

exercise physiology. The challenge is to establish a common solid foundation of basic horse knowledge and build upon it. The non-science majors particularly need to learn basic biology as well as how it is applied to the horse. There is also a problem with dispelling horse folklore and learned misinformation. A questionnaire distributed at the beginning of each semester revealed that 40 to 50% considered their level of horse knowledge to be "Lots!" with 35% selecting "Moderate". Only 5% or less considered their knowledge level as either "Expert", "A Little", or "None". A "pre-course knowledge exam" completed by the students within the first week assesses the types of horse knowledge and experiences represented in the class. An experiential learning model of do-apply-reflect is used throughout the semester with cooperative learning a key technique. Group work causes the students to work together and maximize their own and each other's learning. Specific cooperative learning examples include the use of Think-Partner-Share and ways to deal with contrasting information and misinformation. This mix of teaching techniques meets the needs of different student learning styles. A "post-course knowledge exam" has indicated that basic horse science knowledge is improved and a final exam practicum allows students to demonstrate that they can apply what they have learned. Horses attract interest from a variety of students and once exposed to an animal sciences course, some may become interested in additional agricultural courses. Most important, these students now have an understanding of a domestic farm animal and an overall improved agricultural literacy.

**Key Words:** Horse Science, Cooperative Learning, Teaching

**642 Integration of an equine program in an animal science curriculum: the minor degree approach.** G. R. Galagher\*, *Berry College, Mt. Berry, GA.*

Student interest has increased pressure toward incorporation or expansion of equine programs into traditional food animal production cur-

riculum. Successful integration of the equine program during a 10-year period into the animal science program at Berry College provides a case study of methodology. Prior to 1989, equine were utilized for physical education activity credit and a senior level horse production course. In 1989, 4 equitation related courses listed under animal science were developed. In the same year, an 8-member intercollegiate equestrian team began competing in the Intercollegiate Horse Show Association (IHSA). Equine minor degree programs open to all academic majors were introduced in 1993, despite pressure to develop an equine option in the animal science major or an equine major. In the same year the equestrian team had to be limited to 65-members due to popularity. Changes in student enrollment in the freshman introduction to animal science course increased 394% from 1988 (n=18) to 1998 (n=71). The equine minor provided a flexible curriculum allowing students to design their program based on interests including: science, business or recreation. The department benefited by increased teaching credit hours generated, recruitment and retention of students, and public relations. The college also benefited in recruitment and retention of students. A survey of species interest was completed by freshman students enrolled in the introductory animal science course fall 1998 (n=71). Students ranked in descending order of interest (7=greatest, 0=least): beef, dairy, domestic pets, horse, sheep, swine, poultry, wildlife/exotics. Mean responses for species interest were: horse (6.1), domestic pets (5.1), wildlife/exotics (4.1), dairy (4.0), beef (3.7), sheep (2.3), swine (1.9) and poultry (1.0). Results indicate a strong preference of freshman toward equine and domestic pets. In 1998, the department maintained 132 animal science majors, 45 equine minors and 15 animal science minors.

**Key Words:** Undergraduate, Equine, Minor degree

## INTERNATIONAL ANIMAL AGRICULTURE

**643 Genotype differences in heat-shock protein (Hsp70) expression in bovine lymphocytes exposed to temperature treatments.** R. Banuelos-Valenzuela\*<sup>1</sup>, C. F. Arechiga<sup>1</sup>, H. R. Vega-Carrillo<sup>2</sup>, and S. H. Sanchez-Rodriguez<sup>2</sup>, <sup>1</sup>FMVZ-Universidad Autonoma de Zacatecas, Zacatecas, Zac. Mexico, <sup>2</sup>CREN-Universidad Autonoma de Zacatecas, Zacatecas, Zac. Mexico.

In order to determine whether heat-shock protein (Hsp70) expression could be a potential indicator of animal adaptation to harsh environments and environmental stress, the present study determined heat-shock protein (Hsp70) expression in response to four temperature treatments in bovine lymphocytes from different breeds (Holstein, Australian-Holstein, Brown Swiss, Limousin and Criollo). Lymphocyte viability was above 98% in all eight replicates performed. Constitutive expression of Hsp25, 60, 75, 90 was determined at 38 C (homeothermic temperature), but only Hsp70 was expressed in lymphocytes. Bovine lymphocytes were then exposed to temperature treatments of 40, 42 and 44 C during 4 h. Exposure of lymphocytes to 40 C induces a slight increase in Hsp70 expression and a maximum expression at 42 C in all five different cattle breeds. There were statistical differences in protein expression due to temperature treatments (P<0.05), but no difference among cattle breeds, and neither the interaction. However, there was a tendency for differences in Hsp70 expression among breeds in a decreasing pattern as follows: Australian-Holstein, Brown Swiss, Criollo, Holstein, and Limousin. In all five cattle breeds, Hsp70 expression decreased at 44 C (lethal temperature for lymphocytes). In conclusion, elevated temperature act as a source of stress for bovine lymphocytes inducing Hsp70 expression, however, further research is required to determine whether Hsp70 expression in bovine lymphocytes could be used as a precise indicator of adaptation to environmental stress in bovines from arid regions or whether Hsp70 expression is correlated with animal adaptation.

**Key Words:** Hsp70, cow, adaptation

**644 Management of tropical pastures renovated using the Barreiro system.** C. D. U. Magnabosco\*<sup>1</sup>, R. D. Sainz<sup>2</sup>, A. O. Barcellos<sup>1</sup>, I. P. Oliveira<sup>3</sup>, and D.O. Costa<sup>3</sup>, <sup>1</sup>Embrapa Cerrados, Planaltina,DF/Brasil, <sup>2</sup>University of California, Davis, <sup>3</sup>Embrapa Arroz e Feijão, Goiânia,GO/Brasil.

Three systems of renovation and management of degraded tropical pastures were compared during two years following renovation using the Barreiro system, which involves establishment of a pasture stand in association with an annual crop, in this case upland rice. System 1 was establishment of *Brachiaria decumbens*; systems 2 and 3 were establishment of *Brachiaria brizantha* cv. Marandu, without and with a protein bank (*Stylosanthes guyanensis* cv Mineiro). Each system was established on 6 ha blocks. Yearling bulls of several breeds (Nelore, InduBrasil, Santa Gertrudis, and Canchim (5/8 Charolais x 3/8 Nelore)) were allowed to graze each area during the dry and wet seasons. Paddocks were rotated in a 35 day cycle, and animal weights and available forage measured at each cycle. Carrying capacity was greater in year 1 (636, 740 and 868 kg/ha/yr) than in year 2 (365, 448 and 480 kg/ha/yr) for systems 1, 2 and 3, respectively. Average daily gains (g/d) were also higher (P<0.001) in year 1 (538) than in year 2 (458). However, there were no differences between breeds, or between high and low 365-day weight EPD groups within the Nelore animals. Total weight gains for each system were 393, 449 and 500 kg/ha in year 1 and 210, 254 and 260 kg/ha in year 2 for systems 1, 2 and 3, respectively. The decline in carrying capacity from year 1 to year 2 was expected, due to disappearance of residual fertilizer from the crop. However, the decline in average daily gains was likely due to an abnormally wet and cold rainy season, which had adverse effects on pasture growth and quality, and on animal performance. In addition, sire EPD for 365-day weight was expected to affect animal performance. It is difficult to draw conclusions from such a small sample, but the lack of effect may have been due to the generally low performance allowed by the environment. Nevertheless, this project is ongoing and further work should help to elucidate some of these interactions.

**Key Words:** Beef Cattle, Pasture renovation, Forage production

**645 Sustainable use of mountain pastures by sheep in Switzerland.** M. Schneeberger\*, *Swiss Sheep Breeders' Association*.

The Alpine area is a complex and fragile ecological system, used by agriculture, tourism and recreation. The Swiss sheep population is 420.000 in total, 200.000 are pastured during summer for approx. 100 d in the Alpine area, 1600 to 2700 m above sea level. Thus, mountain pasture represents an important part of Swiss sheep production systems. Properly managed flocks have positive effects on landscape and reduce danger of avalanche damage to dwellings, roads and railway tracks. Insufficient flock and pasture management, however, can cause damage, i.e. erosions, loss of botanical diversity, and competition for feed with feral animals (chamois, ibex). Sustainable use of mountain pastures, thus, is essential. An interdisciplinary working party studied several mountain sheep pastures. Sheep have a tendency to follow the melting snow and overgraze the young plants, while lower parts of the pastures remain undergrazed. The elements of sustainable use of mountain pastures by sheep were elaborated; 1) Demarcation of the area to be pastured. In general, moderately steep country, covered by closed vegetation, is suited, whereas steep country, only partly covered by vegetation, and areas where grazing increases the danger of erosion are not suited for pasture. 2) System of pasture and flock management. Equal use of pasture can be achieved by permanently guiding flocks by a shepherd and sheep dogs. In most cases, however, this system is not feasible because of topography, and limited to large flocks for economical reasons. Similar results can be obtained by dividing the pasture in paddocks, delimited by natural boundaries or fences. The cost of putting up fences in mountain areas may be prohibitive. The only possible system often is free pasture, where sheep run free and select the location of grazing themselves. 3) Load of sheep, i.e. head per ha. This depends on elements 1) and 2). It varies with altitude, exposition and topography of the pasture. Conflicts between interests of environment conservation and agricultural utilization cannot be completely eliminated, they need to be weighed up according to the particular situation, differing from one farm to the next.

**Key Words:** Sheep, Mountain pasture, Switzerland

**646 Effect of a synchronized-ovulation treatment in Hereford heifers at the beginning of a breeding program with bull sires and/or timed artificial insemination in North-Central Mexico.** J. A. Ramirez-Chequer, R. de Leon-Medina, J. O. Enriquez, M. A. Castillo-Pecina, R. M. Rincon, R. Banuelos-Valenzuela, and C. F. Arechiga\*, *FMVZ-Universidad Autonoma de Zacatecas, Mexico*.

A protocol for synchronized ovulation (SO= d 0, GnRH<sub>a</sub>; d 7, PGF<sub>2a</sub>; d 9, GnRH<sub>a</sub>; d 10, breeding: bull sire or timed artificial insemination) was evaluated in Hereford heifers under two breeding systems: 1) natural breeding with bull sires (BS); 2) timed artificial insemination (TAI). The protocol was implemented and the number of pregnant heifers to first service above total number of heifers was determined (pregnancy rates). Hereford heifers (n=37; >200 kg; from "TULA" Ranch in Zacatecas), were included in a breeding program and exposed to a synchronized-ovulation treatment at two different months during the breeding season (may and august). In d 10, heifers were exposed to either: 1) breeding with bull sire (n=18); 2) breeding with timed artificial insemination for the first service (n=19), followed by breeding with bull sires for subsequent heats. During the first period of the breeding season (may), there were no pregnancies at the first induced ovulation. During the second period of the breeding season (august), 15.8% of the heifers (3/19) were pregnant in response to the synchronized-ovulation treatment (10.5% BS; 5.3% TAI) All pregnant heifers had >250 kg of BW). Pregnancy diagnosis by rectal palpation resulted in a total pregnancy rate of 46% by 180 d after the SO-treatment (17/37) (more pregnancies from following heats within the seasonal breeding of 120 d length). In conclusion, synchronized-ovulation programs can be also implemented in breeding programs with bull sires. Pregnancy rates were greater during the raining season (august), with heifers of greater body weight and with at least a corpus luteum at the beginning of the synchronized-ovulation treatment. Heifers bred with TAI required greater body weights than heifers bred with bull sires.

**Key Words:** beef heifer, timed insemination, bull sire

**647 Manure Management in Dairy Systems: A China-State of Wisconsin Comparison.** M.A. Wattiaux\*<sup>1</sup>, J.M. Powell<sup>2</sup>, G.G. Frank<sup>3</sup>, and Z.G. Wu<sup>2</sup>, <sup>1</sup>*The Babcock Institute*, <sup>2</sup>*U.S. Dairy Forage Research Center*, <sup>3</sup>*The Center for Dairy Profitability, University of Wisconsin, Madison*.

The objective was to compare efficiencies of manure N recycling through crops in contrasting dairy systems in China and Wisconsin. A multi-disciplinary team of scientists interviewed owners or managers of nine farms in China's southernmost province of Yunnan and northernmost province of Heilongjiang and collected data on livestock, crop, grassland, and manure management. The Chinese farms surveyed were located in different agroclimatic zones and differed in size (three to 320 cows), ownership and management style. For this reason, each farm was considered a case study. The data collected were compared to Wisconsin averages (Wisconsin Agricultural Statistics, 1999 and survey results of 93 farms). In Yunnan, the dairy system could be classified as landless because animals were kept in confinement all year and more than 90% of the estimated feed needed was purchased. This landless system was found in peri-urban farms and among small holders who used their land for rice and vegetable crops. Heilongjiang farms were classified as a mixed livestock-crop system in which corn silage served as the forage source during the winter and cows were grazed in communal pasture in summer. Dairy livestock density ranged from 2.2 to 20.9 animal units (one unit = 454 kg BW) per hectare of cropland in China, compared to the average of 1.5 in Wisconsin. Manure availability for cropland application ranged from 156 to 1,468 kg/hectare/yr in China, compared to the average of 104 kg/hectare/yr in Wisconsin. Overall, 12% of manure N was recycled through small holders' crops in Yunnan, as compared to 21% in Wisconsin, while in the peri-urban system 35 to 40% of manure N was captured and exported from the farm. The higher efficiency of the peri-urban system was associated with privatization of manure handling and marketing for vegetable crops. The overall risk of pollution through N loss to the environment was high, but varied considerably depending upon production systems and nutrient management strategies.

**648 Evaluation of three different feeding systems for dairy calves in Mexicali, Mexico.** J. S. Saucedo-Quintero<sup>1</sup>, L. Avendano-Reyes\*<sup>1</sup>, and F. D. Alvarez-Valenzuela<sup>1</sup>, <sup>1</sup>*Instituto de Ciencias Agricolas, Universidad Autonoma de Baja California, Mexico*.

Two trials were conducted with seventy-six Holstein calves to compare daily weight gains and economics of three different liquid feeding systems. All calves received 2 l of colostrum at 6 and 12 h after birth and 4 l of whole milk until day 30 in trial 1 (n=34 and average birth weight of 33.7 kg) and until day 20 in trial 2 (n=35 and average birth weight of 27.2 kg). Calf starter and alfalfa hay were offered from the first week of age until day 60. Calves were alternately assigned to one of three treatments: 1) whole milk (4 l of milk), 2) commercial milk replacer (400 g of milk replacer in 3.6 l of water), and 3) combination of the previous treatments (2 l of milk replacer and 2 l of whole milk). Calves were maintained in pens during the trial. Information was analyzed using a statistical model that included sex, treatment, and the effects sire and initial weight as covariables. In trial 1, average daily weight gain and final weight were similar (P>.05) for treatments 1, 2, and 3 (0.71  $\bar{n}$  0.45, 0.70  $\bar{n}$  0.44, and 0.72  $\bar{n}$  0.45 kg, and 65.6  $\bar{n}$  1.35, 65.5  $\bar{n}$  1.33, and 66.1  $\bar{n}$  1.37 kg) respectively. The cost of feeding during the 30 d of the trial was 440, 239 and 321 dollars for treatments 1, 2, and 3 respectively. In trial 2, average daily weight gain and final weight were similar (P>.05) for treatments 1, 2, and 3 (0.71, 0.64, and 0.68 kg with a S.D. of 0.04, and 63.0  $\bar{n}$  1.63, 60.0  $\bar{n}$  1.72, and 61.8  $\bar{n}$  1.79 kg) respectively. The cost of feeding during the 40 d of the trial was 640, 366, 452 dollars for treatments 1, 2, and 3 respectively. The use of milk replacer represents an economical alternative that can be used for dairy producers in the Mexicali valley, Baja California, Mexico.

**Key Words:** dairy calves, milk replacer, economics

**649 Recovery of degraded tropical pastures using the Barreirao system.** I. P. Oliveira<sup>1</sup>, J. Kluthcouski<sup>1</sup>, C. U. Magnabosco\*<sup>2</sup>, L. C. Balbino<sup>1</sup>, R. S. M. Santos<sup>1</sup>, L. P. Yokoyama<sup>1</sup>, and R. D. Sainz<sup>3</sup>, <sup>1</sup>*Embrapa Arroz e Feijao*, <sup>2</sup>*Embrapa Cerrados*, <sup>3</sup>*University of California, Davis*.

Millions of hectares of pasture in Brazil present serious problems of chemical, biological and physical degradation. We studied direct and indirect systems of pasture recovery to reverse this process. Cost recovery in the direct systems is delayed because of the lag in producing

animals for market. The indirect system (Sistema Barreirao) involves a sequence of soil preparation operations, and planting of new pastures in association with an annual crop. A cooperating farm was selected in the district of Parana - Goiás state, with predominantly medium texture, low fertility Oxisol. The traditional system is characterized by meat and milk production on pasture, with a small area destined to grain crops. The pastures planted in the 1970's presented low carrying capacities, and forage and concentrate production was insufficient for animal maintenance. Three alternative systems were compared during eight months: A) Traditional; B) Barreirao system, using upland rice and *B. brizantha*; and C) Barreirao system, using corn and *B. brizantha*. Systems B and C produced 2,821 and 3,040 kg/ha of paddy rice and corn, respectively. Subsequent green forage masses were 2.82 and 6.65, 8.91 and 19.61, and 7.87 and 20.27 kg/ha for A, B and C during the dry and rainy seasons, respectively. The overall stocking rates were 0.94, 2.19 and 2.00 AU/ha for A, B and C, being 0.52 and 1.35, 1.67 and 2.70, and 1.44 and 2.57 for A, B and C during the dry and rainy seasons, respectively. The total weight gains by cattle were 117, 732 and 639 kg/ha for systems A, B and C, respectively. These were divided into 42 and 75, 199 and 533, and 133 and 506 kg/ha for A, B, and C during the dry and rainy seasons, respectively. We conclude that systems B and C were successful in recovery of pastures, but that system B yielded higher returns in both grain production and animal gains. This system enables more rapid cost recovery, through production of a cash crop.

**Key Words:** Pasture, Crops, Recovery

**650** **Hydropic-fetal membranes in cows from an endemic region in Southern Zacatecas State, Mexico.** F Flores<sup>1</sup>, J Valencia<sup>2</sup>, R Rosiles<sup>2</sup>, R Banuelos-Valenzuela<sup>\*1</sup>, and CF Arechiga<sup>1</sup>, <sup>1</sup>FMVZ-Universidad Autonoma de Zacatecas, <sup>2</sup>FMVZ-Universidad Nacional Autonoma de Mexico.

Quantity and volume of amniotic and allantoic fluids in healthy Zebu/crossed cows was determined throughout the nine months of gestation (n=90). Metabolites in amniotic and allantoic fluids were measured at each third of gestation. Moreover, necropsies were practiced in healthy (n=10) and hydropic cows (n=5) from an endemic region in southern Zacatecas State in Mexico. Anatomy, pathology and blood exams were performed, as well as evaluation of metabolites in amniotic and allantoic fluid, in order to determine differences among healthy and hydropic cows. Results showed that quantity of amniotic and allantoic fluids increase as fetal size increases. At 1st third of gestation, healthy cows showed greater levels of Cl, Na, K, Mg, P, Ca and creatinin (P<0.05) in amniotic fluid than allantoic fluid, but uric acid was lower (P<0.01). At 2nd third of gestation, Cl, Na and glucose increased (P<0.05) in amniotic fluid, and Mg, K, uric acid and creatinin increase in allantoic fluid (P<0.01). By the end of gestation, Cl, K and uric acid increased, but Na decrease in amniotic fluid (P<0.01). In conclusion, healthy cows showed increased levels of Cl, Na, glucose, uric acid, and total protein in amniotic fluid. As well as greater levels of K, Mg, glucose, creatinine and uric acid; but lower Cl, Na and total protein in allantoic fluid than in hydropic cows. Blood levels of Cl, Mg, glucose, cholesterol and glutamic-oxaloacetic transaminase were greater in hydropic cows than healthy cows (P<0.01) with no differences among Ca, P, K, Na, uric acid and total protein. Hydropic cows had amniotic and allantoic fluids in a range of 80-110 L, smaller placentomes and adrenal glands, degenerated pituitary and thicker placenta with edema (even 10 cm of thickness).

**Key Words:** cow, hydrops, fetal membranes

**651** **Effect of male presence on reproductive function and estrous cycle succession in Mexican-Criollo goats exposed to a controlled photoperiod.** R. M. Rincon<sup>\*1</sup>, F. de la Colina<sup>1</sup>, F. J. Escobar<sup>1</sup>, R. Banuelos-Valenzuela<sup>1</sup>, J. Valencia<sup>2</sup>, and C. F. Arechiga<sup>1</sup>, <sup>1</sup>FMVZ-Universidad Autonoma de Zacatecas, <sup>2</sup>FMVZ-Universidad Nacional Autonoma de Mexico.

The purpose of the present study was to determine whether it was possible to increase reproductive activity (i.e., shorten anestrus season) by controlling buck presence, in mexican-criollo goats under a defined photoperiod. Thus, reproductive function of mexican-criollo goats (n=10) exposed to a six-months long photoperiodic cycles was evaluated either, in the presence or not of a male buck. Goats were housed in controlled chambers and artificially exposed to light in a range of 10.6 to 13.4 hours

per day increasing and decreasing gradually throughout a six-months cycle (instead of a whole year as normally occurs at our research station in Zacatecas, Mexico; latitude 22, 57' N). Goats were randomly assigned to two groups of five animals each: 1) goats exposed to a sexually active male wearing a harness that prevented coitus, and, 2) goats not exposed to male. Blood samples were collected twice weekly and progesterone was determined by radioimmunoassay. The presence of the male shortened anestrus and increase reproductive function and estrous cycle succession. In Group 1, male presence increased ovarian activity during longer light-hours days, while, in Group 2, goats still remained in anestrus. Mean number of estrous cycles during long days were 3.2  $\bar{n}$  0.8 vs. 0.8  $\bar{n}$  0.8 for Groups 1 and 2, respectively (P<0.05), and did not differ during shorter light-hours days (5.6  $\bar{n}$  1.1 vs. 6.0  $\bar{n}$  0.7, for Groups 1 and 2, respectively) (P>0.05). In conclusion, the presence of a male increased reproductive function of female goats exposed to a six-months long photoperiodic cycles shortening the anestrus period and improving estrous cycle succession.

**Key Words:** goat, photoperiod, male effect

**652** **Serum calcium and phosphorus levels throughout the year in six beef cow genotypes grazing semi-arid range at the northeast of Mexico.** E.M. Romero-Treviño\*, M. Castillo-Martinez, E. Gutiérrez-Ornelas, E. Olivares-Saenz, H. Bernal-Barragan, and C. De-Luna-Villarreal, *Universidad Autonoma de Nuevo Leon, Mexico.*

One hundred forty cows and 17 heifers representing Charolais, Simmental, Beefmaster, Brangus, Hereford and Bradford breeds from six production units in the Northeast of Mexico were sampled throughout a year to evaluate the effect of season of the year on body condition score (BCS) and their levels of Ca and P in blood serum. Native and introduced grasses such as *Bouteloua gracilis* and *Cenchrus ciliaris* were the principal forage species available for grazing. Mineral supplementation practices varied from minimal to adequate. Blood samples were taken from the coccigea vein, they were centrifuged at 970 X g for 10 min to separate serum which was kept frozen (-20° C) until the analysis. Serum was analyzed for Ca and P using the atomic absorption and colorimetric procedures, respectively. Effects of genotype and season were analyzed using the GLM procedure, using production units as the blocking criteria. There was difference (P > .05) in the changes in BCS recorded among the breeds throughout the year. Serum Ca levels ranged (P < .05) from 6.8, during spring, to 10.9 mg/dL during winter and cows from only one production unit were marginal deficient for Ca. Charolais and Beefmaster cows trend to have lower Ca levels than the rest of the genotypes, but no effect (P > .05) was found for P levels. Serum P levels ranged (P < .05) from 4.0, during spring, to 8.5 mg/dL during summer in heifers. Supplementation strategies should be developed to provide adequate supply of Ca and P.

Production unit	1	2	3	4	5	6
Ca:P (mg/dL)						
Spring	8.5:4.0	6.8:5.4	8.6:5.4	10.0:5.2	8.6:6.0	10.3:6.5
Summer	8.8:6.0	8.7:5.0	9.2:6.0	10.2:4.7	9.2:6.9	
Autumn	9.7:4.9	8.7:6.9	10.1:6.8	9.9:8.6	10.8:5.7	8.9:6.4
Winter	8.9:5.8	7.9:6.8	10.2:6.0	10.9:4.6	8.7:7.1	11.3:4.3
SE±	.10:.19	.12:.20	.12:.16	.11:.14	.13:.16	.14:.17

**Key Words:** Calcium, Phosphorus, Beef cows

**653** **The effect of molasses-urea supplementation on high fiber buffalo diets in Gujarat State, India on production parameters and methane losses.** G.W. Turnbull\*, B. Ducharme, R. Livingston, and R. Bowman, *Global Livestock Group.*

The objective was to evaluate the effect of molasses-urea supplementation on typical high fiber diets in Gujarat State, India on milk production, butterfat production, weight gains, reproductive performance and methane production. Sixteen buffalo blocked by weight and lactation number were randomly assigned to either a basal ration (BR) or BR plus a molasses-urea supplement (BR-MU). The BR consisted of mixtures of rice straw, wheat straw, Jowar, alfalfa, cottonseed cake and wheat bran. Daily feed offerings, orts, milk production and reproductive performance were recorded. Milk samples taken from two consecutive milkings were used for butterfat analysis. Body weights were taken every 14 days. Four animals from each group were randomly chosen to measure daily

methane emissions. Methane was measured using an internal tracer (sulfur hexafluoride, SF<sub>6</sub>) method. The buffalo were fitted with collection canisters and measurements were taken for five consecutive days. The gases were analyzed using a gas-liquid chromatograph equipped with a flame-ionization detector and an electron capture device. Results were analyzed using analysis of variance procedures. Buffalo consuming the BR-MU produced more 4% Fat Corrected Milk as compared to the BR group ( $P < 0.05$ ) (63.7 liters vs. 51.8 liters). When analyzed monthly, buffalo consuming the BR-MU produced more milk per month ( $P < 0.05$ ) as compared to buffalo consuming BR. Likewise, buffalo consuming the BR-MU has a greater butterfat concentration as compared to the BR group ( $P < 0.05$ ) (6.6% vs. 6.0%). Furthermore, the average weight gain of buffalo consuming the BR-MU was greater ( $P < 0.05$ ) than the BR group (28 kg vs. 15 kg). Daily methane production for the buffalo consuming the BR-MU was 190 grams per day as compared to 239 grams per day for the BR group ( $P < 0.05$ ). Supplementing typical high-fiber buffalo diets with a combination of molasses-urea resulted in greater daily production of butterfat, milk and weight gain. Furthermore, the addition of molasses-urea resulted in a 20% reduction in the amount of methane produced per animal and the amount of methane per unit of 4% FCM was 34% less. The data suggests that the supplementation of high fiber diets with a molasses-urea combination will reduce methane emissions.

**Key Words:** methane production, global warming, molasses-urea supplementation

**654 SUPEROVULATORY response and embryo recovery in buffalo heifers and cows treated with Super-Ov and LH gonadotropins.** A.M. Osman\*, S.H. Shehata, and G.A. Megahid, *Dept Theriogenology, Fac. Vet. Medicine, Assiut University, Assiut.*

Superovulation and nonsurgical embryo collection were tried on 5 heifers and 10 buffalo cows. These animals were healthy, cycling, non lactating

## MEAT SCIENCE AND MUSCLE BIOLOGY

**655 Pork quality of pigs finished indoors or outdoors under a commercial setting.** J.G. Gentry, J.R. Blanton, J.J. McGlone, and M.F. Miller\*, *Texas Tech University, Lubbock.*

The objective of this study was to determine the effects of outdoor and indoor housing on pork quality of pigs. Barrows and gilts were randomly selected from a group of indoor raised pigs and placed into one of two housing systems. The outdoor housed pigs were finished on a dirt lot while the indoor housed pigs were finished on concrete slats. The average initial weight of the pigs was 30 kg. Carcass data were collected and boneless loins were aged for 14 days. Pork loins were cut into 2.54 cm thick chops and frozen for further analysis. Retail shelf life was evaluated on chops aged 14 days in a simulated retail case. Chops were scored daily for color, uniformity, discoloration and browning. Hunter L\*, a\*, b\* measurements were taken at the 10th rib. Other measurements included subjective color, firmness, and marbling, Warner-Bratzler shear force (WBS) and sensory panel scores for tenderness, juiciness and flavor. No differences were detected for average daily gain ( $P > .05$ ). Outdoor finished pigs had a larger loin eye area ( $P = .0003$ ), whereas indoor finished pigs had a higher NPPC marbling score ( $P = .001$ ). There were no significant differences in 6, 12 or 24 hr pH measurements of the *Longissimus dorsi* muscle. No differences were detected for sensory evaluation except, indoor pigs had a higher initial juiciness score ( $P = .003$ ), which may be attributed to the higher marbling score. Retail display scores were similar among the groups, but the outdoor finished pigs had lower visual color scores on day 1 and day 4 ( $P < .05$ ). These results indicate little differences in pork quality of pigs finished in outdoor and indoor environments.

**Key Words:** Pigs, meat quality, environment

**656 The effect of magnesium supplementation on pork quality.** R. vanLaack\*<sup>1</sup>, <sup>1</sup>*Department of Food Science and Technology, University of Tennessee, Knoxville.*

The objective of the study was to determine the feasibility of improving pork quality by magnesium supplementation, as magnesium-sulfate. In a pilot study, we determined that the level and duration of magnesium

and 2-5 years old. They were selected from those raised in a local buffalo farm. Through rectal examinations, these animals were assigned to be at mid luteal phase before superovulation treatment. Super-Ov (purified porcine FSH: Mfd. in Canada by W.A. Montreal Inc.) was administered intramuscular, morning and evening for 3 consecutive days (Total 75 NIH. unit divided into 6 equal doses). Lutalyse 25 mg was injected with the fifth Super-Ov injection according to manufactures instructions. In addition, 2000 USP unit chorionic gonadotropine (Steris, Lab. Inc. Phoenix, Arizona) was injected at the 5th day of the treatment to improve rate of ovulation. All buffaloes were closely observed by experts to detect the onset and duration of oestrus. Buffalo bulls were allowed to mount female at oestrus several times. Rectal examinations was performed to count numbers of corpora lutea (CL) and unovulated follicles at day 7 from breeding and just before the nonsurgical embryo collection. The onset of oestrus began earlier in heifers than cows (16.0 + 1.4 and 24.7 + 9.9 hours respectively) and the difference was significant ( $P < 0.05$ ). The duration of oestrus was significantly shorter ( $P < 0.05$ ) in cows than heifers (30.2 + 3.7 and 39.2 + 8.1 hours respectively). The number of CL was significantly higher ( $P < 0.01$ ) in cows than heifers (4.2 + 1.03 and 2.4 + 0.5 respectively). The number of unovulated follicles was significantly higher ( $P < 0.05$ ) in heifers than cow (4.4 + 1.6 and 2.3 + 0.67 respectively). The ovulation rate is higher in cows (83%) than heifers (35%). Uterine flushing failed in 3 cases due to narrow cervix (2 heifers) and subclinical endometritis (1 cow). The other flushing revealed a total of 12 embryos with a recovery rate of 27.9% (range from 0-66%) from the cows only. The used protocol appeared satisfactory in buffalo cows rather than heifers.

**Key Words:** Superovulation, Buffalo, Embryo

supplementation required to increase blood levels of magnesium (Mg) by 10% was 2 g elemental Mg/kg feed for 5 days before slaughter. The final concentration of Mg in the control and supplemented feed were 1.3 and 3.7 g Mg/kg feed, respectively. Subsequently, 100 halothane-negative pigs were supplemented at this level of magnesium for 5 days before slaughter. One-hundred non-supplemented pigs of the same genetic line were used as control group. Pigs were slaughtered on day 6, after 12 h fasting and transport to the packing plant. Blood, collected immediately after slaughter, was analyzed to determine Mg concentration. Blood Mg concentration in supplemented animals was 10% higher than in the control group ( $P < 0.05$ ). At 30 min, and at 3, 5 and 20 h postmortem, the pH in the loin was 6.43, 6.39, 6.20 and 5.71 respectively. Mg supplementation did not influence the pH decline. Meat quality characteristics at 24 h postmortem (color and water holding capacity) of the loin and ham (semimembranosus muscle) were not influenced by Mg supplementation. Mg supplementation did not influence purge % and shear force of 3 weeks stored loins. We conclude that in normal halothane-negative pigs, short term Mg supplementation does not significantly improve pork quality or reduce purge losses.

**Key Words:** Magnesium supplementation, Water-holding capacity, Color

**657 Effect of chromium-methionine supplementation on the apparent muscle fiber number in newly hatched Japanese quail (*Coturnix coturnix japonica*) under heat stress condition.** G. Contreras\*, F. Rios, and R. Barajas, *Universidad Autonoma de Sinaloa, Sinaloa, Mexico.*

The fact that chromium stabilize nucleic acids is known, in concordance with that, the hypothesis that organic chromium supplementation increase myofiber number was tested in this study. Our objective was to determine the effect of chromium-methionine supplementation on apparent muscle fiber number in newly hatched Japanese quail under heat stress condition. A complete randomized design experiment was conducted. 320 breeders Japanese quail (240 females and 80 males) were divided in 10 groups of 32 avian (24 females and 8 males), and allocated in metal wire cages. The quails were randomly assigned to one of two experimental diets: 1) Diet containing 21% CP and 2.9 Mcal of