between Angus and Herefords, and three composite populations (MARC I, MARC II, and MARC III). Respiratory disease was detected by physical examination, necropsy, or laboratory analyses. To avoid multiple incidence, records on the same calf which may be due to lingering respiratory disease, only the initial infection during the preweaning period was considered. Overall average incidence of recorded respiratory disease was 11.6%. Incidence was highest in Braunvieh (18.1%) and MARC I (17.8%), a composite breed with one fourth Braunvieh heritage. Herefords and the Hereford x Angus cross had the lowest incidence (4.6 to 7.8%). Incidence was highest after d 84. Variance components were estimated using REML. Fixed effects included year of birth, age of dam, sex of calf, and breed type. Calf and dam of the calf were considered random effects. Variance due to permanent environmental effects of the dams was not significant. Phenotypic variance for respiratory disease was 0.095. Heritability estimates for the calf direct and maternal effects were low, 0.14 $\pm$ 0.01 and 0.04 $\pm$ 0.01, respectively. Estimate of the direct-maternal genetic correlation was large and negative, -0.93 $\pm$ 0.04. Large and significant breed differences for respiratory disease were found. Within breed, response to selection to reduce the incidence of respiratory disease in calves would be expected to be slow although breed differences suggest a potential to improve resistance by selection or crossbreeding.

Key Words: Pneumonia, Lung, Health

352 Simulation of net return using days to finish estimated breeding values in beef production. M. A. Cleveland*, R. M. Enns, W. J. Umberger, and B. L. Golden, *Colorado State University, Fort Collins, CO*.

The objective of this study was to determine if sire genotype and choice of finish endpoint for progeny interact to affect net return. A model was developed to determine the distribution of progeny for three carcass traits, carcass weight (CW), backfat thickness (BF) and marbling score (MS), when feeding to a CW, BF or MS endpoint. Days to finish carcass weight (DCW), backfat thickness (DBF) and marbling score (DMS) estimated breeding values (EBV) were used to simulate feeding costs, grid revenue, and net return. Three sire days to finish genotypes, high (H), medium (M) and low (L), as indicated by EBV, were considered for each trait. An H EBV suggests above average days to finish, while an L EBV indicates a shorter than average time on feed. All possible combinations of EBV resulted in 27 distinct sire genotypes for days to finish. Assuming an average of 130 days to each endpoint, results showed that progeny from sires with H EBV for days to finish needed an average of 142 days to reach a constant CW, and 148 days to reach constant BF and MS endpoints, while progeny from L EBV sires needed an average of only 118 days or less to reach each endpoint. The results from the model indicated that considerable re-ranking occurred among sires for net return, suggesting an interaction between genotype and finish endpoint. Re-ranking resulted in changes of up to 20 positions at alternative endpoints for some sire genotypes. Net return was calculated using average yardage costs and grid revenue. When feeding to a constant CW or BF, the LHL sire (first character indicates the DCW, second, the DBF, and third, the DMS EBV) realized the highest return, while the LLL sire was most profitable at the BF endpoint. Progeny from sires with H EBV for DMS, when fed to the MS endpoint, were overall least profitable. With the inclusion of more precise costs of production, this type of model has the potential to become a selection and management tool using days to finish genetic predictions to assist producers in maximizing profitability.

Key Words: Beef cattle, Days to finish, Simulation

353 Comparison of different selection criteria in populations simulated under growth curve parameters of Brazilian zebu cattle. E. S. Sakaguti*[1], E. N. Martins[1], and L.O.C. Silva[2], [1]*Universidade Estadual de Maringa, Maringa, Brazil,* [2]*Embrapa Gado de Corte, Campo Grande, Brazil*.

Recently the Brazilian Association of Zebu Breeders started to report the EPDs for a new growth trait, the number of days that an animal would take to gain 240 kg in the postweaning period (D240). This new trait can be used as a substitute of the traditional postweaning average daily gain (ADG) and is calculated as D240 = 240/ADG. However, there is some uncertainty about the consequences of this change. Then the objective of the present work is to evaluate the response to selection when four different traits (ADG, D240, live weight at 205 (WW) and 550 (YW) days of age) were individually considered in populations generated by Monte Carlo simulations. A FORTRAN 90 program generated the parameters (A, B and K) of the Von Bertalanffy function for each animal. The parameters were implemented as biological traits with Medelian inheritance, polygenic effect and phenotypic and genetic correlations. Estimates of genetic parameters from live weight data of Tabapua breed were employed. Two levels of heritability (approximately .1 and .5) were considered and 10 base populations were generated for each level of heritability. Approximately 25,000 progenies of 200 sires and 10,000 dams composed a population in each generation. Simulations of a random mating system with single calf per parturition produced populations with half-sib family structure that were evaluated by 10 generations of BLUP selection on each trait. The selection for ADW and D240 produced similar results. Both showed the highest increases of the mature weight (A) and the lowest decreases of the maturing rate (K). In the other hand, the selection for WW had the lowest increases of A and the highest decreases of K. Intermediate results where found with the selection for YW. The selection for D240 produced the highest inbreeding increases that can be a consequence of the smallest estimates of heritability of this trait in the early generations.

Key Words: Monte Carlo simulation, Growth curve, Selection responses

Companion Animals

354 A new approach to testing nutraceuticals in animals: A placebo-controlled evaluation of a milk-based "immuno-nutritional" product in dogs. D. A. Gingerich* and J. D. Strobel, *SMBI, Cincinnati, OH, USA*.

Functional foods and dietary supplements with structure/function claims have become important in the health care system in USA, especially since the passage DSHEA in 1994. Pet owners are interested in the therapeutic value of such products for their pets. However, few dietary supplements have been rigorously evaluated in animals. Furthermore, it is FDA/CVM's position that DSHEA does not apply to animal products. Milk is a food with biological functions in addition to its nutritional value. A special milk protein concentrate (SMPC) prepared from the milk of hyperimmunized cows was shown to express anti-inflammatory and anti-arthritic activity in humans. To determine if SMPC is also beneficial to dogs, an 8-week, placebo-controlled clinical study was conducted in older dogs with osteoarthritis. The study was designed to test the product and also to evaluate an owner-based questionnaire designed specifically for dogs. Fifty dogs in 5 veterinary practices were enrolled, of which 35 completed the study. Significant ($p < 0.05$) improvement in mean questionnaire scores and owner global assessments was detected in dogs in the SMPC group but not the placebo group. The treatment responses were significantly greater in the SMPC group than in the placebo group ($p<0.005$). The effect sizes (treatment response - placebo response/SD placebo response) for case-specific and client global outcomes were 1.61 and 0.90 respectively, which are considered large. No treatment-related adverse effects or changes in serum chemistry findings were detected. Unlike many dietary supplements with no recognized nutritional value, SMPC contains high quality dairy protein. Because there is laboratory evidence that the anti-inflammatory activity in the milk from hyperimmunized cows is exerted through immunological mechanisms, we describe SMPC as an "immuno-nutritional". The results of this study also indicate that the individualized owner-based questionnaire is a valuable tool in testing nutraceuticals and can be adapted to evaluate a variety of new products in pets.

Key Words: Nutraceutical, Milk-based, Anti-inflammatory

355 Measuring absorption of a purified, crystalline lutein additive in the canine. L. B. Deffenbaugh*, *Kemin Nutrisurance, Inc.*.

Lutein is one of numerous carotenoids with potential health benefits for companion animals. Natural sources include green leafy vegetables, marigolds, and maize, in which lutein is present as a fatty acid ester.

Lutein esters are commercially obtained via a solvent extraction process from marigolds and are commonly used as a pigmenter in poultry diets. Saponified (un-esterified) lutein exists in animal tissues and may play a beneficial role in eye and immune health for companion animals. A purified (>90%) source of free lutein is a promising functional ingredient for animal feeds. A minimally invasive canine model for measuring uptake from consumption of a crystalline lutein feed additive will be described. Factors affecting the presentation of lutein to the digestive system must be controlled to produce reliable results. These factors include fat content of the total diet in which the lutein additive is included and individual animal variability. Monitoring bioavailability of lutein additive forms is critical to demonstrating the utility of lutein for intended purposes. Utility data is crucial to justify using functional ingredients in feeds for companion animals as well as for preparing a submission for regulatory clearance of an ingredient.

Key Words: Lutein, Absorption, Canine model

356 Evaluation of stabilized rice bran as an ingredient in dry extruded dog diets. J. K. Spears*, C. M. Grieshop, and G. C. Fahey, Jr., *University of Illinois at Urbana-Champaign, Urbana, IL USA.*

During rice processing, lipase from testa and cross-cells hydrolyzes oil in the aleurone layer and germ, resulting in an unpalatable byproduct. Inactivating lipase prevents hydrolysis, resulting in stabilized rice bran (SRB). The purpose of this research was to evaluate the effect of SRB and defatted rice bran (DRB) on food intake, digestibility, fecal characteristics, and blood fatty acid, phospholipid, and eicosanoid concentrations in dogs. Diets contained 12% SRB or DRB, and poultry fat, beef tallow, or poultry fat:soybean oil (50:50) as the main fat sources. Two blocks of 18 dogs were used, with each block fed the diets for 42 d. Days 1 through 38 constituted an adaptation phase and d 39 through 42 was the collection phase during which a total fecal collection was made. Blood samples were collected on d 1 and 42. Blood fatty acid profile and eicosanoid data were analyzed as differences from baseline values (d 1 vs d 42). No differences ($P > 0.05$) were noted in food intake, digestibility, or fecal characteristics. Changes in blood profiles due to rice bran source could not be explained by diet because differences in rice bran fatty acid profiles were negated by the dietary fat sources. Dogs consuming DRB diets had lower ($P < 0.05$) plasma phospholipid total monounsaturated fatty acids, while plasma concentrations tended ($P < 0.12$) to decrease. Dogs consuming beef tallow diets tended to have lower ($P < 0.11$) RBC phospholipid PUFA and higher total saturated fatty acids ($P < 0.15$), while dogs consuming poultry fat diets tended to have higher ($P < 0.09$) n-6 PUFA. Dogs consuming beef tallow diets had lower ($P < 0.05$) RBC phospholipid 18:2 n6 and 20:2 n6 and increased plasma 20:3 n6. Trends were detected in individual fatty acids due to rice bran source, fat source, and the interaction. Eicosanoid concentrations did not change due to treatment. Stabilized rice bran is an acceptable ingredient when included in dog diets, but did not elicit an effect on inflammatory immune mediators in healthy dogs.

Key Words: Canine, Stabilized Rice Bran, Digestibility

357 Defining Safe Lower and Upper Limits for Selenium (Se) in Adult Cats. K. Wedekind*[1], C. Kirk[1], S. Yu[1], and R. Nachreiner[2], [1]*Hill's Pet Nutrition, Inc., Topeka, KS,* [2]*Michigan State University, East Lansing, MI.*

Petfood regulatory recommendations for minimum Se in adult cat foods are 0.1 mg Se/kg diet. No recommendations are given for safe Se maximums for the cat; however, 2 mg Se/kg diet is recommended as a maximum for the dog. Given the higher Se concentrations contained in cat vs dog diets, we felt it was important to define, if possible, both a safe lower and upper limit for Se in adult cats. Our study used 33 adult cats. Cats were fed a low Se (0.03 mg Se/kg diet) diet for 3 wk after which this same diet was supplemented with 6 levels of selenomethionine (0, 0.1, 1, 2.5, 5 and 10 mg Se/kg diet) and fed for 6 mo. Response variables measured included Se concentration, Se-dependent glutathione peroxidase (GSHpx) activity in serum and RBC, complete thyroid hormone profile, complete blood count (CBC), serum chemistry profile (SCP), hair growth rate and immune function measures. No significant changes in body weight, CBC, SCP or clinical signs were observed. All serum thyroid hormone concentrations were within normal ranges. A definitive breakpoint for serum GSHpx yielded a minimum recommendation of 0.10 mg Se/kg diet. Serum Se concentrations in cats, were significantly higher than dogs, even when fed similar Se levels. Unlike chicks and dogs, serum Se did not plateau above the cat's requirement for Se, but increased linearly. Hair growth rate was significantly decreased at Se concentrations below the breakpoint, but was unchanged at high Se concentrations. We were unable to define in our study, a safe upper limit or lowest observable adverse effect level (LOAEL) for Se in cats. Results indicate a minimum requirement of 0.1 mg Se/kg diet in adult cat foods.

Key Words: Selenium, Cat, Requirement

358 Docosapentaenoic acid accumulates in plasma phosphatidyl choline but not cholesteryl ester fractions in linseed oil fed dogs. J.E. Bauer*[1], A.L. Spencer[1], and M.K. Waldron[2], [1]*College of Veterinary Medicine, Texas A&M university, College Station, TX,* [2]*Nestle-Purina Pet Care, St. Louis, MO.*

We have previously observed that total plasma phospholipid is enriched with docosapentaenoic acid (DPA, 22:5n-3) when flaxseed supplemented diets are fed to dogs, but that cholesteryl ester is not. This observation suggests that DPA is not a substrate for the plasma enzyme, lecithin:cholesterol acyl transferase (LCAT). The present work was undertaken to determine whether the preferred substrate for LCAT, specifically plasma phosphatidyl choline (PC), and cholesteryl ester (CE) fatty acid contents are similarly composed in dogs when a diet containing a high concentration of alpha-linolenic acid from linseed oil is consumed and when compared to dogs fed preformed sources of long chain n-3 PUFA (including DPA). Forty adult mixed breed dogs were divided into 4 groups (n=10). A low fat basal diet was supplemented with either safflower oil (SFO), beef tallow (BTO), linseed oil (LSO), or Menhaden fish oil (MHO) for 28 days at a dosage of 18 g oil per 100 g basal diet. Blood samples were collected, plasma total lipids were extracted with chloroform:methanol (2:1, v/v), PC and CE were fractionated via thin-layer chromatograpy, and methyl ester derivatives of these fractions were analyzed by capillary gas chromatography. Fatty acid compositions were expressed as relative per cent and ANOVA was performed. The PC fraction of dogs fed the LSO diet contained significantly increased amounts of eicosapentaenoic acid (EPA) but no accumulation of either DPA or DHA was seen beyond that found in the BTO or SFO groups. By contrast, significantly increased amounts of EPA, DPA and DHA were found in the MHO group PC fraction. In the CE fractions, neither DPA nor DHA were seen with linseed oil feeding. Unexpectedly, DPA in CE fractions of dogs fed the menhaden oil also did not accumulate although there was an increase in DHA in this fraction. These data confirm that, when diets high in ALA (LSO group) or fish oil (MHO group) are fed, DPA is present in plasma PC but not in plasma CE. It is concluded that transfer of DPA from PC to CE mediated by LCAT may not occur under these conditions and that DPA may not be a suitable substrate for the enzyme. Such a mechanism would help assure that DPA is transported to tissues using n-3 fatty acids in some preferential manner via plasma phospholipids.

Key Words: DPA fatty acids, Cholesteryl ester, linseed oil

359 Lifetime diet restriction impact on carbohydrate metabolism affects survival and time-to-first treatment for chronic disease in dogs. B. T. Larson*[1], D. F. Lawler[1], E. L. Spitznagel, Jr.[2], and R. D. Kealy[1], [1]*Nestle Purina PetCare Company, St. Louis MO,* [2]*Washington University, St. Louis MO.*

Labrador retrievers (48) were used to assess carbohydrate metabolism effects on survival and time-to-first chronic disease treatment during lifetime diet restriction. Restricted dogs were fed 75% of same diet consumed by control-fed pair-mates. Intravenous glucose tolerance testing (IVGTT) was done annually (maximal stimulation, non-steady-state, ages 9-12). Time when it became necessary to treat a specific chronic disease condition for humane reasons was recorded for each dog. Forty-six of 48 dogs were eventually euthanatized for humane reasons and two died spontaneously. Euthanasia was carried out only after extensive diagnostic evaluation, careful monitoring and response-to-treatment assessment, serial clinical condition evaluation, and prognosis consideration, according to practices established for entire colony. Cox proportional hazards regression models analyzed IVGTT parameter relationships to survival. The Cox model was used to explain differences in survival due to varying IVGTT covariate levels, in terms of impact on the hazard function. As hazard increases, survival rates decrease more

rapidly. Survival was modeled in three ways: 1) time to death, 2) time to death or treatment for osteoarthritis, or 3) time to death or treatment for any chronic disease. Time-to-first osteoarthritis treatment or death was longer with lower basal glucose and higher insulin sensitivity (P = 0.021, P = 0.023), and median survival time tended to be greater with lower basal glucose and insulin (P = 0.065, P = 0.096), but diet restriction explained most variation. Higher insulinogenic indices associated with greater median survival (P = 0.053) and those with higher insulin sensitivity had less (P = 0.018) hazard of dying or receiving chronic disease treatment. These insulin indices added more information than diet restriction alone (P = 0.057, P = 0.055). Lifelong diet restricted glucose disposal efficiency and insulin response was associated with increased life quality and quantity.

Key Words: Diet restriction, Chronic disease, Dog

Forages & Pastures: Grasslands, forage supplementation

360 Effect of defoliation system and nitrogen input on nitrate losses from grassland systems. M. Wachendorf*, M. Buechter, H. Trott, and F. Taube, *University of Kiel, Kiel, Germany.*

Nitrogen (N) recovery in specialized dairy farms is known to be low. This causes serious environmental problems due to increased losses of N as nitrate (NO_3) to the watercourse, as in northern central Europe intensive dairy farming is mainly located on freely draining sandy soils. As part of an integrated research project, a field experiment was conducted over a 4 year period to determine NO_3 leaching losses on grassland, which is the predominant forage crop in this region. The experiment consisted of all combinations of five defoliation systems, i.e. cutting-only, rotational grazing, mixed systems with one or two silage cuts plus succeeding rotational grazing respectively, and simulated grazing, four mineral N application rates (0, 100, 200, and 300 kg N ha^{-1} yr^{-1}), and two slurry levels (0 and 20 m# slurry ha^{-1} yr^{-1}). Prior to the start of the experiment, white clover was established in all plots by oversowing. Samples of leachate were taken by ceramic suction cups. Water fluxes were derived from water balance calculations. Due to the high N return by grazing animals leaching losses in rotational grazing systems generally caused NO_3-N concentrations exceeding the European Union (EU) limit for drinking water (50 mg NO_3 l^{-1}). NO_3 leaching losses in a rotational grazing system could be reduced by lowering the N fertilizer intensity and inclusion of one or two silage cuts in spring. However, even in unfertilized mixed systems NO_3 concentrations were well above the EU limit. In terms of leaching losses, the cutting-only system was the most advantageous. NO_3 leaching losses (y; kg N ha^{-1}) could be predicted by the amount of soil mineral N at the end of the growing season (x_m; kg N ha^{-1}) with: y = - 9.5498 + 0.6758 x_m; r^2=0.74; s.e. 11.2 and by the N surplus calculated from N balances at the field scale (x_s; kg N ha^{-1}) with: y = 17.2200 + 0.1907 x_s; r^2=0.77; s.e. 10.4. From the results obtained an adapted N fertilization and a reduced grazing intensity by integrating silage cuts are suggested.

Key Words: Grassland, Nitrogen losses, Environment

361 Metabolic changes in Brangus stocker calves grazing wheat pasture. L. A. Appeddu*[1], M. A. Brown[2], and W. A. Phillips[2], [1]*Southwestern Oklahoma State University, Weatherford, OK,* [2]*USDA-ARS Grazinglands Research Laboratory, El Reno, OK.*

Previous research suggests stocker calves do not effectively convert wheat forage to gain when first placed on pasture. The objective of this research was to investigate metabolic changes in stockers over the first 21 to 49 d on fall wheat pasture (39% CP, 35% NDF) by evaluating serum metabolites and rumen function in Brangus x Hereford calves. Calves were weaned (n = 24; 268 ± 36.4 kg), and offered Prairie hay *ad libitum* (6% CP, 76% NDF) and 40% CP supplement daily (1362 g hd^{-1}). Calves were sorted into three groups to be placed on wheat at successive 10 to 14 d intervals. Calf weights and serum samples were taken prior to and after grazing wheat. Rumen fluid was taken from two cannulated steers over 72 h on 10 d prior to and 4 d after placed on wheat to determine ammonia levels. Additional fluid was taken to evaluate potential changes in 48-h *in vitro* digestibility of wheat forage prior to and on d 6, 13, and 21 after grazing wheat. As expected, calves did not achieve a positive weight gain until after grazing wheat for 14 d. Calves gained 1.7 kg d^{-1} from d 28 to 49. Serum non-esterified fatty acid levels did not change in steers prior to or after grazing wheat for 6 or 13 d (295 vs avg 294 ± 23.7 mg dl^{-1}); however, levels decreased (P < 0.001) by d 20 and 27 (avg 213 mg dl^{-1}). Serum glucose levels increased (P < 0.01) after d 20 (87 vs 100 ± 5.0 mg dl^{-1}). Serum urea nitrogen was higher (P < 0.001) during the first 21 d on wheat regardless of sample day (9 vs 23 + 0.7 mg dl^{-1}). Rumen ammonia levels also increased (P < 0.001) after cannulated steers were placed on wheat (2.5 vs 22.7 ± 3.74 g dl^{-1}). Serum glucose and urea nitrogen remained elevated through d 49 (117 ± 5.0 and 21 ± 1.2 mg dl^{-1}). Day of rumen fluid collection did not change wheat forage *in vitro* digestibilities (90 ± 1.1%). From January 2 to April 9, 2002, calves gained 1.0 + 0.05 kg d^{-1}, and wheat quality declined to 26% CP, 51% NDF, and 83% *in vitro* digestibility. Serum urea nitrogen and glucose levels remained above 21 ± 0.8 and 83 ± 7.1 mg dl^{-1}. While potential digestibility of wheat forage remains high, results suggest stocker calves adjust metabolically when first introduced to wheat pasture before positive weight gains can be achieved.

Key Words: Wheat pasture, Metabolism, Adaptation

362 Effect of field pea based supplement on intake, digestion, and ruminal fermentation of nursing steer calves grazing native range in western North Dakota. A. A. Gelvin*[1], G. P. Lardy[1], J. S. Caton[1], and D. G. Landblom[2], [1]*North Dakota State University, Fargo, North Dakota/USA,* [2]*Dickinson Research Extension Center, Dickinson, North Dakota/USA.*

Eight Angus x Hereford nursing steer calves (145 ± 44 kg initial BW) fitted with ruminal cannulas were used to evaluate effects of field pea-based supplement and advancing season on dietary composition, intake, digestion, and ruminal characteristics. Treatments were control (CON) and field pea-based creep (CREEP; 19.1% CP, DM basis) fed at 0.45% BW daily. Calves grazed native pasture with their dams from late June through early November. Collection periods were 10-d long and occurred in July, August, September, and October. Masticate samples from CREEP were lower in ADF ($P = 0.09$) and higher in CP ($P = 0.07$) than CON. Dietary CP and ADIN decreased linearly with advancing season ($P \leq 0.03$). In vitro OM digestibility decreased from July to October ($P < 0.01$; 58.5% to 41.3%). Forage intake was not different ($P = 0.89$) between treatments, but increased linearly with advancing season (1.67, 1.90, 3.12, 3.38 kg/d for July, Aug, Sep and Oct, respectively; $P = 0.03$). Milk intake (% BW) was similar ($P = 0.55$) between CON and CREEP, but decreased linearly ($P = 0.001$) with advancing season. Supplemented calves had greater total intake (forage + milk + creep; $P = 0.05$) than CON. Grazed forage OM and CP digestibilities were higher ($P = 0.004$) for the CREEP than CON. With advancing season, NDF, ADF, and OM digestibilities decreased linearly ($P < 0.01$). No treatment effects were observed for in situ DM disappearance rate of forage or creep ($P > 0.10$). Creep DM disappearance decreased linearly ($P = 0.02$) and forage DM disappearance decreased quadratically ($P = 0.03$) with advancing season. Supplementation reduced ($P < 0.01$) ruminal pH at several times measured. Ruminal ammonia levels were higher ($P < 0.01$) in CREEP compared with CON. These data indicate supplementation with field peas increases total intake but has no effect on forage or milk consumption of nursing calves.

Key Words: Calves, Intake, Digestion

363 Reproductive responses and carcass characteristics of ram lambs fed endophyte-infected tall fescue. J. M. Burke*[1], C. F. Rosenkrans[2], R. W. Rorie[2], C. Golden[2], and J. K. Apple[2], [1]*USDA, Agricultural Research Service, Dale Bumpers Small Farms Research Center,* [2]*University of Arkansas, Department of Animal Science.*

The objective of this study was to examine the influence of endophyte-infected tall fescue on reproductive development and function and carcass characteristics of ram lambs. Hampshire and Suffolk rams, 214 d of age, were fed individually a diet of endophyte-free (EF; n = 8) or infected (EI; n = 9) fescue seed (34% of diet; 4.8 μg/g ergovaline) for six weeks. Intake was similar between treatments and averaged 2.7% BW (33.7 μg ergovaline/kg BW). Daily high temperature ranged between 16 and 27°C. Data were analyzed using the mixed models, repeated measures procedure of SAS and heterogeneity of regression. Signs of fescue toxicosis in EI fed rams included increased rectal temperature