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02. Animal Science

University of Central Oklahoma

Abstracts from the 2013 Oklahoma Research Day

Held at the University of Central Oklahoma

05. Mathematics and Science

02. Animal Science

05.02.01 Prediction of Heat Production in Boer Goats Using Heart Rate

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Heart rate (HR) is often used to predict heat production (HP) by livestock in settings with unrestricted movement. Most accurate prediction is with HP:HR of individuals. The decrease in accuracy from predicting HP based on an average HP:HR was determined with 163 Boer goat bucks used in two 84-day performance tests, having an average HP:HR of 5.63±0.098 kJ/kg BW0.75 per heart beat. HP:HR was determined once for 1 day with a head-box respiration calorimetry system for measuring O2 consumption and production of CO2 and CH4, and HR was measured at the same time. HP predicted based on the average HP:HR was moderately correlated with that based on individual HP:HR ($r=0.55$; $P<0.05$). When using the average HP:HR, 22% of the bucks had HP not different from the estimate using individual HR:HP. The number of animals with maximum error of 5, 10, 15, and greater than 15% was 30, 23, 14, and 12%, respectively. When using the average HP:HR to calculate HP, the percentage of under- and overestimates was similar (9.6 vs 9.5%, respectively, $P=0.91$). However, the distribution pattern of HP observations differed ($P<0.05$) between method of determination, with means of 561 and 565 kJ/kg BW0.75 and SD of 56.5 and 85.4 for use of individual and average HP:HR, respectively. These results support the advantage of using HP:HR of individual animals to predict HP from HR, but suggest potential use of average ratio in some instances, such as with large expected treatment differences in HP.

05.02.02 Factors Influencing Feed Intake, Growth Performance, and Behavior by Boer Wethers With an Automated Feeding System

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Effects of the number of Boer wethers per automated feeder and length and time of feeder access on feed intake, growth, and behavior were determined during a 10-wk period. Treatments were 6 and 12 wethers per pen and feeder with continuous access (C-6 and C-12, respectively); 2 and 4 wethers per feeder with 8 h/d access during daytime (D-2 and D-4, respectively); and 4 and 8 wethers per feeder with 16 h/d access at night (N-4 and N-8, respectively). Dry matter intake (DMI) was greater for continuous vs restricted access and for N vs D (2.04, 2.01, 1.45, 1.50, 1.92, and 1.76 kg/d), and feeder occupancy time per wether tended to be greater for continuous access (1.83, 1.55, 1.23, 1.34, 1.51, and 1.25 h/d for C-6, C-12, D-2, D-4, N-4, and N-8, respectively). There were effects of continuous vs restricted and D vs. N on average daily gain (ADG) and a tendency for an interaction between time and length of restricted access (237, 252, 174, 207, 247, and 211 g for C-6, C-12, D-2, D-4, N-4, and N-8, respectively. ADG:DMI tended to be greater for N than for D (128, 130, 97, 117, 150, and 127 g/kg), although residual feed intake (RFI) was greater for continuous vs. restricted access and tended to be less for D vs N and for 2 vs. 4 h/d of maximal occupancy time per wether (121, 20, -63, -165, -16, and -14 for C-6, C-12, D-2, D-4, N-4, and N-8, respectively). In conclusion, restricting feeder access influenced feed intake, growth, and behavior, with results impacted by time of access.

05.02.03 Factors Affecting Behavior of Goats in Pens With Electric Strand Additions to Cattle Barb Wire Fence

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Effects of meat goat breed, gender, experimental period, and preliminary and washout treatments on behavior in pens with electric strand modifications to cattle barb wire fence were determined. Boer and Spanish wethers and doelings were assigned to 5×5 Latin squares. Test pens one side with barb wire strands at 30, 56, 81, 107, and 132 cm from the ground. Fence treatments were electric strands at 15 and 43 (LH), 15 and 23 (LM), 15 (L), 23 (M), and 43 cm (H) at 6 kV. During a 4-wk adaptation period, animals were sequentially exposed each week to test pens with different fence conditions. Two treatments were applied the week before the first measurement period. During the Latin square periods, animals were placed in test pens and observed for 1 h. Different treatments also were employed in the 1-wk interval between observation periods. There were no effects of gender or preliminary or interval treatment. Fence treatment affected the percentage of animals exiting test pens (31, 23, 16, 35, and 30% for LH, LM, L, H, and M, respectively). Breed also influenced exit (12 and 43% for Boer and Spanish, respectively). Exit decreased as period advanced (60, 35, 23, 10, and 8 % for 1, 2, 3, 4, and 5, respectively). In conclusion, meat goat breed needs to be considered in development of a method to evaluate electric fence additions to cattle barb wire fence, and differences in exit among periods indicates that a Latin square approach may not be suitable.

05.02.04 Effects of (-)-Epigallocatechin-3-gallate (EGCG) on Viability of Haemonchus Contortus and Immune Responses in White Blood Cells of Goats In Vitro

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Effects of (-)-Epigallocatechin-3-gallate (EGCG; a polyphenol in green tea extracts) on viability of third-stage larvae (L3) of Haemonchus contortus and cytokine gene expression in white blood cells (WBC) of goats were investigated. Viable L3 in phosphate buffered saline (PBS) were delivered to each well of a 96-well culture plate with EGCG at concentrations of 0, 50, 100, 250, 500, 1000, 3000, or 5000 μg/ml. Viability of larvae was determined at 12, 24, 48, 72, and 96 h after exposed to EGCG. Viability decreased with increasing dose of EGCG and with increasing time. The reduction of viability after 96 h was 3, 21, 41, 48, 45, 92, 100, and 100% for 0, 50, 100, 250, 500, 1000, 3000, and 5000 μg/ml of EGCG, respectively. Isolated WBC were cultured. Treatments were control (without antigen or EGCG), antigen (20 μg protein/ml) only, antigen plus 5 μg/ml EGCG, and antigen plus 50 μg/ml EGCG. Cells were harvested at 0, 1, 2, 4, 12, and 24 h after treatment. L3 antigen up-regulated expression of IL-4, IL-6, IL-10, IL-12, IL-17, IFN-γ, and TNF-α, but depressed IL-2. EGCG synergistically up-regulated expression of IL-4, IL-6, and IL-17, but down-regulated IL-12 in the cells stimulated with L3 antigen. In conclusion, EGCG may have anthelmintic effect on H. contortus as well as indirect influence through regulating immune responses of lymphocytes. Further work is needed to investigate whether EGCG can exert anthelmintic effects in live animals.

05.02.05 Spatial-Temporal Movements of Grazing Goats

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A study was conducted to monitor grazing behaviors in goats. Fourteen Spanish wether goats were fitted with GPS collars and released into a 14-ha paddock. Collars that recorded a fix every 5 min were deployed for 2 wk during the early summer. Fixes from 1 h after sunrise (07:00 h) until 1 h before sunset (19:30 h), resulting in 2,730 fixes, were analyzed for grazing behaviors, which included distance traveled and turning angles, using a repeated measures analysis. Distance traveled was calculated from two consecutive fixes and turning angle involved three consecutive fixes. Turning angle was then categorized into four quadrants. Hour of the day greatly affected ($P < 0.01$) distance traveled, peaking at 1,440 m traveled at 13:00 h with two minima at 10:00 and 17:00 h (266 and 430 m, respectively). The time of 13:00 h also accounted for proportionally the greatest percentage of forward movements (79, 5, 6, and 10% for forward, backward, left, and right, respectively, for that hour) and the 10:00 and 17:00 h accounted for the least (46, 13, 21, and 20% for forward, backward, left, and right, respectively, for those hours). Generally, forward movements accounted for 61% of the fixes, right and left movements were equal at 15%, and backward movements were 9%. These results indicate that goats had directed movement at mid-day and more tortuous movement at mid-morning and mid-afternoon.

05.02.06 The Effects of Level and Length of Supplementation on Leather Characteristics of Yearling Boer and Spanish Wethers

Arthur Goetsch, Anton El A'mma, Cheng-Kung Liu, Nick Latona, Roger Merkel,

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Spanish and Boer wethers were used to determine effects of level and length of supplementation on leather characteristics. The experiment started in January and had 110 and 108 day periods (PR). A pelleted diet was supplemented at 0.5 or 1.5% BW (DM; L and H, respectively). Skins were salted for 10 to 14 d and then chrome tanned. There were BR differences in initial BW (33.3 and 23.7 kg), initial thickness of leather (1.83 and 1.48 mm), and % elongation (66.6 and 55.1% for B and S, respectively). ADG was greatest among PR-BR treatments for PR1-B (139, 74, 63, and 56 g for PR1-B, PR1-S, PR2-B, and PR2-S, respectively). Leather thickness (1.91 vs 1.71 mm) and tensile strength (31.0 vs. 28.1 MPa) were greater for B vs S. Percent elongation was greater in PR1 than PR2 (51.9, 58.6, 45.1, and 40.5%, for PR1-H, PR1-L, PR2-H, and PR2-L, respectively) and greater for B than for S skins (50.6 vs. 47.4%). Young's modulus was unaffected by BR (15.9 and 14.7 MPa for B and S, respectively) but was greatest for L goats in PR2 (9.47, 6.93, 19.38, and 25.61 MPa for PR1-H, PR1-L, PR2-H, and PR2-L, respectively). Fracture energy was higher for B than S skins (5.39 vs. 4.61 J/cm3) and was greatest for L goats in PR1 (5.00, 5.96, 4.73, and 4.32 J/cm3for PR1-H, PR1-L, PR2-H, and PR2-L, respectively). As goats aged, leather stiffness increased. Boer goats had greater skin thickness than Spanish, which contributed to the greater values of B leather for tensile strength and % elongation.

05.02.07 Efficacy of a Bovine Colostrum Replacement Product for Goat Kids

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When adequate doe colostrum is not available for neonatal goat kids an alternative source of colostrum is necessary. The objective of this study was to determine the efficacy of a commercially available bovine colostrum replacement product (Land O'Lakes Colostrum Replacement manufactured by The Saskatoon Colostrum Co., Ltd., Saskatoon Canada) in neonatal goat kids. Goat kids were removed from the doe at birth and a jugular blood sample taken for analysis of serum IgG. The colostrum replacement was reconstituted with water. Kids were fed reconstituted colostrum replacement at 10% of their body weight divided into three feedings over a 16-hour period. Six hours after the last feeding another blood sample was collected for determination of serum IgG. Kids were observed for 10 minutes after each feeding for any adverse reactions. After the three feedings of colostrum kids were fed a milk replacer and offered starter feed. Health and weight gains were compared to other kids fed heat-treated goat colostrum up to 3 weeks of age. Postfeeding level of IgG was much greater than prefeeding, and the level post-feeding was the same for both colostrum treatments. There were no cases of scours or off-feed conditions. Weight gain was similar for both treatments as well. In conclusion, the bovine colostrum substitute resulted in satisfactory blood levels of IgG and kids that were equally healthy to cohorts and gained similarly.

05.02.08 Effects of Level and Length of Supplementation on Body Weight and Harvest Characteristics of Yearling Boer and Spanish Wethers

Arthur Goetsch, Roger Merkel, Terry Gipson, Zaisen Wang,

Langston University

Yearling Spanish and Boer wethers were used to determine effects of level and length of supplementation on body weight and harvest characteristics. The experiment started in January, with wethers residing in four pastures primarily with warm season grasses. Alfalfa hay was given free-choice and a pelleted diet was supplemented at 0.5 or 1.5% of body weight. Wethers were harvested at the beginning of the study and after 110 and 218 days. Live and carcass weight were greater initially for Boer than for Spanish wethers. Average daily gain was greater for Boer vs Spanish wethers in the first part of the study but was similar thereafter. Body weight was greater with the high than low level of supplementation, as was also true for weight of the carcass and noncarcass components. Digestive tract and mass relative to empty body weight were similar between breeds. Liver mass was lower for the high vs low level of supplementation and less at the end of period 2 than 1. Mass of internal fat was increased by the high level of supplementation in period 2 but not period 1. In summary, advantages of Boer in body weight and carcass weight were similar after period 1 and 2, breed had little effect on noncarcass components relative to empty body weight, and a long feeding period was required for effect of the high level of supplementation on mass of internal fat.

05.02.09 Ruminal Methane Emission by Boer and Spanish Does Supplemented with Garlic

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Twenty Boer and 20 Spanish does were used to examine effects of garlic on ruminal methane emission and heat production. All does received 200 g/day (as-fed basis) of a concentrate mixture, and one-half of the does also received 20 g/day of garlic powder. For at least 2 months does grazed grass/forb pastures in the summer. Thereafter, sets of four does consisting of one doe per treatment were sequentially placed in metabolism crates for 2 weeks, continued to receive supplements, and were fed coarsely ground alfalfa hay free-choice. Gas exchange was measured on the last day for 24 hours in an indirect, open circuit respiration calorimetry system with four metabolism cages fitted with head-boxes. There were no interactions between breed and supplement treatment. Intake of alfalfa hay during the calorimetry measurement period was greater for garlic than for control does. Ruminal methane emission was less for garlic than for control in g/day and relative to intake of dry matter and energy. Treatment did not affect the respiratory quotient, heart rate, heat production, or the ratio of heat production to heart rate. In conclusion, supplementation with garlic decreased ruminal methane emission and increased dry matter intake by Boer and Spanish does consuming alfalfa hay.

05.02.10 Effects of Meat Goat Breed, Gender, and Conditions Before and Between Measures on Behavior in Pens with Barb Wire and Electric Fence Strands

Arthur Goetsch, Glenn Detweiler, Terry Gipson, Tilahun Sahlu, Yoko Tsukahara,

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Growing Boer and Spanish goats were used to evaluate conditions for a method to test efficacy of electric fence strand addition to barb wire fence for cattle to contain goats. Test pens included one side adjacent to a pasture with abundant vegetation with barb wire strands at 30, 56, 81, 107, and 132 cm from the ground. Fence treatments were electric strands at 15 and 43 (LH), 15 and 23, 15, 23, and 43 cm at 6 kV. Adaptation procedures entailed four sequential weekly exposures to test pens: no electric strands, one strand at 0 kV, LH, and LH. Two preliminary treatments were imposed the week before the first observation period in week 1: barb wire with no electric strands vs. LH. All sets were observed for 1 hour in week 1, and four sets were exposed to the same fence treatment in week 6. During the 5 weeks between observations, sets were exposed to two washout treatments while on pasture: without or with electric strands at ≥ 6 kV situated next to concentrate feeders. Differences among fence treatments in the percentage of animals exiting pens were as expected based on the number and position of strands. More goats received a shock in week 1 vs. 6. Behavior of Boer and Spanish goats differed; therefore, breed should be a consideration for the testing method being developed. Adaptation procedures employed appeared conducive to use of an experiment with one observation period, whereas repeated observations would necessitate evaluation of other washout treatments.

05.02.11 Anthelmintic Efficacy of Medicinal Herbs in Goats Infected with Nematode Parasites

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Boer does naturally infected with Haemonchus contortus from grazing pasture were allocated to five groups and moved to a barn to investigate anthelmintic efficacy of three medicinal herbs, Rheum palmatum L. (rhubarb), Meliae cortex (melia bark), and Quisqualis indica L. (rangoon creeper). Does were given ad libitum access to grass hay and water and a limited amount of a concentrate-based supplement. Treatments were control, rhubarb, melia bark, rangoon creeper, and a 1:1:1 mixture of the three herbs. The herbs in powder form were mixed with water just before drenching. After being acclimated for 7 days, does were drenched with water alone or with the respective herbs at 20 g/day for 10 days. Fecal samples were collected on days 0, 3, 6, 9, 13, and 16 after the start of drenching for worm egg count. Blood samples were taken on day 0 and 13 for measuring packed cell volume. After 10 days of treatment, none of the herbs showed anthelmintic effects. Compared with control does, does treatment with rhubarb and the mixture had higher packed cell volume; however, the increases may have been due to scouring in response to treatment with rhubarb. In conclusion, these herbs were not effective anthelmintics for the most problematic internal parasite of goats, H. contortus, in much of the US.

05.02.12 GIS Grid Analysis of Utilization of Adjacent Pastures by Two Herds of Goats

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A 15.8-ha pasture was stocked with 36 Spanish goats and 12 Angus cows (GC), and a 14.1-ha pasture was stocked with 36 Spanish goats without cattle (GO) to observe spatial patterns. The pastures consisted of fescue, bermudagrass, various Panicum such as switchgrass, bahiagrass, and broomsedge bluestem, but areas were reverting to woody plant species such as sapling-sized trees of pecan, elm, and honey locust. GPS collars used recorded a fix every 5 minutes in the first 2 weeks. A GIS point-in-polygon analysis using a 10 × 10 m grid was conducted for each pasture. The GO had greater explored space compared with GC. Of the grids explored, GO had a higher percentage with a density of 100 or more fixes than did GC, indicating a wider area of methodical exploration or habituation. Goats in GO preferred pasture locations closer to the water point than did GC; however, GC came to the water point earlier than did GO. The favored location in the morning for each pasture was near the water point in the eastern intersection of the pastures. During the remainder of the day GC favored the southwestern-most corner of their pasture near a central fence line. In the afternoon, GO preferred the location near GC but also had a favorite location shaded by trees in the center of the pasture. The spatial behavior of the groups of goats appeared to be influenced by each other, and presence of cattle may have inhibited GC from fully exploring their pasture.

05.02.13 Different Supplement Treatments for Lactating Meat Goat Does Grazing Grass/Forb Pastures

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Lactating meat goats grazing 0.4-ha grass/forb pastures were used to determine effects on performance of different supplement treatments. Boer does with one or two kids were used in a study with four 4-wk periods starting 22 d after birth. Treatments were no supplementation, access to a 20% protein supplement block, and placement in a supplement pasture with mimosa (Albizia julibrissin) trees for 6 h 1 d/wk or twice weekly for 3 h/d. Forage mass was high and forage samples averaged 15% protein. Treatment did not affect doe average daily gain (ADG), although that by kids in the first three periods differed between type of supplement and frequency of supplement pasture access. Spanish does nursing two kids were used in a study with three 4-wk periods starting 66 d after kidding. Access to supplement pastures was for 24 h 1 d/wk or 2 d for 6 h/d. Forage mass was relatively low (i.e., 750 to 1,530 kg/ha) and, thus, grass hay was supplemented. Forage composition was similar to that earlier. Kid ADG in periods 1 and 2 was not affected by treatment. Doe ADG was increased by supplementation and greater with access to mimosa trees than the supplement block, which resulted from effects in period 3 after weaning rather than earlier. In conclusion, use of the supplement block was not beneficial, and infrequent access to supplement pastures had relatively small effects on average daily gain, perhaps because forage availability and nutritive value were not severely limiting.

05.02.14 Stocker cattle performance grazing wheat vs. three perennial cool season grasses (PCSG)

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Wheat is the primary forage for winter grazing of stocker cattle in the southern plains however grazing is very dependent on weather condition. Scientist at the USDA-ARS Grazinglands Research Laboratory, El Reno, OK has been evaluating PCSG as a more stable alternative to the unpredictability of wheat pasture. Data was provided by the USDA and was used to compare the performance of stocker cattle grazing three different PCSG (Jose tall wheatgrass, Manska intermediate wheatgrass, and Lincoln smooth brome) to Wheat through three fall and spring grazing seasons. Cattle were grazed on 36 different plots (9 of each grass. Plots were grazed in the fall before cattle were combined into one group and grazed on wheat through the winter. Cattle were returned to plots in the spring. Start weights for the fall ranged from 512 lbs to 574 lbs with a standard deviation of 28.5 lbs. Average daily gain was different between grasses and year ranging from 1.45 lbs to 2.86 lbs in the fall and 2.77 lbs to 4.28 lbs in the spring but no trend was apparent. In the fall Wheat had higher carrying capacity than PCSG. In the spring carrying capacity was similar between all four grasses and PCSG pastures were grazed longer in the spring as compared to wheat. Performance of cattle on the various grasses was highly dependent on year.

05.02.15 Performance of Crossbred Heifers on Fescue Pastures with and without Protein Supplement

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Beef stocker calves have lower average daily gains (ADG) when grazing fescue pastures as compared to wheat pasture. We theorized that dietary crude protein (CP) concentration limited animal performance. Data provided by USDA-ARS Grazinglands Research Laboratory, El Reno, OK was used to determine the impact of providing CP supplements (SUPPL) to stocker calves grazing fescue pastures in the fall and again in the spring. Start weight (SWT) of the heifers used was 564 ± 12.0 lbs (fall) and 718 ± 20.2 lbs (spring). Final BW of the heifers was 588 ± 23.2 lbs (fall) and 779 ± 25.9 lb (spring). In the fall, heifers consumed more ($P < 0.07$) of the 20% CP SUPPL than the 40% CP (3.4 ± .64 vs. 2.2 ± .48 lbs.). In the spring, SUPPL intake averaged 1.54 ± .37 lbs and was not different ($P > 0.41$) among treatments. Providing CP to heifers grazing fescue pastures did not increase ADG. Additional research is needed to determine the factor limiting animal performance on fescue diets.