

**176 The effects of breeding for increased milk production in dairy cattle on other productive traits.** G. A. Carpenter\* and E. L. Karcher, *Michigan State University, East Lansing.*

The economic model of milk production in the United States gives incentive to dairy farms that produce large amounts of milk. As a result, there is a movement to genetically select cows for superior production. Unfortunately, breeding cattle based on volume of milk produced may affect other traits, such as survival, milk composition, disease, and reproduction. Current research suggests that the stress associated with higher production may lead to increased mortality in these animals. A study by Castillo-Juarez et al. (2000) suggested an adverse correlation between mature equivalent milk and somatic cell score over the entire lactation. Additionally, cows that are genetically superior in milk production are genetically inferior in fertility (Dematawewa and Berger, 1998).

Although, high production can have antagonistic genetic effects on other productive traits, these effects can be reduced with a combination of breeding selection and sound management practices. Low heritability and repeatability estimates for survival indicate that management can reduce cow mortalities. Moreover, positive error correlations between survival and other traits suggest that producers may be providing better management for high-producing cows than low-producing cows. These management practices may include more meticulous udder preparation and more vigilant estrous detection. Combined, these have the potential to effectively lower the mortality rates for high-producing cows. It can be deduced from these studies that while breeding cattle for increased production can harmfully affect some traits, with proper management, these consequences can be minimized while still achieving a greater profit.

**Key Words:** breeding, genetics, production

## ADSA-SAD (Student Affiliate Division) Undergraduate Competition: Original Research

**177 Feeding brown midrib forage sorghum silage and wet corn gluten feed to lactating dairy cows.** C. S. Heine\*<sup>1</sup>, P. J. Kononoff<sup>1</sup>, J. F. Pedersen<sup>2</sup>, A. G. Geis<sup>1</sup>, and A. M. Gehman<sup>1</sup>, <sup>1</sup>*University of Nebraska, Lincoln*, <sup>2</sup>*USDA-ARS Grain, Forage, and Bioenergy Research Unit, Lincoln, NE.*

Brown midrib (BMR) forage sorghum contains less lignin, resulting in increased NDF digestibility compared to conventional sorghum. An experiment was conducted to evaluate the effects of BMR sorghum silage in diets containing wet corn gluten feed (WCGF). The objective was to determine the effect of diet on milk production, composition, and total tract digestibility. Twenty Holstein cows weighing  $729.8 \pm 3.27$  kg and averaging  $124 \pm 29.0$  DIM were assigned one of the four dietary treatments: 1) conventional sorghum and 0% WCGF, 2) conventional sorghum and 30% WCGF, 3) BMR sorghum and 0% WCGF, and 4) BMR sorghum and 30% WCGF. The experimental design was a  $4 \times 4$  Latin square in which each cow received each diet during 4 21-d periods. In diets containing no WCGF, 27% DM consisted of sorghum compared to diets containing WCGF, in which 17% DM consisted of sorghum. Ruminal NDF digestibility of sorghum silages was evaluated *in vitro* by incubating approximately 0.3 g of sample in rumen fluid for 48 h. The proportion of NDF digested after 48 h was higher ( $P < 0.01$ ) for the BMR sorghum ( $53.0 \pm 1.7\%$ ) compared to the conventional sorghum ( $39.0 \pm 0.78\%$ ). Compared to the conventional sorghum, DMI tended ( $P = 0.07$ ) to be higher when cows consumed BMR sorghum silage ( $24.6$  vs.  $26.0 \pm 1.11$  kg/d). In contrast, total tract NDF digestibility was lower when animals consumed diets containing BMR sorghum silage ( $54.5$  vs.  $57.0 \pm 0.70\%$ ). The inclusion of WCGF did not affect DMI or total tract NDF digestibility, and no interactions between silage type and WCGF were observed. Although cows consumed more of the rations containing BMR sorghum silage, no differences were observed in milk production or composition. Similarly, the inclusion of WCGF did not affect milk yield or composition. Across treatments, milk yield averaged  $30.5 \pm 1.63$  kg/d and fat and protein yield averaged  $1.08 \pm 0.06$  kg/d and  $0.90 \pm 0.05$  kg/d respectively. In spite of increased *in vitro* NDF digestibility and DMI, increases in milk production were not observed in cows consuming BMR sorghum silage and no interactions with WCGF were observed.

**Key Words:** brown midrib, sorghum, wet corn gluten feed

**178 Measuring the citrate content in milk, mammary epithelial cells, and blood using capillary electrophoresis.** M. J. Howell\* and R. Jimenez-Flores, *California Polytechnic State University, San Luis Obispo.*

Citrate is an important regulator of calcium in milk and is indirectly related to de novo fatty acid synthesis in milk synthesis by providing NADPH. In this research our objective was to find if there was a correlation between citrate and milk productivity in the two commercial breeds of dairy cows. Levels of citrate were compared in raw milk, mammary epithelial cells, and blood of 12 cows (6 Holstein and 6 Jersey). Based on productivity records of the Cal Poly Dairy Farm, the cows were classified as high or low producers; they were selected among a herd of 200 cows and chosen at same age and parity. All cows were fed mixed rations and were fed ad libitum. Raw milk was collected by hand, mammary epithelial cells were extracted from the raw milk using Wisteria Floribunda-A lectin bound to magnetic beads (Dynabeads of 10 micron diameter), and blood was collected via tail vein. Experiments were run in triplicate, and all samples were compared to a standard citrate curve using capillary electrophoresis. While there was a similar trend in citrate content between groups in blood and milk, differences citrate levels were only statistically significant in the blood. Jersey high producing cows had an average of 3.7mM greater concentration of citrate in milk samples compared to low producers of the same breed as well as to the high producers of the Holstein breed, where there was an average of 3.9mM greater concentration of citrate. In blood, the citrate content of Jersey high producing cows was statistically significant when compared with lower producing Jerseys ( $p=0.078$ ) as well as compared with high producing Holstein cows ( $p=0.007$ ). Holsteins had no significant difference in citrate levels in the milk or the blood within the breed. Citrate was non-detectible in mammary epithelial cells, as citrate levels in the cells were too low to measure. This data shows there is a difference in citrate concentration between breeds which will have a significant impact on milk composition, like heat stability.

**Key Words:** citrate, productivity, milk

### **179 Effects of black hair coat color in neonatal Holstein bull calves.**

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The objective of this study was to evaluate if the percent black hair coloring on a Holstein calf influences the rectal temperature (RT), or respiration rate (RR) of the calf. Holstein bull calves < 3 d of age were housed in fiberglass hutches from May 3 to July 8, a total of 56 days. Average Thermal Heat Index (THI) was calculated for each day by averaging the 72 recorded temperatures and RH%. The RT, and RR were taken at 0600 (am) and 1800 hours (pm). RT was taken using a digital thermometer. The RR was taken visually. Free choice water intake was measured in mL. The percent black was calculated using a dot grid on a picture of each side of each calf and determining the percentage of dots of black area and of white area. The two sides were added together and the total percentage determined. On day 51, RT, and, PP was recorded each hour for a full 24 hour period. The percent blackness was divided into three categories based upon standard deviation of percent blackness. Low blackness (LB; < 37.1), medium blackness (MB > 37.1 and < 56.9), and high blackness (HB > 56.9). Calves with MB and HB had decreased am RT than LB respectively (374.92 vs. 374.5 vs. 374.8,  $P = < .01$ ). Calves with LB had a greater pm RT than the HB (375.3 vs. 375.28,  $P = < .01$ ) and the calves with MB had the lowest pm RT compared to HB and LB respectively (375.24 vs. 375.28 vs. 375.3,  $P = < .01$ ). Calves with HB had a greater pm RR than those calves with LB and MB respectively (53.08 vs. 48.68 vs. 52.39  $P = < .01$ ). Calves with LB had a greater am RR than those calves with MB (39.50 vs. 39.30  $P = < .01$ ). Calves with HB had decreased am RR than calves with MB (39.48 vs. 39.50  $P = < .01$ ). Calves with HB had a higher water consumption compared to MB (3611.89 vs. 3482.71  $P = < .01$ ). Calves with LB had increased water consumption compared to MB (3572.51 vs. 3482.71  $P = < .01$ ). Calves with the MB had the greatest am RT, and am RR than the LB and HB calves. Calves with HB had a greater pm RR, and the largest increase in water consumption than those calves with LB and MB. Calves with LB had a greater am RR, pm RT, and am RR than the HB and MB calves.

**Key Words:** calves, black

### **180 The effect of TGF- $\beta$ 1 on cell proliferation in the bovine mammary gland during the dry period.**

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Transforming growth factor-*beta*1 (TGF- $\beta$ 1) stimulates stromal cell proliferation and inhibits epithelial cell growth in the mammary gland. The role of TGF- $\beta$ 1 during the dry period of dairy cows is unknown. The objective of this study was to determine whether TGF- $\beta$ 1 affects the proliferation of bovine mammary tissue during the dry period. We hypothesized that addition of TGF- $\beta$ 1 to mammary explant cultures would increase stromal cell proliferation and decrease epithelial cell proliferation. Mammary biopsies from seven multigravid Holstein cows were collected at four different time points—275 days lactation, one week dry, three weeks prepartum, and one week prepartum. Biopsied tissue explants were incubated for two hours in Waymouth's media supplemented with insulin, hydrocortisone, 50 $\mu$ M bromodeoxyuridine (BrdU) and either 0ng or 5ng of TGF- $\beta$ 1. Immunohistochemistry was performed on formalin fixed paraffin embedded tissue sections using the Zymed BrdU Staining Kit (Invitrogen, Carlsbad, CA). Images were analyzed using Image Pro Plus software by manually tagging stained and unstained epithelial and stromal cells. At each time point, approximately 2,200 epithelial cells and 1,500 stromal

cells were counted. When the study is complete, it's estimated that 10,000 to 15,000 cells of each cell type, epithelial and stromal, will be counted. As expected, the preliminary data revealed an increase in epithelial cell proliferation from 0.2 percent during late lactation to 0.7 percent during one week prepartum ( $P < 0.02$ ). TGF- $\beta$ 1 did not alter the percent of cell proliferation in either the stromal or epithelial cell population, however there was large variability in the response. *This project was supported by National Research Initiative Competitive Grant no. 2006-35206-16719 from the USDA Cooperative State Research, Education, and Extension Service.*

**Key Words:** mammary gland, proliferation, transforming growth factor-*beta*1

### **181 The economic impact of soybean meal products on milk production and components for Holstein dairy cows.**

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Dairy producers are continually challenged with volatility in both milk and commodities markets. Protein sources are the most expensive component of a dairy cow ration, contributing to a majority of the purchased feed costs on dairy farms. Two studies were conducted to evaluate various soybean meal (SBM) products when fed in the lactating cow ration as well as their economic effects. In the first study, ruminal disappearance of six different SBM products were tested. Two of the products evaluated were SoyChoice and Turbomeal. These SBM products are treated by different methods to increase the amount of rumen undegradable protein (RUP) by extracting oil from the soybeans. The methods of treatment include a heat-generated expelling process for Turbomeal and both a heat and mechanical extruding process for SoyChoice. At 12 and 16 hours, ruminal protein disappearance was lower for SoyChoice compared to Turbomeal, and hence a higher RUP percentage. In the second study, SoyChoice was examined for its effects on milk yield and components in 120 Holstein dairy cows. SoyChoice was fed for 17 days at 4% ration DM. Turbomeal served as the control and was fed at 3.6% ration DM. Both rations contained 15% CP and 33% NDF on a DM basis and contained similar nutrient compositions. Individual daily milk yields were recorded and also analyzed weekly for components. The SBM products did not affect milk yields and components as they were similar before and after treatment. The percentages of milk fat and protein for the treatments and control groups were 3.5 and 3.1% and 3.7 and 3.1%, respectively. The treatment group was 6.1% higher for income over feed costs (IOFC) versus the control. Based on the similar results in milk components and yields, the product that was treated with both a heat and mechanical extruding process had a higher IOFC and RUP content. The heat and mechanically extruded product can serve as an adequate protein source in dairy cow rations with added economic advantages and provide a higher source of by-pass protein compared to the product that was treated only with a heat-generated expelling process.

**Key Words:** rumen undegradable protein sources, income over feed costs

### **182 Microbial growth in refrigerated colostrum over seven days.**

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Passive transfer of immunoglobulins in colostrum is very important for calf health and growth. Using a protocol that allows the calf to receive clean colostrum in under 6 hours is an important factor for overall herd

health. Colostral immune factors are essential for calf health, but it is thought that bacterial contamination of colostrum may negate some of the benefits (Stewart, et al. 2005). The objective of this study was to establish the rate of bacterial growth from contamination (aerobic and coliform) in colostrum stored in a calf bottle over the course of a week. Colostrum samples were collected in sanitized calf bottles at the first milking after parturition. Bottles were then placed in a refrigerator at 0° Celsius after the first sample was plated. Each day samples from the bottle were plated in duplicate using coliform and aerobic Petrifilm plates (Petrifilm, St. Paul, MN) to measure growth in a 24 hour period. Results for aerobic and coliform bacterial growth and titratable acidity by day increased significantly. Results for coliform growth were 927.88, 617.93, 644.45, 761.88, 1029.82, 1858.15, 1255.66 CFU for days 1 through 7, respectively. Results for aerobic growth were 4621, 23084, 20921, 29171, 46769, 46363, 51406 CFU for days 1 through 7, respectively. Titratable acidity resulted in 0.7221, 0.9291, 1.0258, 1.1692, 1.2415, 0.09661% for days 1 through 7, respectively. The findings of this study suggest that there is significant microbial growth in colostrum stored in refrigeration during a period of one week. These results indicate that colostrum should be fed before one week after collection in order to ensure low bacterial contamination for optimal calf health.

**Key Words:** colostrum, bacteria, calves

**183 Postpartum plasma progesterone changes during early lactation in Holsteins, Jerseys and their crosses.** S. Sheer\*, K. L. Brown, B. G. Cassell, and F. C. Gwazdauskas, *Virginia Polytechnic Institute and State University, Blacksburg.*

First lactation cows (n = 147; 35 Holstein-Jerseys (HJ) crosses, 42 Jersey-Holsteins (JH) crosses, 45 Holsteins (HH), and 25 Jerseys (JJ)) were sampled to determine if plasma progesterone differed between breeds. Blood samples were collected weekly postpartum for a 10 wk period. Statistical models (MIXED) evaluated breed, profile, season (cold - November to May; hot - June to October), and breed by season interaction on days open and the slope of change in progesterone to first increase above 1 ng/mL plasma prior to 30 d postpartum. Profile characterized progesterone changes as delayed where progesterone did not increase above a threshold by 70 DIM; early where progesterone increased above a threshold before 28 DIM and did not cycle; normal where progesterone increased above a threshold before 30 DIM and cycled normally; and short, where progesterone increased above a threshold before 30 DIM and declined below the threshold by the next sample. Days open were significantly affected by profile and breed. Days open for HH were longest (152.6 ± 4.5 d), not different for HJ (132.4 ± 4.5 d) and JH (128.2 ± 4.1 d), and JJ (140.5 ± 5.2 d) was different from all except HJ. Cows with a short profile had 33 to 60 d open less than the other groups. There was a breed by season interaction for days open (P < 0.05). Slope was affected by breed (P = 0.0273), profile (P < 0.001), and breed by season interaction (P = 0.0067). The HH group had a slope of 0.196 ± 0.023, HJ had a 0.160 ± 0.022 slope, JH had a 0.157 ± 0.020 slope, whereas the JJ slope was 0.229 ± 0.026. The JJ slope was steeper than HJ and JH slopes. Profile of progesterone affected (P < 0.0001) slope. A delayed profile had a slope of 0.0024 ± 0.014, early had 0.216 ± 0.017, normal had 0.168 ± 0.018, and short had 0.335 ± 0.061. Only short was not different from early and normal. The delayed slope suggests that there was not an increase in progesterone during the early postpartum period. Breed by season interaction showed a greater slope for JJ in summer and a lower slope in winter than other breed combinations. Breed differences were evident in measures of reproductive efficiency.

**Key Words:** progesterone

**184 Differentiating effects of effective fiber sources on performance of lactating dairy cows.** R. A. Starkey\*, P. N. Gott, M. L. Eastridge, E. R. Oelker, A. R. Sewell, B. Mathew, and J. L. Firkins, *The Ohio State University, Columbus.*

Because of high feed costs and limited availability of some forage sources, alternative effective fiber sources are being considered. The objective of this study was to compare the feeding of corn silage as the sole forage versus feeding corn silage with alfalfa hay, wheat straw, and corn stover to lactating dairy cows. A 5x5 Latin square design was used with 5 multiparous cannulated Holstein cows (122 ± 62 DIM). Diets were: 1) CS = corn silage as sole forage source, 2) ALF = corn silage and 11.5% alfalfa hay, 3) STW-5 = corn silage and 5% straw, 4) STW-10 = corn silage and 10% straw, and 5) STV = corn silage and 5.5% corn stover (without cobs). Diets were formulated for similar concentrations of CP, NFC, and 18% forage NDF, except for STW-10 with 23% forage NDF. Diets were fed for 3 wk, and samples were collected during the last week of each period. Period 4 was extended 9 d because one cow had a displaced abomasum at the beginning of the period. The DMI was lowest for STW-10 (28.6, 28.9, 30.5, 26.7, and 28.6 kg/d for CS, ALF, STW-5, STW-10 and STV, respectively; P < 0.05). The BW (734 kg) and BCS (3.18; 1 to 5 scale) were similar. Milk (35.6 kg/d), milk fat (3.56%), milk protein (2.87%), and MUN (17.4 mg/dl) also were similar. The different forage sources resulted in similar total tract digestibilities of OM (76.9%) and NDF (63.5%). Rumen pH (6.12), acetate:propionate (3.10), and ruminal concentrations of total VFA, acetate, propionate, butyrate, and valerate were similar. Concentrations of isovalerate (P < 0.01) and isobutyrate (P < 0.10) were highest for STW-10 compared to the other diets, and isovalerate was also lower (P < 0.10) for ALF than for STW-5 and STV. Feeding the higher level of straw may have caused more rumen fill and thus reduced DMI, which would likely lower milk yield in a longer study. Feeding similar forage NDF concentrations using corn, alfalfa hay, and wheat straw can result in similar animal performance and ruminal fermentation with adequate formulation of NFC and total NDF.

**Key Words:** corn stover, straw, effective fiber

**185 The effects of betaine on free choice water intake and vital signs related to heat stress of neonatal Holstein bull calves.** J. L. Clark\*, G. A. Holub, and J. E. Sawyer, *Texas A&M University, College Station.*

A study evaluating the effects of Betaine (BET) added to milk replacer on free choice water intake and vital signs related to heat stress was conducted with Holstein calves <3 days in age (n=44; mean BW = 42.28 ± 3 kg). The study was conducted in College Station, Texas beginning on May 13 and ended July 8 (d=56). BET, is reported to be used by the animal as an osmolyte which can help maintain cell volume and fluid balance. Calves were housed in fiberglass hutches with free choice water and commercially available starter feed. BET (2g/d, 96% BET) was added at time of mixing to the .9 Kg of commercially available milk replacer (25% CP; 20% CF). Calves were randomly assigned to BET treatment or control groups. Free choice water intake was measured daily in mls. Starter intake was measured daily in Kgs. Vital signs were measured daily at 0600 h (AM) and 1800 h (PM). Vital signs included Respiration Rate (RR), Pulse Rate (PR), and Rectal Temperature (RT). RR was obtained visually. PR was obtained by digital palpation of the jugular vein and RT was taken with digital thermometer. Water intake in BET calves was greater than control calves (3818.24 and 3528.78; P<.0273). Significant differences in vital signs included RR AM and RR PM. BET calves had a trend toward lowered AM RR (39.03 vs 39.77, P>0.0540); however, PM RR of BET calves was greater than control

calves (52.21 vs 50.72,  $P > 0.0491$ ). In all, calves fed BET consumed more water than control calves, and BET calves had greater RR in the hottest part of the day than control calves.

**Key Words:** betaine, calves, osmolyte

**186 Producer assessment of dairy extension programming in Kentucky.** R. A. Russell\* and J. M. Bewley, *University of Kentucky, Lexington.*

The Kentucky dairy industry is challenged by a shrinking number of dairy farms, an aging farmer population, per cow milk production levels well below the national average, and competition from more progressive dairy industries in neighboring states. To assess opportunities to address these issues through extension programming, a survey was distributed to all licensed milk producers in Kentucky. Two hundred and twenty-nine producers responded to the survey. Within this survey, a series of questions were asked about off-farm meeting attendance. With regard to frequency of off-farm meeting attendance, 1.8% indicated they attended meetings twice per month, 3.5% attended monthly, 12.8% attended quarterly, 29.1% attended twice per year, 25.1% attended annually, and 27.7% indicated they never attended meetings. The top three reasons selected for not attending more meetings were (1) not enough time (62.0%), (2) meetings held at the wrong time of day (37.0%) and (3) meetings not held at a convenient location (32.9%). Producers reported that the most effective methods for extension to communicate with them were (1) printed farm magazines (81.0% of respondents), (2) agricultural newspapers (77.4%) and (3) printed newsletters from a county agriculture agent (75.7%). Respondents indicated that the most important management topics for extension programming (with mean response calculated using the following numeric values: not important-1; important-3, very important-5) were (1) mastitis and milk quality ( $4.35 \pm 1.05$ ), (2) animal well-being ( $4.05 \pm 1.14$ ), (3) disease prevention and vaccinations ( $4.01 \pm 1.06$ ), (4) cow comfort ( $3.97 \pm 1.09$ ) and (5) disease treatment ( $3.95 \pm 1.10$ ). Dairy producers prioritized extension program areas (with mean response calculated using the following numeric values: low-1; medium-3, high-5) as follows: (1) providing written and printed information for producers ( $3.96 \pm 1.31$ ), (2) conducting local and regional extension programs ( $3.74 \pm 1.33$ ) and (3) on-farm planning and troubleshooting ( $3.66 \pm 1.37$ ). These results provide invaluable insight for future dairy-related Cooperative Extension Service programming efforts.

**Key Words:** survey, dairy extension, needs assessment

**187 Performance of weanling goats when fed a mixed concentrate with dried distillers grains compared to a pelleted concentrate.** J. Popowski\*<sup>1</sup>, M. Raeth-Knight<sup>1</sup>, T. Walsh<sup>2</sup>, J. Linn<sup>1</sup>, and R. Larson<sup>2</sup>, <sup>1</sup>*University of Minnesota, St. Paul,* <sup>2</sup>*Hubbard Feeds, Mankato, MN.*

The primary objective was to compare intake, growth, and carcass characteristics of weanling goats when fed a mixed concentrate with dried distillers grains (DDG) or a pelleted concentrate. The secondary objective was to determine the impact of corn processing in a mixed concentrate on goat performance and carcass characteristics. Two groups of 45 weanling dairy crossbred wether goats were randomly assigned to 1 of 3 dietary treatments. Treatments were 1) pelleted concentrate (CON); 2) mixed concentrate using whole corn (MWC); or 3) mixed concentrate using cracked corn (MCC). The CON treatment contained (as-fed basis): corn (43.3%), wheat middlings (30.0%), alfalfa meal (10.0%), soybean hulls (7.5%), soybean meal (4.9%) and vitamins and

minerals (4.3%). Mixed concentrate treatments included (as-fed basis): corn (61.5%), DDG (18.5%), protein/fiber pellet (15.0%) and a molasses trace mineral mix (5.0%). Goats were housed in pens with five goats per pen for 56 d (6 pens per treatment). Treatment diets and water were fed free choice daily and hay was limit fed at 0.23 kg (as-fed)/head/d. Feed offered was recorded daily and refusals were weighed 3 d each week. Body condition score and live carcass evaluation were determined d 1, 28 and 56. Body weights were taken every two weeks. Using three pens per treatment, two goats from each pen (total 18 goats) were harvested for carcass evaluation 3 d after study completion. Concentrate intake and average daily gain was 0.13 kg/d and 0.02 kg/d higher, respectively for goats fed a pelleted compared to a mixed concentrate. Processing corn for mixed diets slightly improved concentrate intake (0.07 kg/d) but had no impact on body weight gain.

**Table 1.**

	Trt <sup>1</sup>			C <sup>2</sup>	
	CON	MWC	MCC	1	2
DM Intake, kg/d					
Total	1.13	0.96	1.04	<0.01	<0.01
Concentrate	0.92	0.76	0.83	<0.01	<0.01
ADG, kg/d	0.17	0.15	0.15	0.03	0.74

<sup>1</sup>Treatments: CON= pelleted concentrate; MWC = mixed concentrate using whole corn; MCC = mixed concentrate using cracked corn. <sup>2</sup>Contrast: 1 = CON vs. MWC and MCC; 2 = MWC vs. MCC.

**Key Words:** goat concentrate, dried distillers grains

**188 The effects of in-vivo derived trophoblastic vesicles on corpus luteum lifespan and serum progesterone concentrations in dairy cattle.** E. R. Waggoner\*, J. L. Fain, and J. R. Gibbons, *Clemson University, Clemson, SC.*

Embryo transfer is a technique used with success in the dairy industry, however freezing embryos for future transfer compromises quality and reduces conception rates. One proposed method of increasing pregnancy rates with frozen embryos is through the utilization of trophoblastic vesicles (TV). Trophoblastic vesicles, formed from the outer, trophoblastic cells surrounding an elongating embryo, secrete bovine interferon tau; the hormone presumed responsible for maternal recognition of pregnancy. It is hypothesized that intrauterine transfer of TVs in normally cycling cows will prevent lysis of the corpus luteum (CL); extending its lifespan and maintaining higher progesterone levels to potentially enhance the opportunity for pregnancy establishment. The current research aims to study the effects of TVs on CL lifespan and serum progesterone (P4) concentrations in dairy cattle. This study consisted of mature, lactating Holstein cows (n=8) and breeding-age Holstein heifers (n=12). Trophoblastic vesicles were generated through embryo collection of superovulated donors 14 days post insemination. After collection, inner cell masses were removed and embryos were sectioned, with segments allowed to incubate 24 hours before freezing. All transfer recipients were synchronized using CIDRs and prostaglandin F<sub>2α</sub> injections. In-vivo derived, frozen/thawed TVs, ranging from 0.6 to 1.0 mm in diameter were transferred on day seven to uterine horns ipsilateral the CL of half the animals in each group (n=10) using standard embryo transfer procedures. Utilizing the same technique the remaining cattle received sham transfers of phosphate buffered saline. Blood samples were collected daily through the estrous cycle for each animal and assayed for P4 concentrations. Beginning at day seven, ultrasonography

was used to map corpus luteum development until return to estrus. No difference in estrous cycle length was observed between the two groups ( $P > 0.05$ ), indicating trophoblastic vesicle lifespan may be limited to

14-20 days and therefore does not significantly delay luteolysis when transferred on day seven of the estrous cycle.

**Key Words:** trophoblastic vesicle, P4, dairy

## Animal Health: Immunity and Swine Health

**189 Pea dietary fiber for adhesion and excretion of enterotoxigenic *E. coli* K88 to prevent intestinal colonization.** P. M. Becker\*, P. G. van Wikselaar, A. J. M. Jansman, and J. van der Meulen, *Animal Sciences Group of Wageningen UR, Lelystad, the Netherlands*.

Enterotoxigenic *Escherichia coli* (ETEC) expressing K88 (F4) fimbriae are associated with post-weaning diarrhea in piglets. Dietary components as well as feed additives can interfere with the colonization of the porcine intestine by ETEC. Digestion resistant fibers, for example, can competitively inhibit the adherence of ETEC to host intestinal tissues. Grain legumes such as peas or faba beans are alternative plant protein sources to soybeans in animal feed that can be cultivated in temperate climates. In fact, these crops are not only rich in protein, but also contain starch and fiber. The aim of this study was to test the binding capacity for ETEC O149:K91:K88ac (LT+/STb+) of pea (*Pisum sativum*, cv. Attika) and faba bean (*Vicia faba*, cv. Divine), and of different fractions of these grain legumes obtained before and after *in vitro* digestion. All products were milled to a particle size of less than 1 mm. *In vitro* digestion was performed using pepsin and pancreatin. Adhesion of ETEC K88 to the pea and bean materials was determined in a microplate-based binding assay. When comparing the raw products, pea hulls, pea inner fiber, whole pea, pea starch and pea protein scored higher in terms of adhesion of ETEC K88 than faba bean starch, whole faba bean, faba bean protein and faba bean hulls. Pea hulls proved even superior to a commercial yeast cell wall product in terms of the binding capacity for ETEC K88. After *in vitro* digestion, the binding capacity for ETEC K88 remained preserved in washed digestion remnants of both pea hulls and whole pea, indicating the potential of these products to offer alternative adhesion sites for ETEC K88 to host receptors in the piglet small intestine.

**Key Words:** anti-adhesion, *E. coli* K88, grain legumes

**190 Health benefits of yeast derivatives: in vitro and in vivo investigation.** A. Ganner\* and G. Schatzmayr, *BIOMIN Research Center, Tulln, Lower Austria, Austria*.

Yeasts have been used for fermentation and baking as well as for health aids throughout the history. In animal nutrition yeast products have been discussed as replacements of preventive antibiotics and as health promoting feed additives for over 20 years. Yeast products which are primarily promoted on the market are cell walls, beta-glucans, nucleotides and autolysed yeast. According to literature, yeast cell walls can prevent colonization of the intestinal tract by pathogens (binding of pathogens through mannose-specific type I fimbriae); beta-glucan and nucleotide products are described as immune stimulants by activating phagocytic cells, but little research has been conducted regarding specific pathogen binding capabilities. Therefore, *in vitro* pathogen binding assays and immunological assays were conducted with subsequent *in vivo* feeding trials to gain more profound knowledge on health benefits of yeast products. The pathogen binding capacity of yeast cell wall was investigated with microplate-based assays by measuring the OD as growth parameter of adhering bacteria. Several *E. coli* and *Salmonella* strains adhered to a particular cell wall product with an amount between 1000 and 1000000

CFU/mg. As immunological parameters the nitric oxygen-production of a chicken macrophage cell line (HD11) stimulated with yeast nucleotides and yeast beta-glucans was analyzed. Production of NO was enhanced up to 100% relative to the positive control (LPS *E. coli* 0127). In an *in vivo* trial with piglets fed yeast beta glucan in concentrations of 250 and 500 mg/kg, beneficial effects on lymphocyte viability and an increase of IL-18 could be demonstrated, however, animal performance was not affected. In an *in vivo* trial, broilers received yeast cell wall at a concentration of 2kg/T. Body weight was improved with statistical differences ( $P < 0.05$ ) compared to the control (+10%) and mortality reduced (-2%), also FCR (-5.8%) was improved to 35 days of age. *In vitro* and *in vivo* results suggest that yeast derivatives are promising health and growth promoters for animal husbandry.

**Key Words:** yeast, pathogens, immunology

**191 Use of *Saccharomyces cerevisiae* fermentation product during *Salmonella* infection in weaned pigs.** K. L. Price\*, H. R. Totty, H. B. Lee, M. D. Utt, M. A. Ponder, and J. Escobar, *Virginia Polytechnic Institute and State University, Blacksburg*.

Fermented yeast products are rich in mannanoligosaccharides, beta-glucans, and other compounds that may optimize gut health and immunity, which can translate into better growth performance and a lower risk of food borne pathogens. The objective of this study was to quantify the effects of *Saccharomyces cerevisiae* fermentation product (Original XPC, Diamond V Mills, Inc., Cedar Rapids, IA) inclusion in nursery diets on pig performance before, during, and after an oral challenge with *Salmonella*. Pigs (n=10/treatment) were weaned at 21 d of age, blocked by BW and randomly assigned to treatments. The experimental design was a complete randomized design in a 2x2 factorial treatment arrangement consisting of diet (control or 0.2% XPC) and inoculation (broth or *Salmonella*). Pigs were fed a 3-phase nursery diet (0-7 d, 7-21 d, and 21-35 d) with ad libitum access to water and feed. On d 14, pigs were orally inoculated with  $1 \times 10^9$  CFU of *Salmonella enterica* serovar Typhimurium or sterile broth. From d 17-20, all pigs were treated with an antibiotic (10 mg/kg BW i.m. ceftiofur). Growth performance was measured during pre-inoculation (PRE; 0-14 d), SICK (14-21 d), and post-inoculation (POST; 21-35 d) intervals after weaning. Rectal temperature (RT), BW, and ADG were measured weekly and daily during SICK. Diet had no effect on BW, ADG or RT during any period ( $P = 0.12$  to  $0.95$ ) or frequency of *Salmonella* shedding in feces ( $P = 0.14$  to  $1.00$ ) during SICK. Pigs inoculated with *Salmonella* had decreased ADG and BW, and elevated RT during SICK ( $P < 0.001$ ). Furthermore, fecal CFU (log transformed) was correlated with ADG ( $r = -0.50$ ,  $P < 0.001$ ) and RT ( $r = 0.63$ ,  $P < 0.001$ ) during SICK. During POST, an interaction between diet and inoculation ( $P = 0.009$ ) on ADG indicated that pigs infected with *Salmonella* grew better while consuming Original XPC compared to the control diet. The addition of XPC to the diets of weaning pigs can result in greater compensatory gains after infection with *Salmonella* than pigs fed conventional nursery diets.

**Key Words:** pig, *Salmonella* challenge, *Saccharomyces cerevisiae* fermentation product