from participating farms is summarized by farm to identify a range of herd performance. The prototype herd serves

as a base herd for simulations utilizing the extremes of the traits of co-operating farms. Simulation modelling utilizes SIMHERD (Sorensen, et al. - DK). The objective of the SIMHERD developers was to create a model which would be sufficiently detailed to include relationships likely to have significant effects at the herd level and yet simple enough to allow successful parameterization and interpretation of the results of the model. Crossbreeding was initiated in the prototype herd by mating Holstein cows to Jersey bulls, followed by Montbeliarde mating to

Holstein cows and Jersey by Holstein crosses. A separate high breeding value Holstein line is retained as a genetic control group. An additional strain utilized in outwintering studies utilizes Scandinavian Red by Jersey by Holstein genetics. Seasonal calving systems contrasts a spring calving group that is outwintered with fall calving with shed housing.

Key Words: Dairy systems, Grazing, Crossbreeding

Breeding and Genetics

19 Realized difference among daughters of Holstein sires for milk yield and composition after four generations of selection for high and average fat plus protein yield. P. J. Berger*, M. H. Healey, and A. E. Freeman, *Iowa State University*.

The objective of this research is to determine if enhancements in quantity and quality of milk can be achieved by selecting sires for high or average PTA fat plus protein yield. Data were all completed 305d mature-equivalent lactation records for cows ($n = 978$) in the Ankeny dairy breeding genetic resource population, 1988 to 2004. Data were edited to exclude lactations that ended in abortion, parity >6 , or records that may have been influenced by other experimental protocols. Traits included in the analysis were: 305d ME milk, fat and protein yields; percentage fat and protein; and somatic cell score. Data were analyzed by using a sire model with repeated records in SAS PROC MIXED. Repeated lactation records were modeled assuming a constant variance over lactations and a positive correlation between any two measurements on the same cow. The model included fixed effects of year-month, parity, line (high vs average); sire, cow and residual were random effects. The high line had significantly ($P < .01$) higher yields for milk, fat, and protein than the average line; $493 \text{ kg} \pm 152$, $27 \text{ kg} \pm 5.1$, and $20 \text{ kg} \pm 4.5$ for milk, fat, and protein yield, respectively. There was little difference between the high and average line for fat and protein percentage, and somatic cell score; $0.1 \% \pm 0.04$, $0.04 \% \pm 0.02$ and 0.14 ± 0.11 , respectively. Implication of this research is that genetic change in milk composition can be achieved by selection for quantity of milk components and not percentage composition.

Key Words: Holstein, Milk yield and composition, Sire selection

31 Reproductive performance in daughters of Holstein sires selected for high and average milk yield or fat plus protein yield. P. J. Berger, M. H. Healey, and G. A. Gutierrez*, *Iowa State University*.

The objective of this analysis was to compare the reproductive performance, i.e., number of services (NS), and days open (DO) between two long-term selection lines. Sires were selected for high or average PTA milk yield (1968-1987) and high or average PTA fat plus protein (1988-2002). Cows ($n=1066$) were restricted to have three consecutive conception dates at 0, 1st and 2nd parity. Heifers were excluded from

analysis for DO. Data were analyzed by using a repeated measure model in SAS PROC MIXED. Fixed effects were year-season, parity, lines and interaction of parity by lines. Random effects of cows within lines were modeled assuming heterogeneous autoregressive (co) variance structure. Estimates of the correlation among repeated records were $NS=0.07$ and $DO=0.15$. There was evidence of significant differences ($P<0.01$) among effects for year-season and parity for NS and DO. Least-squares means were 2.3 ± 0.07 and $125d \pm 3.0$ for NS and DO, respectively. Differences between lines and the interaction of parity by lines were insignificant for all variables. Implications of this research are that heifers do not retain their fertility as they get older. Both NS and DO tended to increase with parity.

Key Words: Holstein, Number of services, Days open

32 A Bayesian threshold-linear evaluation of perinatal mortality, dystocia, birth weight, and gestation length in a Holstein herd. J. M. Johanson¹ and P. J. Berger*², ¹*Western Carolina University*, ²*Iowa State University*.

The objective of this research was to estimate variance components for a multiple trait evaluation of dystocia (DYS), perinatal mortality (PM), birth weight (BW), and gestation length (GL). Dystocia and perinatal mortality were both recorded as to categories (unassisted versus assisted and alive versus dead, respectively), while birth weight and gestation length were continuous traits. The data included 4612 calving records collected between 1968 and 2000 from the Iowa State University research dairy farm in Ankeny. The incidence of PM was 7.6%; calving difficulty was 24.6%. The mean BW was 40.5 kg; GL was 278.8 d. A threshold-linear model was used to estimate variance components via Gibbs sampling. Effects in the model were year, season, sex of calf, parity, sire group, random maternal genetic, and random permanent environment. Maternal heritabilities with standard errors in parentheses for DYS, PM, BW, and GL were calculated to be 0.09(0.025), 0.09(0.027), 0.13(0.022), and 0.18(0.019), respectively. Genetic correlations with standard errors in parentheses between maternal effects for DYS-PM, DYS-BW, DYS-GL, PM-BW, PM-GL, and BW-GL were estimated to be 0.98(0.023), 0.30(0.15), 0.27(0.13), 0.34(0.16), 0.15(0.14), and 0.39(0.086), respectively. Genetic trends in correlated traits will be discussed.

Key Words: Birth weight, Dystocia, Perinatal mortality

Extension-Beef

69 Using ethanol industry co-products in dairy rations. R. Kaiser, R. Shaver*, and L. Armentano, *University of Wisconsin-Madison*.

There is a growing supply of ethanol industry co-products in the Midwest as new plants continue to come on line. This paper will focus on the use of dry and wet distillers grains in dairy rations. Variation in the nutrient composition of distillers grains and handling/storage considerations for wet distillers grains are topics of other presenters at this symposium. We will review and summarize the scientific literature regarding the use of distillers grains in dairy rations. The role that distillers grains play in the following areas of dairy cattle nutrition will

be discussed: CP, RUP/RDP and amino acid supply, moderation of dietary NFC and starch, NDF, digestible NDF and physically-effective NDF contributions, supplemental fat, and phosphorus supply. The use potential for distillers grains in dairy rations as concentrate and forage substitutes will be explored along with limitations to inclusion amounts placed upon distillers grains by their lysine, fat, and phosphorus contents. Supplementation strategies to augment the use of distillers grains in dairy rations along with potential impacts on ration costs will be discussed.

Key Words: Distiller's grains, Dairy cows, Nutrition

Extension-Dairy

70 Increasing cow stayability in dairy herds. K. Weigel*, *University of Wisconsin.*

Longevity is critically important, but genetic selection for this trait is challenging. Trait definition, data collection, validation, and statistical analysis have many pitfalls. Challenges in trait definition are reflected by various names, such as longevity, survival, productive life, stayability, and herd life. These are prefaced by true or functional, to differentiate voluntary and involuntary culling. Longevity is farmer-recorded and is susceptible to bias. Culling risk is influenced by many factors, such as availability of replacements, plans for expansion, competence of herds-men, or milk quota restrictions. Data validation poses challenges, often due to limitations of the DHI system. Culling codes (sold for dairy, sold due to mastitis) lack specificity and flexibility. Primiparous cows culled before first test may not enter the system, and multiparous cows culled before first test may have errant culling dates. Statistical analysis is hampered by skewed distributions of survival times and high percentages of censoring. Time-dependent covariates must account for management changes within and between lactations. Factors such as disease exposure, facility modernization, and milk prices change often, and all affect risk of culling. Data should be analyzed using failure-time methodology to account for non-normality, censoring, and time-dependent covariates, so the instantaneous risk of culling for a cow can be calculated at any given time for any set of explanatory variables. Inference should be based on relative risks of culling for high, average, and low-producing cows within a herd. Optimal schemes yield low risk of involuntary culling among high-producers and high risk of voluntary culling among low-producers. If possible, selection for components of longevity, namely health and fertility, should augment or replace direct selection on culling data. On-farm recording of health disorders is common, and methods to validate and store such data across herds are needed. Traits such as pregnancy rate, body condition score, lameness, mastitis, and ketosis are measured early in life, and substantial genetic variation exists between sires for these traits.

Key Words: Longevity, Culling, Dairy

71 Nutritional impacts on culling. M. Hutjens*, *University of Illinois.*

Feeding programs can impact culling and longevity. Six areas leading to increased culling can be investigated when designing and delivering a feeding program: transition cow feeding approaches, rumen acidosis, lameness, pregnancy status, mastitis, and death. Each area has various levels of economic importance with key management related factors that can minimize the impact. Michigan, Minnesota, and New York field studies using DHI data indicated 34, 26, and 29 percent, respectively, of all cows culled occurred in the initial 63 days after calving with no differences related to milk yield (rolling herd average) or parity. Dairy managers can measure the impact of feeding on longevity using benchmarks including dry matter intake, feed efficiency, level of metabolic disorders, culling rate, reasons for culling, and nutrients delivery by the feeding program. Dairy nutritionists have a tool box of feed additives that can be used to modify culling risk factors that can lead to premature culling (loss of milk yield and animal value) including rumen buffers, glucose precursors, non-esterified fatty acid (NEFA) lowering additives, rumen stabilizers, immunity enhancement additives, and hoof improvement additives. Effective feeding strategies can lower cull rates and extend productive life.

Key Words: Culling, Feeding, Dairy

72 Managing cows to minimize culling. J. Olson*, *Pfizer Animal Health.*

Between 25 to 45 percent of the cows that are culled from dairy herds are culled in the first sixty days of lactation. Because early lactation should be the most profitable period of a cow's lactation, removal of cows in

early lactation from either death or culling is an expensive proposition. The first goal of dairy management should be prevention of postpartum diseases and conditions that result in the removal of cows in early lactation. Nutritional management of cows through the transition period is an important component of promoting cow health in early lactation. In addition, mastitis control and vaccination programs can aid in the reduction of postpartum health problems. Since even with the best prevention programs, some cows in early lactation will develop postpartum diseases, the second goal of management should be to minimize death and culling losses associated with these diseases through the early identification and treatment of these conditions. Intensive fresh cow monitoring programs through the first ten to fourteen days of lactation can aid in the early identification of postpartum diseases. In conjunction with early identification of disease, appropriate treatment protocols need to be developed which includes the selection of appropriate drugs, dose, and duration of treatment. Early identification can reduce secondary complications such as abomasal displacement, fatty liver and salmonellosis which are associated with reduced dry matter intake from the primary disease condition. An additional benefit that has been observed in herds following the implementation of programs for monitoring fresh cows has been an increase in peak milk production for the herd.

Key Words: Culling, Post partum disease

73 Timing of the culling event. R. Cady*¹, S. Godden², and S. Stewart², ¹*Monsanto*, ²*University of Minnesota.*

Every cow is eventually culled. Thus, it is not a question of if a cow will be culled, but rather when she will be culled. Culling is primarily an economic risk management practice, moderated by existing economic conditions, both internal and external to the dairy operation, and further mitigated by risk tolerance and management capability of the dairy management team. The only exceptions to this would be loss due to death, theft, or cows that are simply too difficult to manage (eg. kickers). Knowledge of three factors is necessary to successfully manage culling: 1) how often does the event occur (rate), 2) when does the event occur (timing), and 3) why the event occurred at that time. The cow's life is a continuum from birth to death, divided into a growth and maturation process followed by a series of parturition/lactation events. Thus, the risk of cull is more than a simple function of increasing risk with increasing time because the initiation of each new lactation increases the risk of cull every time it occurs. Subsequent pregnancy reduces the likelihood of being culled. Internal and external, controllable and uncontrollable factors influence culling. An example of an uncontrollable risk is increased culling associated with age. An external uncontrollable factor is beef price. Many factors however are within management purview, such as mitigating disease incidence, changing risk tolerance, production level, reproductive performance, transition cow care, and herd long-term growth goals. High production and good reproductive performance both reduce the risk of being culled. Culling management is more complex than simply reducing herd turnover rate. There is an optimum time to cull a cow based on her productive, reproductive and health status and probability for future economic success. Culling too early limits profitability through the loss of the ability to recover costs of investment. Culling too late limits profitability because of lost opportunity to gain higher profits with a more profitable cow. Opportunity exists to better manage the timing of cull events, however there is no global optimum culling rate.

Key Words: Culling, Risk management, Herd turnover

74 Trends in dairy heifer supply and culling rates in the US. M. Schutz*, *Purdue University.*

Within dairy herds, culling rates are driven by many factors. Those factors include availability of replacement heifers, heifer prices, calving interval, milk price, cow and heifer mortality rate, conception rates, and a host of other factors. On a national or regional basis, heifer supply

is a major factor affecting the rate at which cows are culled. Historical numbers of US milk cows and dairy replacement heifers weighing >227 kg were obtained from USDA since 1920 and by state since 1989. While cow numbers have declined from around 27.8 million in 1945 to about 9.1 million in 2003 (67% decline), dairy replacement heifers >227 kg declined only from 6.3 million to 4.1 million (24% decline) in the same time period. Proposed explanations for the vastly slower decline in heifer numbers include consistency of reporting, directed breeding for dairy (versus beef) offspring, and especially decreased mortality. Estimated culling rates based upon cow and heifer numbers increased over time from around 13% in the 1920s to around 33% in the decade ending in 2002. On a national basis, culling rates appear to be limited by heifer supply. The highest estimated annual culling rate of 38% occurred in 1986 and coincided with the national Dairy Buyout Program. As with milk cow numbers, heifer production appears to have moved from the Midwest to the West, though at a slower rate. During expansion of cow numbers, heifers are purchased from outside the state or region. Therefore, caution must be used when attempting to determine state or regional culling levels. Supply of dairy cows varied inversely with monthly ratio of milk price to feed price from 1995 to 2003 (Pearson correlation coefficient = -.5). Similarly, annual number of imported females varied proportionally with milk:feed price ratio (Pearson correlation coefficient = .63) prior to the closing of the Canadian border to live animal imports in 2003. However, relationships of numbers of cows or replacement heifers with milk:feed price ratio were not readily discernable on an annual basis.

Key Words: Culling rate, Heifer supply, Milk price

76 Efficacy of on-farm pasteurized waste milk systems on dairy and custom calf rearing operations. M. A. Jorgensen^{*1}, P. C. Hoffman¹, and A. J. Nytes^{2, 1} *University of Wisconsin-Extension, Madison, WI, ²Vita Plus Corp., Madison, WI.*

The objective of this study was to evaluate the efficacy of on-farm milk pasteurizers in a commercial environment. Thirty-one on-farm pasteurizers were evaluated by collecting one sample each of raw (RWM) and pasteurized (PWM) waste milk from a daily pool. Waste milks were sampled from dairy or custom calf feeding operations using batch or continuous flow pasteurizers. Both RWM and PWM were analyzed for fat, protein, lactose, bacterial plate count, and SCC. Milk was plated, incubated and colony forming units/ml of *Salmonella sp*, *Coliform sp*, *Streptococcus sp*, *Staphylococcus sp*, and *Enterococcus sp*, determined. Presence of β -lactam and non β -lactam antibiotics and alkaline phosphatase (AP) activity were also determined. Mean fat content of RWM was higher ($P < 0.01$) than PWM at 4.42 and 3.90 percent, respectively. Mean protein contents of RWM and PWM were similar at 3.25 percent. Fat (2.79-4.70), protein (2.89-5.10) and lactose (3.78-4.80) contents of PWM were highly variable between operations resulting in a wide range of metabolizable energy (4.75-6.61 Mcal/kg) contents in PWM. Four pasteurizers did not denature AP, indicating failure of pasteurization. Pasteurization significantly ($P < 0.001$) reduced standard plate count and all bacterial populations in waste milk. Pasteurization had no effect ($P = 1.0$) on β -lactam and non β -lactam antibiotic residues in waste milk. Milk from the same operation tested positive for β -lactam or non β -lactam residues in RWM and PWM, indicating pasteurization had no effect on antibiotic activity. We observed a 50.0% incidence of antibiotic residues in pasteurized waste milk. Further research is needed to determine what effect antibiotic residues have on calf nutrition. Based on these observations PWM should be routinely evaluated because nutritional and microbiological characteristics of PWM fed to calves can be extremely variable.

Key Words: Waste milk, Calves, Pasteurization

77 Using Ovsynch as a model to test the relationship between time of AI and time of ovulation in lactating dairy cows. R. Pursley^{*}, *Michigan State University.*

Synchronization of ovulation (Ovsynch) technologies are reproductive management tools designed to improve pregnancy rates and labor efficiency. During the past 40 years, estrus detection and conception rates of lactating dairy cows have steadily declined. These trends are likely attributable to the tremendous physiologic changes related to increased milk production in the lactating dairy cow during this period since estrus detection and conception rates of heifers have remained relatively constant during this period. Ovsynch technologies allow for the opportunity to reverse the trends in estrus detection rate by commanding when cows receive first and subsequent artificial insemination (AI). Unfortunately, current Ovsynch technologies do not have the capabilities to improve fertility unless standard reproductive practices are sub par. One aspect of applied reproductive research at Michigan State University is currently focused on improving fertility of lactating dairy cows by gaining a greater understanding of the interaction between time of AI and time of ovulation in dairy cattle. Ovsynch, GnRH, 7 d later PGF_{2 α} , 48 h later GnRH, is the current model being used to test this interaction. Ovsynch allows for the regression of corpora lutea and the ovulation of a newly formed dominant follicle in approximately 87 % of treated cows. In previous work, time of ovulation ranged from 24 to 32 h following the final GnRH induced LH surge in cows that had luteal regression in response to the PGF_{2 α} . This allowed for the testing of AI at different intervals from this synchronous time of ovulation. In recent data, extending the time of AI prior to ovulation affected % pregnancies per AI, % of female calves born as a result of that AI, and pregnancy losses in cows that were inseminated to low fertility bulls. This paper will explore the relationship of timing of AI relative to ovulation and the potential to use Ovsynch as a model to gain a greater understanding of fertility problems of lactating dairy cows.

Key Words: Ovsynch, Fertility, Dairy cows

78 Response of heat stressed lactating dairy cattle fed dried seaweed meal. B. Cvetkovic^{*}, M. Brouk, and J. Shirley, *Kansas State University.*

The objective of this study was to quantify the effects of feeding Tasco-14[®] seaweed meal on feed intake, milk production, milk component concentration, rectal temperature, rear udder surface temperature, and respiration rate of heat stressed lactating dairy cattle. Twenty-four Holstein cows were assigned to one of twelve blocks by lactation number, days in milk (DIM), and energy corrected milk production. Treatments consisted of total mixed ration (TMR) control diet or control diet with 56.7 g of Tasco-14[®] seaweed meal per cow daily as a top-dressing. Data were collected for five weeks following a 7-day adjustment period during which 113.4 g/cow daily of seaweed meal was fed to treated cows. There was no significant difference in feed intake ($P > 0.05$); however, milk production was greater ($P < 0.01$) for cows receiving seaweed meal (33.5 versus 35.3 kg/cow daily for control and seaweed diets, respectively). Milk fat and milk protein percentages and milk fat production was similar ($P > 0.05$). Milk protein yield was greater ($P < 0.01$) for treated cows (1.11 kg/cow daily) as compared to controls (1.02 kg/cow daily). Respiration rates were similar ($P > 0.05$) across treatments as well as rectal and rear udder surface temperature ($P > 0.05$). The increase in milk protein yield resulted from greater milk production and a trend for higher milk protein percent for cows receiving Tasco-14[®] seaweed meal. Since feed intakes were similar, increased milk production likely resulted from an increase in lactation efficiency for treated over control animals. Previous studies reported a reduction in respiration rates and body temperature during heat stress for animal receiving seaweed meal. In this study, the addition of brown seaweed to diet did not reduce the normal heat stress responses typically observed in dairy

cattle. Additional research is needed to specify the factors responsible for the observed increase in milk and milk protein yield.

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Key Words: Heat stress abatement, Milk production, Feed additive

79 Somatic cell count, yield and chemical composition of milk from cross-bred cows. C. T. Sathian, S. S. Anil*, and M. Mukundan, Kerala Agricultural University, India.

Six hundred pooled milk samples were collected from cross-bred cows belonging to Livestock farm and Field progeny testing units of Kerala Agricultural University, India. The data on milk yield, age, parity and stage of lactation of these cows were also recorded. The milk samples were subjected to analysis of somatic cell count (MF-DNA method) as well as percentages of fat (Gerber), total solids (TS-Gravimetric), solids-not-fat (SNF), protein (Dye binding), lactose (Feitosa-Teles) and chloride (Titrimetric method). The correlations between somatic cell count and individual chemical components of milk were analysed by comparing means of observations (ANOVA). Data were grouped into different classes based on milk yield, fat per cent and SNF per cent and correlations were tested within groups. The association between the milk-yield of the cows and somatic cell count was also analyzed. Lactose per cent in milk was negatively correlated with somatic cell count ($P=88040.05$). TS and SNF per cent of milk had a negative correlation with somatic cell count in samples with fat per cent between 3.5 and 4.5 ($P=88040.05$) or SNF per cent between 8.5 and 8.99 ($P=88040.05$). Above groups of samples constituted a major share of total samples collected. Chloride content of milk had no significant correlation with somatic cell count. Somatic cell count had a negative correlation with milk yield of cows in all groups ($P=88040.05$). The results suggest that low lactose level in milk may indicate high somatic cell count in milk. Key words- milk-somatic cell count- lactose

Authors acknowledge the facilities provided by Dean, College Veterinary & Animal Sciences Mannuthy for this research project.

Key Words: Milk, Somatic cell count, Lactose

Graduate Student Paper Competition-MS

96 Highly fermentable sugars and slow-release urea in diets fed to lactating dairy cows. G. Golombeski*, K. Kalscheur, A. Hippen, and D. Schingoethe, South Dakota State University.

A study was designed to test the inclusion of liquid co-products from the ethanol and cheese industries in dairy rations and their interaction with a source of nonprotein nitrogen. Eight multiparous and four primiparous Brown Swiss cows (96 ± 46 d in milk) were blocked by parity and randomly assigned to one of three 4 × 4 Latin squares. Basal diets were formulated for CP 16.6% and NE_L 1.55 Mcal/kg and contained 35% of dietary dry matter (DM) as corn silage, 15% alfalfa hay, 34% of a varying concentrate mix of ground shelled corn and soybean meal (SBM) and 16% of a constant premix. The constant premix contained equal proportions of soy hulls, heat treated SBM, corn distillers grains, vitamins and minerals across all diets. Treatments were: 1) control (CON); 2) fermentable sugars (FS; 8.64% RationMate); 3) slow-release urea (SU; 0.61% Ruma Pro); and 4) fermentable sugars and slow-release urea in combination (FSSU; 8.64% FS, 0.61% SU). Feeding FS decreased milk production ($P = 0.05$) and increased ruminal butyrate concentration ($P < 0.01$) compared to feeding CON and SU diets. Feeding SU decreased DM intake ($P = 0.04$), and increased feed efficiency ($P = 0.05$) compared to cows fed CON and FS. Milk fat percent increased for FS ($P < 0.01$) and SU ($P < 0.01$) compared to CON. Dietary treatment had no effect on FCM, milk protein percent, milk fat yield, milk protein yield, or MUN. No interactions between FS and SU were observed. Feeding FS

80 Dietary supplements for prevention of fatty liver and ketosis. A. R. Hippen*, South Dakota State University.

Studies have been conducted evaluating feed additives for prevention of ketosis in transition dairy cows. Glycerol, a coproduct from production of biodiesel, is an effective treatment for ketosis when drenched; however, diets containing up to 1L of glycerol fed to dairy cows from 3 wk pre- to 3 wk postpartum failed to have a positive impact on blood glucose. To understand this, high-producing dairy cows were administered glycerol via drench, esophageal tube, or feeding. Results indicate that if the glycerol is associated with feeding, it is fermented to butyrate within the rumen and metabolized to betahydroxybutyric acid (BHBA) during absorption. Likewise, feeding liquid whey has been shown to increase ruminal butyrate concentrations. To understand the impact of BHBA production from ruminal fermentation of lactose in whey, mid-lactation dairy cows were fed increasing quantities of lactose and whey. Because BHBA synthesis was found to occur at a modest rate, transition dairy cows were fed lactose at 15% of diet DM. Concentrations of ruminal butyrate and blood BHBA were increased in the cows fed lactose, but blood glucose concentrations were not affected. Liver lipid concentrations were decreased and milk production during the first 70 d of lactation was increased by feeding lactose. Lastly, feeding propionate has been demonstrated to aid in prevention of ketosis in dairy cows. It has been hypothesized that, if fed in combination with dietary fat, this effect may be enhanced through synergistic pathways for glucose synthesis and fatty acid oxidation. We determined that when propionate is added to diets containing supplemental fat, prepartum feed intake depression is prevented and carbohydrate status is improved. A second experiment demonstrated that when fat (200 g/d) is added to diets containing propionate (230 g/d), concentrations of nonesterified fatty acids in blood are decreased and energy status is improved. Diets that favor modestly enhanced rates of ruminal fermentation and corresponding increases in post-ruminal delivery of energy-containing substrates improve the carbohydrate status of the transition dairy cow.

Key Words: ketones, glucose, transition dairy cow

increased milk fat percentage and ruminal butyrate concentration while SU improved feed efficiency and milk fat percentage.

Item	CON	FS	SU	FSSU	SEM
Milk, kg/d	26.9	25.5	26.8	25.4	1.3
Milk, fat%	4.19	4.52	4.36	4.46	0.11
Milk, protein %	3.73	3.76	3.76	3.73	0.07
DMI, kg/d	21.3	21.3	19.7	20.0	1.7
ECM/DMI	1.48	1.47	1.64	1.57	0.08
Acetate, molar %	63.3	62.8	62.8	63.3	0.6
Propionate, molar %	21.8	20.6	21.9	21.1	0.5
Butyrate, molar %	10.6	12.2	10.6	11.6	0.27

Key Words: Fermentable sugars, Milk fat, Urea

Graduate Student Paper Competition-Ph.D.

99 Evaluation of various sources of corn distillers dried grains plus solubles (DDGS) for lactating dairy cattle. D. H. Kleinschmit*, D. J. Schingoethe, K. F. Kalscheur, and A. R. Hippen, *South Dakota State University*.

Manufacturing practices differ among ethanol plants, resulting in variations in the nutrient content of DDGS among plants. The objective of this study was to evaluate the effects of feeding DDGS from different sources on intake and milk production and composition in lactating dairy cows. Eight multiparous and four primiparous Holstein cows were used in a replicated 4 × 4 Latin square design with 28-d periods. Dietary treatments consisted of total mixed diets containing soybean meal as the primary protein supplement (C), or 20% DDGS from source 1 (DDGS-1), source 2 (DDGS-2), or source 3 (DDGS-3). Dried distillers grains replaced a portion of the ground corn and soybean meal in DDGS diets to allow diets to be isonitrogenous at 16% CP. All diets had a forage to concentrate ratio of 55:45. Dry matter intake (21.4 kg/d) did not differ among treatments but cows fed diets containing DDGS had

greater yields of milk (34.6 vs. 31.2 kg/d; $P < 0.01$), 4% fat-corrected milk (32.7 vs. 29.6 kg/d; $P < 0.01$), and energy-corrected milk (35.4 vs. 32.3; $P = 0.01$) compared to cows fed the C diet. As a result, feed efficiency was greater ($P = 0.03$) in cows fed DDGS compared to C (1.78 vs. 1.63). Even though there was a tendency ($P = 0.10$) for milk fat percentage to be greater in cows fed DDGS-3 compared to DDGS-2, differences were not observed among treatments. Milk fat yield was greater ($P = 0.02$) in cows fed DDGS compared to those fed C (1.26 vs. 1.14 kg/d). Milk protein percentages (3.28, 3.13, 3.19, and 3.17 % for C, DDGS-1, 2, and 3, respectively) were greater ($P < 0.01$) for C vs. DDGS and tended ($P = 0.10$) to be lower for DDGS-1 than for DDGS-2 and 3. Milk protein yields tended ($P = 0.10$) to be greater for cows fed DDGS than for those fed C (1.09 vs. 1.02 kg/d). Concentrations of milk urea nitrogen were lower ($P < 0.01$) in cows fed DDGS compared to C (9.36 vs. 10.6 mg/dl). Overall, the source of DDGS used in this study did not affect lactation performance.

Key Words: Distiller's dried grains, Dairy cattle, Ethanol co-products

Nonruminant Nutrition

172 A technique for mammary biopsy in lactating sows. J. Pérez Laspiur, R. N. Kirkwood, B. J. Moore, N. K. Ames, and N. L. Trotter*, *Michigan State University*.

The objective of this study was to develop a biopsy technique to obtain mammary tissue (MT) from lactating sows in sufficient amount for RNA and protein extraction and histology examination, while maintaining the physiological integrity of the mammary gland (MG) and welfare of the sow. Eighteen multiparous lactating sows were used. Biopsies were performed between d 4 and 7 and d 17 and 19 of lactation on the first and second thoracic MG, respectively. Piglets were removed and sows anesthetized with an intramuscular injection of TKX (250 mg tiletamine and 250 mg zolazepam in 2.5 mL ketamine and 2.5 mL xylazine-100) at 1 mL per 34 kg BW. During anesthesia, sows were positioned in lateral recumbency to expose one entire side of the udder. One MG was prepared for biopsy using Betadine scrub followed by rinsing with 70% alcohol and cleaning with Betadine solution. The incision area was numbed with

sub-cutaneous and intra-mammary administration of Lidocaine (1 mL, 2%). A 2-cm incision was made vertical to the plica lateralis, aligned with the nipple and approximately 5 cm dorsal to the perimeter of the nipple areola. Hemorrhage was minimal but, if evident, was controlled by pressure with gauze. Mammary tissue (400 to 850 mg, n=2) was exteriorized with forceps and excised with a scalpel in a circular motion. The incision was closed using simple interrupted sutures. Time from incision to closing was approximately 5 min. Piglets were returned to suckle following full recovery from anesthesia. Average daily gain of piglets suckling the glands subjected to biopsy versus that of piglets suckling intact glands did not differ. Sow feed intake on the day following biopsy was not different than that of sows on the day prior to biopsy. In all but one sow, there were no local or systemic infections. In conclusion, up to 1.7 g MT can be obtained in a live lactating sow without adversely affecting lactation performance.

Key Words: Mammary gland, Biopsy, Sow

Ruminant Nutrition

236 Relationship of milk urea nitrogen and total nitrogen excretion from lactating cows. S. W. Zhai* and J. X. Liu, *Institute of Dairy Science and Industry, College of Animal Science, Zhejiang University*.

The objective of this study was to assess the relationship between milk urea nitrogen (mg/dl) and total nitrogen excretion in urine and feces (g/d). Four multiparous cows were fed four different CP level diets (13.2%, 14.1%, 15.0% and 16.2%, DM basis). Diets were isocaloric. The experiment was designed as a 44 Latin square. Experimental periods were 2week in length, with d1 to 9 used for adjustment and d12 to d14 used for a total collection of urine and feces. Crude protein concentration had a significant effect on milk urea nitrogen ($P < 0.05$), total nitrogen excretion (fecal + urinary nitrogen; $P < 0.01$) and no effect on milk yield and composition ($P > 0.05$). There was a linear increase in milk urea nitrogen and total nitrogen excretion with increasing CP level ($P < 0.001$). The linear regression equation of total nitrogen excretion on MUN was Total N excretion (g/d) = 11.47(±1.72)MUN(mg/dl) + 151.01(±19.54). The results in our study suggested that MUN would be used a valuable tool to monitor the changes of dietary CP and predict the amount of nitrogen excreted into the environment.

Key Words: Protein level, Milk urea nitrogen, Total nitrogen excretion

241 Effect of live bacterial inoculants on performance of lactating dairy cows. J. W. West*, J. K. Bernard, G. H. Cross, and D. S. Trammell, *University of Georgia*.

Forty-eight lactating Holstein cows were used in a 10 week randomized block trial to determine the effect of supplemental live bacterial inoculants on intake, milk yield and composition, and on blood metabolites. Treatments were: control (C); B1 (*Propioni freudenreichi* and *Lactobacillus acidophilus* bacteria); B2 (B1 plus an additional *Lactobacillus acidophilus* strain). Bacterial inoculants were top-dressed on individually fed mixed rations offered ad libitum. Data were subjected to analysis of covariance using PROC MIXED procedures of SAS. Orthogonal contrasts were: C vs. supplemental bacterial inoculant treatments B1 and B2 (C vs. B), and treatments B1 vs. B2. Performance means for C, B1 and B2 and significance were: DMI, 25.5, 26.3, 26.3 kg/d; milk, 37.7, 39.6, 38.5 kg/d (C vs. B, $P < 0.08$); energy-corrected milk (ECM), 34.5, 36.8, 37.0 kg/d (C vs. B, $P < 0.03$), and gross efficiency of production (ECM/DMI): 1.34, 1.42, 1.41 kg/kg (C vs. B, $P < 0.03$). Milk fat content for C, B1, and B2 was 3.19, 3.23, 3.40%; milk protein content was 2.95, 2.94, 3.00%. Body weight change (kg) was not affected by treatment. Serum urea N for C, B1, and B2 were 22.62, 20.43, 21.66 mg/dl (C vs. B, $P < 0.01$; B1 vs. B2, $P < 0.08$); serum glucose was 64.73, 67.55, 65.52 mg/dl. Inoculants did not alter DMI. Yield of milk and ECM and the gross efficiency of production were improved by inoculants but no

differences among the inoculant treatments were noted. Serum glucose was not different but serum urea N was lower for inoculants. The live bacterial inoculants used in this study improved the yield of milk and the gross efficiency of high producing dairy cows.

Nutrition Physiology Corporation

Key Words: Lactation, Bacterial inoculants, Nutrition

263 Fatty acid changes in the digestive tract of Holstein steers fed canola supplemented dairy lactation diets. S. Bedgar*, J. Schroeder, M. Bauer, and W. Keller, *North Dakota State University*.

Fifteen cannulated Holstein steers averaging 399 ± 21.7 kg initial body weight (BW) were stratified by BW and assigned to treatments in a completely randomized design to evaluate the effects of feeding ground canola seed on change in fatty acid flow. Diets containing 0, 6.1, and 12.2% of the total ration dry matter (DM) as ground canola seed were offered ad libitum. Rations were formulated to represent high production lactation diets and were isonitrogenous and equivalent to 1.74 Mcal of net energy per kg of DM. The control diet was composed of corn silage, ground corn, alfalfa, soybeans, canola and blood meal, vitamins, minerals, and chromic oxide as an external marker. Corn grain and canola meal were reduced as ground canola seed (39.6% lipid, DM basis) was added to the diets. Steers were acclimated to treatment for 25 d prior to collections. Duodenal and ileal samples were taken to represent every 1.5 h in a 12 h period from d 29 through 31. Rumen fluid samples were taken at 0, 2, 4, 6, 8, 10, and 12 h post-feeding. Dacron™ bags, each containing 5 g ground canola were incubated in the rumen for 0, 2, 4, 8, 12, 16, 24, 36, and 48 h. Inclusion of ground canola seed did not significantly affect DM intake. Intake of total fatty acids ($P < 0.001$) and long-chain fatty acids ($P < 0.001$) increased linearly with increasing canola in the diet. Flow of fatty acids increased to the duodenum ($P = 0.04$) and ileum ($P = 0.01$) and rate of oil disappearance decreased ($P = 0.03$) linearly as canola was added to the diet. Diets that contained 6.9% lipid with up to 4.2% added lipid from ground canola seed did not alter the rate, site, or extent of digestion of DM, organic matter, fiber, and crude protein. These data suggest that ground canola can be used as an ingredient to increase the flow of fatty acids to the small intestine without negatively affecting digestion and ruminal fermentation.

Key Words: Canola, Digestibility, Fatty acid

265 Selenium supplementation of dairy cattle: Responses to organic and inorganic forms of selenium. S. Elliott*, G. Harrison, and K. Dawson, *Alltech Biotechnology, Inc.*

The 2001 edition of the NRC defines the selenium requirement for all classes of dairy cattle as 0.3 ppm. Moreover, the FDA has set the legal limit for supplemental Se to dairy cattle at no greater than 0.3 ppm. Continuing problems with dairy cows, especially mastitis and reproductive disorders, suggest that current practices of Se supplementation may not be adequate. This is particularly true in areas where cattle are fed grains and forages naturally low in Se. Given the legal limits on supplemental Se, improving the Se status of dairy cattle can be challenging. Formulating rations using feeds with higher Se content can boost Se status in dairy cattle. However, this approach would require a consistent source of high Se feedstuffs and constant monitoring of Se content. A more practical approach to improving Se status is through the supplementation of high selenium yeast. Published research has shown Se from selenium yeast to be more available than Se in inorganic salts and more effective in increasing both blood and milk Se levels. Field trial results with Sel-Plex (Alltech, Inc.) confirm earlier university work indicating that a 20 to 30% increase in whole blood Se and an 80 to 100% increase in milk Se levels can be associated with selenium yeast supplementation. Incorporation of seleno amino acids into body proteins may help maintain Se status in the cow, but also improves the Se status of calves at birth. Field data have also reported reductions in cases of mastitis and lower somatic cell counts when supplementation strategies

using selenium yeast are used. Limited data are available regarding reproductive performance, but preliminary results indicate that selenium yeast supplementation strategies may decrease the incidence of retained placenta resulting in less metritis and improved pregnancy rates. Total replacement strategies using organic Se in selenium yeast may not only address concerns associated with more toxic inorganic selenium salts but may also be necessary to realize the full benefits of improved selenium status.

Key Words: Selenium yeast, Minerals, Dairy

266 Feeding an alpha-amylase enzyme preparation to improve the glycemic status and performance of transition dairy cows. J. M. DeFrain*¹, A. R. Hippen¹, K. F. Kalscheur¹, and J. M. Tricarico², ¹*South Dakota State University*, ²*Alltech, Inc.*

Twenty-four multiparous Holstein cows (759 ± 30 kg body weight) were used in a randomized complete block design to determine the impact of feeding an alpha-amylase enzyme preparation during the transition period on rumen fermentation, key metabolic indicators, and lactation performance. Cows were assigned to either a control diet (CON) or the control diet supplemented with alpha-amylase enzyme (662 FAU/g fungal alpha-amylase; AMA) at 0.1% of diet DM. Experimental diets were fed from 21 d before expected calving through 21 days in milk (DIM). From 22 to 70 DIM, all cows were fed a similar lactation cow diet. Milk composition was analyzed at 7, 14, and 21 DIM. Blood was sampled at 21, 14, 7, and 2 d prepartum and 2, 7, 14, 21, and 28 DIM whereas rumen fluid was sampled 21 and 7 d prepartum and at 7 DIM. Liver tissue was sampled via biopsy at 7 and 14 DIM. Average pre- and postpartum DMI were 12.4 and 17.8 kg/d, respectively, and did not differ between treatments; however, from wk -3 to wk -1 prepartum DMI increased in cows fed CON by 1.5 kg/d and decreased 1.8 kg/d in cows fed AMA ($P = 0.03$). Milk production and, with the exception of milk fat percent, composition were not affected by dietary treatments. Milk from cows fed CON tended ($P = 0.13$) to have a greater milk fat percent (4.78 vs. 4.18). Treatment differences were undetected for concentrations of insulin in plasma and lipid and glycogen in liver tissue. Concentrations of glucose ($P = 0.07$) and beta-hydroxybutyrate ($P = 0.11$) tended to be greater in cows fed AMA relative to cows fed CON across all time points. Prepartum plasma nonesterified fatty acid concentrations were greater ($P < 0.01$) in cows fed AMA, but were not different postpartum. Cows fed AMA tended ($P = 0.14$) to have greater proportions of rumen butyrate prepartum but not postpartum. A tendency ($P = 0.11$) for increases in circulating plasma energy metabolites, the sum of beta-hydroxybutyrate and glucose, may place amylase-supplemented cows at an energetic advantage over unsupplemented controls.

Key Words: Amylase, Betahydroxybutyrate, Transition dairy cow

268 The impact of ruminal butyrate production and plasma beta-hydroxybutyrate on the glycemic status of transition cows. J. M. DeFrain*, A. R. Hippen, K. F. Kalscheur, and D. J. Schingoethe, *South Dakota State University*.

Twenty-four multiparous Holstein cows (775 ± 24 kg body weight; 3.4 ± 0.11 body condition score) were used in a randomized complete block design to determine the impact of increased butyrate proportions from ruminal fermentation of lactose on key metabolic indicators and lactation performance during the transition period of late gestation and early lactation. Cows were assigned to either a corn-based control diet (CON) or a diet containing lactose at 15.7% of diet DM (LAC) at the expense of corn. Experimental diets were fed from 21 d before expected calving through 21 DIM. From 22 to 70 DIM, all cows were fed a similar lactation cow diet. Energy density and CP were 1.62 and 1.68 Mcal/kg and 14.3 and 18.1% for pre- and postpartum diets, respectively. Pre- and postpartum DMI averaged 12.8 and 17.7 kg/d, respectively, and did not differ between treatments; however, cows fed LAC did not experience a prepartum decrease in DMI. Milk yields were unaffected by dietary treatments and averaged 45.7 kg/d during the first 70 DIM increasing numerically for LAC after 21 DIM. Plasma glucose and insulin

increased for LAC during the last week prepartum ($P < 0.05$), and non-esterified fatty acids and BHBA increased for LAC during the first week postpartum ($P < 0.05$). Feeding LAC increased the molar proportion of ruminal butyrate both pre- (11.3 vs. $9.2 \pm 0.45\%$) and postpartum (13.0 vs. $10.3 \pm 0.67\%$), which led to increased plasma BHBA (6.1 vs. 4.2 ± 0.3 and 14.6 vs. 8.3 ± 1.7 mg/dL). Liver lipid content decreased (8.6 vs. $14.7 \pm 1.5\%$ of wet weight) in cows fed LAC relative to those fed CON while liver glycogen was unaffected by dietary treatments. Results from this research demonstrated that substituting lactose for corn in diets of transition dairy cows increases the proportion of butyrate in the rumen and in turn increases concentrations of BHBA in plasma. This increased ketone body production did not impact carbohydrate status and was associated with decreased severity of hepatic lipidosis.

Key Words: Lactose, Betahydroxybutyrate, Transition dairy cow

270 Degree of starch availability: An index to define relative starch digestion potential in corn based feeds. H. Blasel, P. Hoffman*, R. Shaver, and S. Offer, *University of Wisconsin, Madison*.

A laboratory method, degree of starch gelatinization (DSG), used by the food industry to assess relative differences in starch characteristics of human foods was modified for application to livestock feeds. Because physical form and DM content of starch are of critical importance to ruminants the DSG assay was modified to accommodate feeds that were not ground nor dried. In addition corn feeds such as corn silage and high moisture corn are fermented and the DSG procedure is based on enzymatic hydrolysis of starch to glucose therefore additional buffer control within the assay was required because enzyme activity is pH specific. The modified assay, degree of starch availability (DSA), was used to evaluate relative starch availabilities of corn based feeds which differed in particle size, dry matter content and endosperm type. The DSA assay was used to evaluate particle size (370, 500, 640, 1100, 3140 and 4000 μm) of corn which is known to influence starch digestion in ruminants. As particle size increased the DSA, % of starch, significantly decreased. For each 100 μm increase in particle size the DSA decreased ($r^2 = 0.98$) 2.68 percentage units. The DSA assay was also used to evaluate high moisture corns which differed in DM content. For each percentage unit increase in DM content of high moisture corn, DSA decreased ($r^2 = 0.76$) 2.00 percentage units. Finally corns differing in vitreous endosperm (0-100 %) were evaluated using the DSA assay and the DSA assay was able to determine relative differences in starch availability with DSA values approximately 20.0 percentage units higher (% of starch) for corns containing no vitreous endosperm as compared to corns containing 100.0 % vitreous endosperm. While no corollaries exist between *in vivo* starch digestion and DSA the DSA assay has the potential to refine prediction of starch digestion characteristics in corn based feeds.

Key Words: Starch, Availability, Vitreous

272 Impact of alfalfa hay neutral detergent fiber concentration and digestibility on Holstein dairy cow performance. M. Raeth-Knight*¹, J. Linn¹, H. Jung^{1,2}, and D. Mertens², ¹University of Minnesota, ²USDA-ARS, ³US Dairy Forage Research Center.

The objective of this study was to determine the effect of alfalfa fiber concentration and digestibility on dairy cow performance by selecting four alfalfa hays representing two concentrations of neutral detergent fiber (NDF); each with a high and low *in vitro* 48-h NDF digestibility (NDFD). Twenty Holstein dairy cows, averaging 193 d in milk and 31 kg of milk/d were randomly assigned to four treatments composed of 95.8% treatment hay and 4.2% molasses (dry matter basis). Cows were transitioned from 76.5% forage: 23.5% concentrate diet to the treatment diets over a 20-d period. Treatment diets were fed for 11 d before data collection occurred from d 12 to 18. Low NDF hays had approximately four percentage units less fiber than high NDF hays. Within both NDF hay pairs, NDFD of the more digestible hay was about three percentage units greater. For cows fed the low NDF hays there was no difference in dry matter intake (DMI); however, between the high NDF hays those cows fed the high NDFD hay consumed more DM as compared to cows fed the low NDFD hay. Yield of 4% fat-corrected milk (FCM) was similar for all hays except for a reduction in FCM for the high NDF, high NDFD hay compared to the two low NDF hays. Milk fat, true protein and lactose content were not affected by hay NDFD or NDF. Although the alfalfa hays contributed 95% of dietary dry matter, the differences in fiber concentration and digestibility were insufficient to impact intake, or milk yield and composition.

Treatment ¹	LH	LL	HH	HL		
NDF	37.2	36.4	41.7	40.8		
NDFD	41.3	37.9	44.6	41.1		
Item					P-value ²	SE
DMI, kg/d	17.4 ^{ab}	22.2 ^a	19.6 ^a	13.1 ^b	.03	2.6
FCM, kg/d	21.0 ^a	20.7 ^a	16.7 ^b	18.1 ^{ab}	.02	.97
Fat, %	3.7	3.8	3.7	3.8	NS	.23
True Protein, %	3.1	3.1	3.0	3.1	NS	.11
Lactose, %	4.5	4.6	4.5	4.5	NS	.09

¹ low NDF, high NDFD (LH); low NDF, low NDFD (LL); high NDF, high NDFD (HH); high NDF, low NDFD (HL), ² NS = ($P < .05$)

Key Words: NDF, Alfalfa, Digestibility

Teaching and Career Development

274 Using web-based tools in small enrollment discussion-type classes. M. Wattiaux*, *University of Wisconsin-Madison*.

Interactive engagement of students with course material, the instructor and other students is key to in-depth learning. Our objective was to study the use of web-based tools to help students prepare for discussion as the primary mode of class time interaction for the semester. Students in a required upper level course in ruminant nutrition ($n=18$) and an elective course in environmental management of livestock operation ($n=8$) were surveyed (SU=survey) 3 wks into the semester and at the end of the semester (EV=evaluation). Aspects of the course that contributed to learning gains were evaluated with a modified Student Assessment of Learning Gains (<http://www.wcer.wisc.edu/salgains/instructor/>). Scores (S) were on a 1-to-5 Likert-type scale (1=Not at all and 5=A great deal) for the environmental course, but 1-to-10 for the nutrition

course. Separate analyses of variance measured the impact of student standing (junior vs. senior vs. graduate student) and the change in students perception during the semester (EV vs. SU). Electronic components of the environmental course that contributed positively to learning (S=4.1) included the transcription of lecture material (S= 4.5) and real-world case studies (S=4.3). Quick time movies of lecturer (broken down in 3-5 min. segments) and a test-your-knowledge quiz ranked lower (S=2.8 and 3.7, respectively). Students felt increasingly comfortable asking questions and their interest for the course increased during the semester (4.0 vs. 4.6, $P = 0.03$ and 3.6 vs. 4.4, $P = 0.08$ for SU and EV, respectively). For the nutrition course, however, students resented having to download reading material and did not find the test-your-knowledge quiz useful (S=5.6). Self-assessed learning gains averaged 9.0, 6.3 and 5.0 for graduate students, seniors and juniors, respectively (all $P < 0.001$). Returning to lecture was ranked low for the nutrition

(S=5.8) and the environmental course (S=2.7). The success of web tools to prepare students for class discussion depends on careful integration with other course components, students maturity or motivation, and the establishment of positive group dynamic early in the semester.

Key Words: Undergraduate education, Web tools, Discussion

275 Using case study format to teach applied dairy herd evaluation. L Kilmer*, *Iowa State University*.

Applied Dairy Herd Evaluation (AnS 435) is a course designed to help students learn how to apply knowledge gained in the classroom to commercial farm situations. Each student works individually with a commercial dairy farm in a case-study format. Students, in consultation with the instructor, select their case-study farm within two constraints: they cannot select their home dairy farm; and the farm must be enrolled on DHI and process their records through Dairy Records Management

Services. Students are taught how to: analyze DHI records and other on-farm records to identify potential problem areas which limit animal performance and/or farm profitability; evaluate on-farm rations and other nutrition-related factors which might limit animal performance; analyze milking procedures, housing, and other factors involved in assessing milk quality; analyze reproductive practices and genetic programs; evaluate cow comfort and facilities; evaluate replacement rearing program; evaluate manure handling and nutrient management; evaluate personnel management; develop practical recommendations based on their analyses of the above factors; evaluate the potential economic impact of their recommendations; and finally prioritize and communicate their recommendations to the management team of the farm. Students develop skills in information gathering, decision making, problem solving, and interpersonal communications. No tests or quizzes are given, however students have weekly homework assignments targeted at a specific aspect of the dairy operation and present their recommendations and economic analyses in a comprehensive report that is shared with the herd owner.

Key Words: case study, undergraduate, teaching

Undergraduate Student Paper Competition

283 Effect of pasteurization of colostrum on serum immunoglobulin concentrations and health of bull calves. K. Shuster*, L. Davis, L. Chapin, J. Liesman, M. VandeHaar, and M. Weber Nielsen, *Michigan State University*.

Immunoglobulins (Ig) in colostrum provide passive immunity to neonatal dairy calves. Colostrum may be pasteurized to reduce the risk of calves consuming viable disease-causing pathogens, but pasteurization can damage colostral Ig. The objective was to determine if pasteurization of colostrum using a batch pasteurizer affected serum Ig concentrations, health and growth rate of calves. Colostrum of high quality (#880550 mg/mL Ig) was divided in half, and one half was pasteurized for 30 min at 61 °C and cooled. Colostrum was stored at -20 °C and thawed in a water bath prior to use. Bull calves were alternately assigned to one of two treatments by date of birth and fed either unpasteurized (U; n=10) or pasteurized (P; n=11) colostrum. Starting body weight did not differ between treatments. Calves were fed 2 L of colostrum within 6 h after birth and another 2 L of colostrum within 12 h after

birth. After 24 h of age, all calves were fed 2 L of milk replacer twice daily and managed similarly according to standard farm procedures. Blood samples were obtained at 48 to 60 h of age for measurement of serum IgG concentrations using a radial immunodiffusion assay. Body weight gain and health indicators were measured from 1 through 10 d of age. Data were analyzed using the GLM procedure of SAS. P colostrum decreased serum IgG concentrations by 20% compared to U colostrum (19.1 mg/mL versus 23.9 mg/mL; $P < 0.06$). Body weight at 10 d of age did not differ between calves fed P or U colostrum (47.8 versus 47.7 kg; $P > 0.66$). Calves fed P colostrum had similar daily rectal temperatures to calves fed U colostrum (39.2 versus 39.1 °C; $P > 0.39$). Fecal scores averaged 3.3 (on a scale of 1 to 5) for 1 through 10 d of age and did not differ by treatment ($P > 0.69$). P colostrum also did not affect ease of breathing of calves. We conclude that pasteurization did not decrease Ig concentration in high-quality colostrum to a degree that produced detectable adverse effects on calf health.

Key Words: Colostrum, Pasteurization, Health