

zearalenone. Feed intake and body weight were monitored over a 21-day period. Horses were maintained on a fixed exercise schedule during the supplementation phase. At the end of the supplementation phase each horse completed a time to fatigue treadmill step test. Parameters measured during pre-test, each step of the test and 5 and 10 minutes post-test were: (1) time to fatigue (2) heart rate (3) hematology (4) serum lactate levels. Feed intake of horses fed contaminated grains was significantly reduced compared to controls throughout the experiment. Consumption of forage remained unaffected regardless of diet fed. Sig-

nificant weight loss over 0 to 21 days was observed in horses fed contaminated grains as compared to control. Horses fed contaminated grains had significantly higher serum lactate levels at time of fatigue, while levels were significantly reduced 10 minutes post-test. It was concluded that horses are susceptible to *Fusarium* mycotoxicoses as indicated by appetite suppression and weight loss.

**Key Words:** Deoxynivalenol, Equine, Exercise

## Rabbit

**T112 Effect of doe-litter separation on reproductive performance of lactating rabbits does.** A. Espinosa, R. Lazaro\*, R. Carabaño, and P.G. Rebollar, *Universidad Politecnica de Madrid, Spain.*

Two trials were conducted to study the influence of separating the litter from the doe for 53 h on fertility and reproductive parameters of multiparous Californian x New Zealand White crossbred female rabbits. There were two treatments; a control group in which litters had free access to nursing and a bioestimulated group in which litters were separated from their does from Day 9 (9:00 a.m.) to Day 11 (14:00 p.m.) postpartum. All the does were artificially inseminated (AI) between 10:00 and 11:00 a.m. of Day 11 postpartum. In trial 1, a total of 419 AI (experimental unit), carried out in 132 multiparous does, was analyzed to determine fertility rate (number of farrowing/number of AI x 100). Separation of the litter from the doe increased fertility with respect to the control group (68% vs 53%,  $P < 0.001$ ). In fact, fertility rate was 38%, 30%, and 31% higher for 2nd, 3rd, and 4th parturition ( $P < 0.05$ ) for the bioestimulated does. In trial 2, a total of 16 does, between 3rd and 6th farrowings and having more than seven suckling rabbits at parturition were used to estimate milk production from 1 to 21 d postpartum. The experimental treatments were the same than in trial 1 and there were eight replicates (one doe) per treatment. Milk production was higher in the control than in the bioestimulated does (5,090±161 vs 4,593±150 g,  $P < 0.05$ ). In fact, on Day 12, 13, 14, and 15 of the lactation period, milk production was 40% ( $P < 0.0001$ ), 18% ( $P < 0.05$ ), 15% ( $P < 0.05$ ), and 15% ( $P < 0.01$ ) higher for the control than for the bioestimulated group, respectively. Also, restricting suckling for 53 h from Day 9 to Day 11 of lactation increased oestradiol 17- $\beta$  during 48 h after the separation and reduced prolactin serum concentrations 24 h after the separation. We concluded that bioestimulation increased fertility rate, specially from the 2nd to the 4th farrowing, but reduced milk production during the first 21 d postpartum.

**Key Words:** Doe-litter separation, Rabbit fertility, Milk production

**T113 Milk production evaluation in rabbits milking one or two times a day.** R. Salcedo-Baca\*<sup>1,2</sup>, J. L. Echegaray-Torres<sup>2</sup>, and A. Robinson<sup>1</sup>, <sup>1</sup>*University of Guelph, Guelph, ON, Canada*, <sup>2</sup>*Universidad Autonoma Chapingo, Texcoco, Estado de Mexico, Mexico.*

Milk production (MP) is an important trait for profitability of rabbit production, since it affects the litter weaning weight. Currently, under a typical management system, the doe is allowed to milk her litter only once a day for 5 to 10 minutes. Some reports in the literature have indicated that around 20 to 30 % of the does would get into the nest to milk 2 times a day if they were allowed. The objective of this study was to evaluate the effect of the number of times milked in a day (one or two) on the total milk production of the doe. In the Universidad Autonoma Chapingo, Mexico rabbitery, sixteen multi-parous New Zealand does with their litters (85 young) were evaluated for a lactation period of 35 days (during January and February, 2003). Every day the litter was weighed before and after milking in order to measure the MP of the doe. Does were separated into morning only milking (T1, n=7) and morning and night milking (T2, n=9). SAS PROC GLM was used to analyze the records, fitting a model including milking pattern, and litter size at birth, day 3, 15 and 30 as covariates. The model explained 75% of the variation. Highly significant differences were found between treatments: 3232g and 4070g for T1 and T2 respectively, the litter size was a significant variable as well. To investigate the effect on fertility, the does were not allowed to milk on day 10 and artificially inseminated (AI), on day 11 after parturition. Pregnancy diagnosis through abdominal palpation was conducted 11 days after breeding. T1 and T2 had 72% and 89%

of pregnancy respectively. There were no significant differences in the doe weight change during the last 2 weeks of the experiment. For the entire period mortality of the young was 8.6% and 6.0% for T1 and T2 respectively. The average individual weight of the young at the end of the test was 511g and 657g for T1 and T2, with litter size of 4.6 and 5.2 respectively. Two times a day milking, when labor cost is not expensive, is thus recommended.

**Key Words:** Rabbit, Milk, Production

**T114 Parturition synchronization in rabbits using prostaglandins: Optimal time for hormone application.** J. L. Echegaray-Torres\*<sup>1</sup>, R. Salcedo-Baca<sup>1,2</sup>, and C. Flores-Martinez<sup>3</sup>, <sup>1</sup>*Universidad Autonoma Chapingo, Chapingo, Edo. de Mexico*, <sup>2</sup>*University of Guelph, Guelph, ON, Canada*, <sup>3</sup>*Instituto Tecnoligico Agropecuario de Oaxaca, Oaxaca, Mexico.*

Currently, industrial rabbit systems typically manage does in sets (bands). Each set of does is artificially inseminated together, but parturition can occur over a 4 d period. This spread in parturition time increases labor demands to attend to does, or alternatively, increases the risk of mortality in the progeny. In addition, fostering young from bigger to smaller litters increases in difficulty as age gaps widen. The objectives of this study were to use pregnant N.Z. White does to 1) evaluate the effectiveness of prostaglandins (PG) in synchronizing parturition and 2) discern optimal PG application times. In Exp. 1, 39 (Jan. 2001) and 31 (Nov. 2002) does were injected with PG 29 d post-insemination (100 mg PG/doe; T1). Respective control groups (T2) contained 38 and 27 does. Time of parturition was measured in hours considering zero the moment of hormone application. Time of parturition was higher ( $P=0.05$ ) in between treatments 53:55 and 66:22 for T1 and T2 respectively. Also, more (97% vs. 60%;) deliveries occurred within 48 h from start of first delivery in T1 than in T2. Litter size at birth (live progeny) was similar in T1 (7.8) and T2 (8). In Exp. 2 (Jan. 2003), different PG application days and times post-insemination (same dose as Exp.1), were tested against a control group (Td), d 29 am (Ta), d 29 pm (Tb), and d 30 am (Tc), each group with 20 does. There were significant differences between treatments in time of parturition (50:42ab, 54:07b, 43:25a, and 55:10b for Ta, Tb, Tc and Td respectively). Parturitions recorded in the first 24 h after the first delivery was 69, 89, 43, and 70% for Ta, Tb, Tc, and Td respectively. In conclusion, injection of 100 mg/doe PG on day 29 (pm) of pregnancy is recommended for rabbit production systems where does are managed in sets.

**Key Words:** Rabbits, Parturition, Synchronization

**T115 The shape of the lactation curve in rabbits milking once or twice a day, and the function to estimate the total milk production.** R. Salcedo-Baca\*<sup>1,2</sup>, J. L. Echegaray-Torres<sup>2</sup>, and A. Robinson<sup>1</sup>, <sup>1</sup>*University of Guelph, Guelph, ON, Canada*, <sup>2</sup>*Universidad Autonoma Chapingo, Texcoco, Edo. de Mexico, Mexico.*

A typical doe production milk (MP) curve starts with around 50g/day increasing to reach a peak, between 200 and 250g, around day 21 and then declines to day 30 when it varies around 150g. The total MP is affected by the litter size. The persistency is known to be influenced by the breed-back schedule; shorter days open results in the MP declining sooner. To predict the total MP the following regression equation is recommended (RER) in the literature to model a rabbit lactation curve (LC):  $MP = 1.77 + 1.39 LW_{21}$ , where  $LW_{21}$  is the litter weight at day 21. Currently milking in rabbits, under commercial production systems, is restricted to once a day. The aim of this study was to find out if there are differences in total MP, shape of the lactation curve and goodness of

fit of the LC function estimating MP under one (T1) or two (T2) times a day milking. The material and methods have been described in another abstract in these proceedings\*. The statistical analysis was done with SAS, PROC REG and PROC CORR, to derive a new lactation curve prediction equation (NLC). Total MP was higher for T2 compared to T1 (4070g vs. 3232g). The peak was reached between days 17-18 and 19-20 for T2 and T1 respectively. Persistence, however, was better for T1, which had a higher production after day 29 than T2. The NLC derived in this study added two components; MP on day 4 and day 30, as

follows:  $MP = 804 + 9.4 MP4 + 1.4 LW21 + 5.5 MP31$ . The correlations were 0.92 and 0.96 between the true MP and LC, and true MP and NLC. In addition MP was underestimated on average in 40% of does with LC while NLC overestimated MP in just 4% of does. If MP is a trait to be improved genetically based on a prediction of lactation milk yield, we recommend fitting a regression incorporating multiple measures of daily milk yield like NLC.

**Key Words:** Lactation, Curve, Rabbits

## Ruminant Nutrition: Dairy and Beef

**T116 Effects of rumen degradable protein and fiber quality on extracellular proteolytic activity in continuous culture.** D. Hastings, K. Griswold\*, T. Kochman, B. Jacobson, and G. Appar, *Southern Illinois University*.

The effects of rumen degradable protein (RDP) and fiber quality on extracellular proteolytic activity (PA) were examined using a 4 x 4 Latin square with a 2 x 2 factorial arrangement of treatments in dual-flow continuous culture. Factors were level of RDP and quality of fiber, and the treatments were: 1) high RDP (12.4% of dietary DM), high quality alfalfa (156 RFV) (HPHF); 2) high RDP (12.4% of dietary DM), low quality alfalfa (105 RFV) (HPLF); 3) low RDP (10.4% of dietary DM), high quality alfalfa (156 RFV) (LPHF); and 4) low RDP (10.4% of dietary DM), low quality alfalfa (105 RFV) (LPLF). Periods were 10 d and samples were collected daily at 0800 h from fermenter contents and from 24 h effluent composites. Samples were centrifuged (20,000 x g, 20 min, 4°C), and supernatant was analyzed for protein content and PA. Using an azocasein assay, PA was defined as units of activity/mg protein, where a unit equaled the change in absorbance at 450 nm/min based on the purified activity of Subtilisin (EC 3.4.21.62). Data were analyzed using SAS MIXED procedures with the model including period, fermenter, RDP, fiber quality, RDP x fiber quality interaction, type of sample (composite vs single time point), and day included as a covariate. Composite samples had greater (P=0.01) protein concentrations and less (P=0.05) PA than single time point samples. Sample protein concentration (mg/mL) was 0.27, 0.40, 0.34, and 0.36, and PA (units/mg protein) was 0.18, 0.16, 0.16, and 0.14 for HPHF, HPLF, LPHF and LPLF, respectively. Dietary RDP concentration had no effect (P>0.05) on sample protein concentration or PA. There was a RDP x fiber quality interaction for HPHF protein concentration to be less (P<0.01) than all other treatments. Decreasing fiber quality increased (P<0.01) protein concentration, and in turn, decreased (P=0.05) PA. These results suggest dietary fiber quality may have a greater influence on ruminal extracellular proteolytic activity than dietary RDP.

**Key Words:** RDP, Fiber quality, Proteolytic activity

**T117 Relative transit time of chyme between duodenal and jejunal segments of the small intestine of cattle.** V. M. Gonzalez<sup>1</sup>, E. G. Arellano<sup>1</sup>, G. Mendoza<sup>1</sup>, F. G. Monge<sup>1</sup>, A. Plascencia\*<sup>1</sup>, E. Silva-Pena<sup>1</sup>, C. Vasquez<sup>1</sup>, and R. A. Zinn<sup>2</sup>, <sup>1</sup>Universidad Autonoma de Baja California, Mexico, <sup>2</sup>University of California, Davis.

Two steers (228 ± 4.5 kg) were equipped with cannulas (25 mm ID) in the small intestine to measure transit time of chyme within the duodenum, and jejunum. Sites for cannula placement were 1) proximal duodenum (6 cm from the pyloric sphincter); 2) duodenal-jejunal juncture (10 cm from the duodenocolic fold) and 3) distal ileum (22 cm from ileocecal valve). Steers were fed 5.75 kg of alfalfa hay (ground to pass through a 7.6 cm screen). Transit time was measured during three consecutive days using aniline dye, pulse-dosed via the duodenal and jejunal cannulas. Subsequently, steers were euthanized. Site of cannula placement were confirmed using anatomical reference and tissue analysis. The small intestine was then dissected and measured. Transit time (time required between infusion of aniline dye into the proximal duodenal cannula and its appearance at the duodenal-jejunal and distal ileal cannulas was 2.56 ± 0.06 and 176 ± 4.21 min, respectively. Length of duodenal, jejunal, and ileal segments of the small intestine were 135 ± 4, 2730 ± 27 and 110 ± 1 cm, respectively. Transit time of chyme within the duodenum and jejunum averaged 46 and 14 cm/min, respectively. Considering that the duodenum represents less of 5% of total length of small intestine, that duodenal transit time is threefold faster than that of the rest of the small intestine, and that pancreatic and bile secretions into the duodenum occur midway along its length, we conclude that the

duodenum plays a minor role in net nutrient absorption from the small intestine.

**Key Words:** Small intestine, Transit time, Cattle

**T118 Effects of feeding a slow-release urea on ruminal nitrogen dynamics in steers.** K. C. Hanson\*<sup>1</sup>, S. E. Kitts<sup>1</sup>, N. B. Kristensen<sup>1</sup>, D. E. Axe<sup>2</sup>, and D. L. Harmon<sup>1</sup>, <sup>1</sup>University of Kentucky, Lexington, <sup>2</sup>IMC, Lake Forest, IL.

Twelve ruminally-cannulated steers (529 ± 11 kg BW) were used to determine the effect of feeding a slow-release urea on ruminal N dynamics. Steers were equally divided into two groups: control (feed grade urea; FGU) or slow-release urea (SRU). Steers were fed corn silage plus 10% supplement at 1.29% BW for 35 d. Diets were formulated to be isonitrogenous and contain 12.5% crude protein. All supplemental N was from FGU or SRU (42% of N intake). Blood was collected via jugular vena-puncture on d 33 and plasma was harvested for analysis of urea, glucose, glutamate, and glutamine. On d 34, ruminal fluid was collected every two h for ten h post-feeding and analyzed for NH<sub>3</sub>, VFA, and pH. Samples taken 4 h post-feeding were analyzed for urease activity. On d 35, an in situ study determined the release of SRU from nylon bags suspended in the rumen. Nylon bags containing SRU were suspended for 0, 2, 4, 6, 8, 12 and 24 h. Upon removal, bags were rinsed and dried at 55° C before analysis for N content. Body weights and DM intakes were similar. Ruminal pH (6.5) was not affected by treatment but ruminal ammonia was less (8.9 vs. 14.1 mM; P < 0.02) and ruminal urease activity was greater (149 vs. 89 mmol/(min·mL rumen fluid); P < 0.06) in steers consuming SRU. In situ rates of SRU degradation were not affected by treatment (6.28 %/h), indicating that the ruminal microbes did not adapt during 35 d of feeding SRU. Plasma glucose concentrations were less (50 vs. 60 mg/dL; P < 0.02) in steers fed SRU. Plasma urea (5.1 mM), glutamine (255 μM), and glutamate (174 μM) concentrations were not affected. Ruminal VFA molar proportions or concentrations were not affected by treatment. These results demonstrate that SRU possesses the ability to slowly release N in the ruminant.

**Key Words:** Ruminant, Urea, Nitrogen

**T119 Effect of a novel hexadecatrienoic acid from marine algae (*Chaetoceros*) and olive oil on methane production by ruminal fluid in vitro.** E. M. Ungerfeld\*<sup>1</sup>, S. R. Rust<sup>1</sup>, M. T. Yokoyama<sup>1</sup>, R. Burnett<sup>1</sup>, and J. K. Wang<sup>2</sup>, <sup>1</sup>Michigan State University, East Lansing, MI, USA, <sup>2</sup>University of Hawaii at Manoa, Honolulu, HI, USA.

Since methane emissions by ruminants are a major loss of feed energy and also contribute to global warming, there is considerable interest in decreasing ruminal methanogenesis. Fats and oils usually decrease methane production both in vitro and in vivo, although they also inhibit fermentation. We studied the effects of a novel hexadecatrienoic acid (C<sub>16:6,9,12</sub>) and of olive oil on ruminal fluid 24 h-batch in vitro fermentation. The hexadecatrienoic acid was purified from a marine algae (*Chaetoceros*) at the Univ. of Hawaii-Manoa. Initial concentrations of both additives were 0, 0.5, 1, and 2 mg/L (n = 4). The hexadecatrienoic acid linearly decreased (P < 0.01) methane production by 96%, while olive oil did not affect it. The hexadecatrienoic acid also caused (P = 0.02) a 6-fold hydrogen accumulation. Production of carbon dioxide was linearly decreased (P < 0.01) by the hexadecatrienoic acid by 46%, while olive oil increased carbon dioxide production linearly (P = 0.03) by 17%. Neither additive had an effect on final pH. Apparently fermented OM, as estimated from the VFA stoichiometry, was linearly decreased (P < 0.01) by the hexadecatrienoic acid by 47%, while olive oil increased it linearly (P = 0.03) by 5%. The hexadecatrienoic acid linearly decreased (P < 0.01) acetate molar percentage from 69 to 55%,