

children still in program, and interest in specific project. A pre-survey of association directors revealed common reasons for volunteering were: enjoy working with youth and horses and a desire to contribute back to a program, which benefited them. Some of the challenges listed included trying to keep program costs minimal for leaders and youth, personal expense when attending association activities, and improving communi-

cation. Overall, directors consider the association to be highly effective in conducting 4-H/youth horse extension activities. These volunteers are examples of extremely dedicated individuals with a common interest - to offer youth quality educational programs.

Key Words: Volunteer association, 4-H/youth, Extension horse activities

ASAS/ADSA Forages and Pastures: Grazing

911 Evaluation of calf and forage production in rotational stocking systems for spring- and fall-calving beef cows. N. A. Janovick*¹ and J. R. Russell¹, ¹Iowa State University.

To evaluate two forage management systems, 24 spring-calving Angus-cross cows with calves were rotationally stocked in four 8.1-ha smooth brome-grass-orchardgrass-birdsfoot trefoil (SB-OG-BFT) pastures on April 22, 1999, and April 26, 2000. In a hay harvest (HH) system, spring-calving cows with calves grazed 2.03 ha for 58 d. Forage from the remaining 6.07 ha was harvested as first-cutting hay and incorporated into the rotational stocking system after 28 d. Over winter, cows were maintained in a drylot. In a first-last (FL) grazing system, six spring-calving cows with calves and 12 stocker cattle grazed paddocks in a rotational stocking system before six pregnant fall-calving Angus-cross cows for 55 d. In addition, forage from replicated 6.07 ha smooth brome-grass-red clover (SB-RC) and tall fescue-red clover pastures (TF-RC) was harvested as first-cutting hay and strip-grazed by spring-calving cows with calves and fall-calving cows for 50 d while stocker cattle grazed SB-OG-BFT pastures. Thereafter, stocker cattle were removed and spring- and fall-calving cows were again rotationally stocked in SB-OG-BFT pastures for 80 d. During winter, spring-calving cows grazed replicated 6.07 ha corn crop residues and stockpiled SB-OG pastures and fall-calving cows grazed stockpiled TF-RC pastures. Fall-calving and spring-calving cows were bred by natural service over 45 and 49 d in yr 1, respectively, and over 42 d in yr 2. No difference in average daily gains of spring calves and total growing animal production per hectare between systems was observed. Conception rates of spring-calving cows in the HH system were lower ($P < .01$) than spring-calving cows in the FL system in yr 1 and lower ($P < .01$) than fall-calving cows in the FL system in yr 2. Hay production per hectare did not differ between systems in yr 1, but was greater ($P < .05$) for the HH system than for the FL system in yr 2. Total perennial winter forage production per cow for the HH and FL systems were 1329, 4898 and 3272, 4681 kg DM in yr 1 and 2, respectively.

Key Words: beef cattle, rotational stocking, stockpiled forage

912 Liveweight and growth rate of cow-calf pairs grazing tall fescue pastures infected with either non-toxic (MaxQTM) or toxic endophyte strains. R.H. Watson*, M.A. McCann, J.A. Bondurant, J.H. Bouton, C.S. Hoveland, and F.N. Thompson, *The university of Georgia, Athens, GA.*

A trial was conducted to determine whether cow-calf pairs grazing tall fescue pastures infected with the non-toxic endophyte, MaxQTM, have better productivity than cow-calf pairs grazing tall fescue infected with the toxic, wild-type endophyte. Two 7.1 ha paddocks and two 7.3 ha paddocks were sown in tall fescue (*cv*: Georgia-5) infected with either the MaxQ or toxic endophyte. The 7.1 ha and 7.3 ha paddocks were stocked in early March with 15 and 16 cow-calf pairs respectively. The cow-calf groups were balanced for cow age, calving date, BW, and body condition-score (BCS). The pairs were grazed on their respective treatment pastures until the calves were weaned in late August. All cows and calves were weighed and blood sampled pre-treatment, and subsequently every 8 weeks, with a final weight recorded at calf weaning. Cows were visually assessed for BCS at these times. Blood samples were analyzed for prolactin as an indication of toxicosis. Serum prolactin levels were lower ($P < .01$) in cows and calves on toxic fescue (32 ng/ml, and 36 ng/ml respectively) than cows and calves on MaxQ fescue (94 ng/ml, and 101 ng/ml respectively). Cow BW and BCS were better ($P < .05$) at weaning in the MaxQ group compared with the toxic group (BW, 512 kg vs 486 kg respectively; BCS, 5.9 vs 5.3 respectively). Steer calves raised on MaxQ fescue had better ADG and weaning weights than all other groups of calves. Heifer calves raised on MaxQ fescue had better ADG and weaning weights than heifer calves raised on toxic fescue but were not different from steer calves raised on toxic fescue. The results indicate that grazing tall fescue infected with the MaxQ endophyte, as

opposed to toxic tall fescue, has the potential to eliminate toxicosis and greatly improve cow-calf productivity.

	Steer calves		Heifer calves	
	Toxic	MaxQ	Toxic	MaxQ
ADG (kg/d)	0.91 ^{a,b}	1.15 ^c	0.87 ^a	1.03 ^b
Weaning weight (kg)	226 ^{a,b}	260 ^c	207 ^a	230 ^b

^{a,b,c} Means on same row with different superscripts are different ($P < .05$)

Key Words: Cow-calf production, Toxic tall fescue, MaxQ

913 Non-toxic endophyte (MaxQTM) use for alleviating tall fescue toxicosis in stocker cattle. J.A. Bondurant*, M.A. McCann, J.H. Bouton, C.S. Hoveland, R.H. Watson, and J.G. Andrae, *The University of Georgia, Athens, GA.*

To address the problem of fescue toxicosis in grazing cattle, plant persistence-enhancing non-toxic endophytes from New Zealand have been incorporated into tall fescue cultivars grown in Georgia. The objectives of the present study were to determine animal performance and evaluate toxicosis in stocker steers and heifers grazing non-toxic endophyte-infected (MaxQTM), endophyte-free (EF), or toxic endophyte-infected (EI) tall fescue. Replicated (n=2) .809-ha tall fescue paddocks were established at the Central Georgia Branch Station near Eatonton, GA and at the Northwest Georgia Branch Station near Calhoun, GA with Jesup and Kentucky-31 tall fescue cultivars, respectively. Animals were stocked on the paddocks using put-and-take grazing management during four periods from Spring 1999-Fall 2000 that averaged 65 d each at Eatonton and 89 d each at Calhoun. Mean stocking rate at Eatonton was 7.1 hd/ha with no treatment differences ($P > .05$). At Calhoun stocking rate averaged 8.9 hd/ha and was higher ($P < .05$) on the toxic EI paddocks compared to the MaxQTM and EF paddocks. Forage available during grazing was approximately 3100 kg DM/ha at the central GA location and 1900 kg DM/ha at the northwest GA location. There were no differences ($P > .05$) seen among treatments for available forage with the exception that MaxQTM available forage levels were lower ($P < .05$) than toxic EI available forage levels during Fall 2000 at Calhoun. D-14+ serum prolactin was depressed ($P < .05$) on the toxic EI paddocks compared to the MaxQTM and EF paddocks during fall grazing at Eatonton and during both seasons at Calhoun. No differences ($P > .05$) were found in d-14+ rectal temperatures among the three treatments. ADG/hd and gain/ha were higher ($P < .05$) on the MaxQTM and EF paddocks than on the toxic EI paddocks in both trials. These results suggest that infecting tall fescue cultivars with non-toxic endophytes is a promising alternative for combating fescue toxicosis in stocker cattle.

Key Words: Tall fescue, Nontoxic endophytes, MaxQTM

914 Performance of beef cattle grazing endophyte-infected tall fescue or sod-seeded ryegrass. D.W. Sanson*¹ and D.F. Coombs², ¹Rosepine Research Station, ²Dean Lee Research Station, *LSU Ag. Center.*

Grazing endophyte-infected tall fescue was compared to grazing sod-seeded ryegrass in West Central Louisiana for two-years with mature beef cows. Seventy-six cows (551 kg) were randomized into four groups of 19 cows. Each group was assigned to 8.1 ha pastures that were subdivided into four 2 ha paddocks. Two pastures were previously established in endophyte-infected fescue along with bermudagrass and bahiagrass, while two bermudagrass/bahiagrass pastures were sod-seeded with ryegrass each fall. Cows were maintained on their assigned pastures throughout the year. Hay was available in the fall prior to calving when forage availability was not adequate for grazing. Cows, predominantly Angus, Simmental, and Hereford crosses, were exposed to Brangus bulls from late April to mid-June of each year. Conception rate was determined by rectal palpation in September. Calves were weaned in mid-October. The model for data analysis included treatment, year,

and the treatment X year interaction. In general, cow weight, cow weight change, or cow condition score were not affected ($P > .1$) by treatment, however, cows grazing ryegrass were heavier ($P = .04$) in September (600 vs 578 kg for ryegrass and fescue, respectively). Cows grazing ryegrass had higher ($P < .03$) condition scores (5.8 vs 5.6) prior to calving, however the difference was probably not of biological significance. Fall pregnancy rates were lower ($P = .03$) for cows that had grazed fescue (70.4%) compared to cows that grazed ryegrass (91.6%). Calves born to cows grazing fescue (38 kg) weighed less ($P = .02$) at birth than calves born to cows that grazed ryegrass (43 kg). There was no difference ($P > .2$) in calf weights at the end of the breeding season or at weaning due to grazing treatment. These data suggest a negative effect of grazing endophyte-infected fescue on pregnancy rates with mature beef cows under West Central Louisiana conditions.

Key Words: Fescue, beef cows, ryegrass

915 Effect of grazing tall fescue endophyte types on subsequent feedlot performance and carcass quality. S. K. Duckett¹, J. A. Bondurant¹, J. G. Andrae¹, J. N. Carter², M. A. McCann¹, T. D. Pringle², and D. R. Gill², ¹University of Georgia, Athens, ²Oklahoma State University, Stillwater.

Research was conducted to determine the effect of grazing tall fescue pastures with different endophyte types on subsequent feedlot performance and carcass quality of beef cattle. Cattle grazed tall fescue endophyte infected (TOXIC), free (EF), or non-toxic (MAXQTM) pastures for 84 d at the Central Georgia Experiment Station (CGES), Eatonton and 112 d at the Northwest Georgia Experiment Station (NWGES). Real time ultrasound measures of fat thickness (UFT), ribeye area (UREA), and intramuscular fat (UIMF) were collected at the end of grazing phase. Twenty-four crossbred steers from CGES and twenty-four Angus heifers from NWGES were transported to the Willard Sparks Feedlot (Stillwater, OK). At the feedlot, cattle were allotted by location, grazing treatment and pasture replicate to pens (4 hd/pen) and fed a high concentrate diet for 112 d. Cattle were weighed at 28-d intervals and pen feed intake data was recorded on a daily basis. Carcass data were collected after harvest. Data were analyzed with treatment, location and two-way interaction in the model. Interactions between treatment and location were non-significant ($P > 0.05$). MAXQTM and EF cattle gained 0.52 kg/d more ($P < 0.05$) than TOXIC during the grazing phase. UFT and UIMF were similar ($P > 0.05$) between grazing treatments. MAXQTM and EF cattle had larger UREA than TOXIC; however, UREA/cwt values were similar ($P > 0.05$). At the beginning and end of feedlot phase, MAXQTM and EF cattle were over 50 kg heavier ($P < 0.05$) than TOXIC. Feedlot ADG was similar ($P > 0.05$) among grazing treatments. Hot carcass weights were higher ($P < 0.05$) for MAXQTM and EF than TOXIC. Other carcass quality measures did not differ ($P > 0.05$) due to grazing treatment. Carcass value was higher ($P < 0.05$) for MaxQTM than TOXIC with EF being intermediate. Thus, TOXIC cattle did not compensate in the feedlot for lower gains attained in the grazing phase and remained lighter in weight than EF or MaxQTM throughout the feedlot phase.

Key Words: Fescue, Feedlot, Carcass

916 The Effect of Yeast (*Saccharomyces cerevisiae*) Mineral on Organic Matter Digestibility in Beef Cattle on Native and Fescue-based Pasture Grazing Systems. Dean Kobs* and Stephen Boyles, *The Ohio State University.*

Twenty cows were given ad-lib access to mineral mix (control) or yeast (Diamond V XP[®]) mineral mix over the course of a year. Organic matter (OM) digestibility of the pasture was measured by randomly sampling the forage base and collecting 10 fecal grab samples per animal over five days (at least two samples per day). The fecal collections were conducted at different times of the day and/or night to account for diurnal variation. The trial was conducted in the winter (December), and twice in the summer (June and August). In-vitro OM digestibility was measured in both forage samples and cow fecal samples (compiled within animal). The indigestible forage and feces were measured for acid detergent fiber (IADF). The IADF served as an internal marker to calculate OM digestibility. There was no significant difference between groups in both seasons. However, in both summer trials, there was a trend of increased June OM digestibility 47% vs. 43% ($P = 0.12$) and August OM digestibility 55% vs. 52% ($P = 0.14$) in the yeast-mineral supplemented

groups. The trend may imply yeast-mineral supplemented cattle have an increased ability to digest organic matter in the summer months.

Key Words: Yeast (*Saccharomyces cerevisiae*)

917 Effect of method of storage on protein and fiber fractions, and *in situ* digestibility of kikuyu grass (*Pennisetum clandestinum*) and guinea grass (*Panicum maximum*). J.R. Carpenter¹, S.E. Ellis², and R.Y. Niino-DuPonte¹, ¹University of Hawaii at Manoa, Honolulu, HI USA, ²University of South Carolina, Columbia, SC USA.

Cattle production in tropical/sub-tropical regions is limited by the available pastures' ability to support growth, reproduction, and lactation due to their high moisture and fiber, and low protein and energy content. The objectives of this experiment were to determine the effect of method of storage (direct cut, wilted silage, haylage and hay) on protein and fiber fractions and their relationship to extent and rate of dry matter, protein and fiber digestion. Six-week old kikuyu grass (KG) and guinea grass (GG) were harvested, chopped, then wilted to various moisture levels before being stored as silage or haylage in replicated experimental silos or as hay. After 30 d, subsamples from each storage method were analyzed for DM, fiber and protein fractions, and *in situ* digestibility. CP, NDF, ADF, and cellulose (averaged across storage methods) were 14.7, 65.7, 35.6, and 25.2% for KG and 8.6, 70.1, 44.7, and 31.8% for GG, respectively. *In situ* extent and rate of digestion differed ($P < .05$) both between grasses and storage method. Extent of digestion for DM, CP, NDF, and ADF (averaged across storage methods) were 54.2, 65.3, 45.4, and 47.4% for KG, and 43.9, 70.9, 46.6, and 45.1% for GG, respectively. Rates of DM, CP, NDF and ADF tended to increase as moisture content decreased for GG, but the opposite trend was observed for KG. For both grasses, the proportion of hemicellulose to NDF and to cellulose decreased and cellulose to ADF increased with decreasing moisture content. The proportions of soluble N decreased and insoluble available N increased as moisture content of storage method decreased. Data suggest that the method of storing tropical grasses alters both the nutrient composition, particularly the protein and fiber fractions, and the rate and extent of *in situ* digestion.

Key Words: Tropical grass and Silage/Haylage, Protein and fiber fractions, *In situ* digestibility

918 Characterization of season and sampling method effects on forage quality in fescue-based pastures. T.M. Dubbs*, E.S. Vanzant, S.E. Kitts, R.F. Bapst, B.G. Fieser, and C.M. Howlett, *University of Kentucky, Lexington.*

Information describing effects of seasonal changes and sampling methods on measurement of forage quality is limited for fescue-based pastures. Eight continuously-grazed, .76-ha, fescue-based pastures were used to compare forage type, method of collection, and seasonal effects on forage quality in a repeated measures, split-plot design. Four pastures were interseeded with red clover during March 2000. Masticate (M; from 4 ruminally-cannulated steers) and hand-clipped (C) samples were collected every 28 days from May until October 2000. In general, interseeding red clover in tall fescue-based pastures did not contribute ($P > .10$) to differences in OM, CP, NDF, ADF, or protein degradability characteristics. Sampling method effects were not evaluated for protein degradability characteristics. Sampling method and season interacted ($P < .03$) for OM, CP, NDF, and ADF. Concentrations of OM were greater ($P < .01$) for C than M in all months and responded quadratically ($P < .01$) to month for both C and M (C: 93, 93, 94, 94, 94, and 93%; M: 91, 89, 87, 88, 87, and 89% for May-October). NDF (C: 69, 73, 75, 74, 72, and 63%; M: 66, 68, 66, 66, 65, and 62% for May-October) and ADF (C: 35, 39, 42, 38, 37, and 31%; M: 33, 35, 33, 34, 34, and 31% for May-October) were greater ($P < .01$) for C than M in all months except October ($P > .10$) and were described by quadratic ($P < .01$) responses across month, except for NDF with C, which was cubic ($P = .04$). Crude protein (C: 13, 11, 12, 13, 14, 17%; M: 16, 15, 18, 18, 18, and 18% for May-October) was lower ($P < .01$) in C than M in all months except October ($P > .10$) and was quadratic ($P < .01$) across months for C, and cubic ($P < .01$) for M. Within M, concentrations of A, B, and C protein fractions, determined from *in situ* analysis (uncorrected for microbial attachment), responded cubically ($P < .01$) to month, whereas protein degradation rate decreased linearly ($P < .01$) from May-October. Estimates of protein degradability responded cubically (72, 61, 64, 67, 65,

and 67% for May-October). In its first growing season, red clover interseeded into fescue pastures did not influence quality of diet selected by grazing steers. Differences between clipped and masticate samples were substantial until late season, when opportunities for selective grazing were minimal.

Key Words: Fescue, Season, Quality

919 Performance of high producing dairy cows with three feeding systems combining pasture and total mixed rations. F. Bargo*, L. D. Muller, J. E. Delahoy, T. W. Cassidy, and J. L. Amick, *The Pennsylvania State University, University Park.*

Forty-five Holstein cows [15 primiparous and 30 multiparous (6 rumen cannulated); 624 kg BW; 44.9 kg/d milk; 109 DIM] were used in a repeated measures design of 21 weeks to study the effect of three feeding systems on animal performance and rumen digestion. Cows were blocked by lactation number and DIM, and randomly assigned to three treatments: pasture + concentrate (PC); pasture + total mixed ration (TMR) (partial TMR; pTMR); and total mixed ration (TMR). Cows on PC and pTMR grazed a grass pasture offered at 30 kg DM/cow/d plus a corn-based concentrate (1 kg/4 kg of milk for PC and an amount to maintain a similar forage:concentrate ratio between PC and pTMR for pTMR). Cows on TMR were fed ad libitum with a nutritionally balanced TMR. Pasture, concentrate and TMR had 26.3, 15.2, and 16.6% CP; 49.9, 15.7 and 30.1% NDF, respectively. Total DMI was measured 4 times in all three treatments using Cr₂O₃ as fecal marker. The highest total DMI and milk production were obtained with the TMR diet, the lowest with the PC, and intermediate with the pTMR. Both the TMR and the pTMR treatments had a higher milk fat and protein percentage than the PC treatment. Cows on PC and pTMR gained less BW (27 and 40 kg, respectively) than cows on TMR (76 kg). Concentration of rumen ammonia N and MUN were significantly lower in TMR and pTMR treatments than in PC treatment. Rumen pH and total VFA concentration were not affected by treatments. The combination of pasture and TMR resulted in a higher milk production with a higher fat and protein content and a better dietary N utilization than the pasture plus concentrate combination.

	PC	pTMR	TMR	SEM
Milk, kg/d	28.5 ^a	32.0 ^b	38.1 ^c	1.15
Fat, %	3.13 ^a	3.35 ^b	3.30 ^b	0.05
True protein, %	2.82 ^a	2.95 ^{ab}	2.99 ^b	0.05
MUN, mg/dl	14.93 ^a	12.01 ^b	10.55 ^c	0.41
Rumen NH ₃ -N, mg/dl	19.96 ^a	10.75 ^b	9.74 ^b	0.48
Concentrate DMI, kg/d	8.7 ^a	2.2 ^b	-	0.11
Pasture DMI, kg/d	13.0 ^a	7.5 ^b	-	0.34
TMR DMI, kg/d	-	15.5 ^a	26.8 ^b	0.40
Total DMI, kg/d	21.7 ^a	25.2 ^b	26.8 ^c	0.47

^{a, b, c}Least square means with different superscripts differ $P < 0.05$

920 Application of a pasture intake model in an educational package to enhance farmer uptake of pasture quality management technologies. S.J.R. Woodward* and M.G. Lambert, *AgResearch Limited, Hamilton, New Zealand.*

Accurate feeding of livestock on pasture depends on a farmer's ability to estimate the quantity and quality of the feed components on offer, and then to predict what animals will eat while grazing. An educational package was developed to better enable New Zealand sheep and beef farmers to manage pasture quality on-farm. The package was designed to promote farmers' (1) understanding of pasture quality, (2) measurement of pasture quality on-farm, (3) prediction of animal responses to pastures with an estimated quality, and (4) management of pasture quality for feeding livestock to achieve pre-determined performance targets. Part of the objective was achieved by constructing a computer-based decision support tool, Q-Graze. A farmer enters field estimates of pasture quality, along with stock and grazing management information, and Q-Graze then predicts changes in herbage mass and quality, intake, and liveweight gain responses of animals. This allows the farmer to check that liveweight gain targets will be met, and if not, to alter his or her grazing plan accordingly. Predicting grazing behavior, intake, and liveweight gain is complicated because of the dynamic interplay between pasture mass and quality, intake rate and composition, rate of digestion, and animal energy metabolism. Mathematical models are the most appropriate tool for simulating these interactions. Underlying Q-Graze is

a pasture intake model that calculates bite size, bite composition, bite handling time (including ruminating), and energy intake rate. The ratio of energy intake rate to animal energy demand is used to determine the animals' instantaneous feeding effort (the time derivative of grazing time plus ruminating time). This allows the seamless integration of four constraints to intake: satiation, digestive capacity, resting requirements, and cessation of feeding when net energy assimilation rate falls below zero. Daily dry matter and energy intakes can then be calculated, and used to predict animal growth. The successful application of this pasture intake model is possible because it is embedded in a user-friendly software tool (Q-Graze). Use of Q-Graze by farmers during its development allowed them to shape the software, and contributed to their learning about pasture quality.

Key Words: Decision support software, Sheep, Beef cattle

921 Using *in sacco* and *in vitro* incubations to determine the digestion and fermentation kinetics of fresh forages. J.L. Burke*^{1,2}, G.C. Waghorn¹, L. G. Barrell^{1,2}, I. M. Brookes², G.T. Attwood¹, and E. S. Kolver³, ¹AgResearch, ²Massey University, ³Dexel Ltd, New Zealand.

The objective of this study was to estimate the nutritive value and digestion kinetics of New Zealand forages using *in sacco* and *in vitro* incubations. Initial studies using three fresh forages (*Trifolium repens*, *Lolium perenne* and *Lotus corniculatus*) indicated that mincing was a more suitable preparation for incubation than either freeze drying and grinding or chopping to 6-mm lengths. Digestion kinetics were determined on 23 contrasting fresh forages following mincing to a particle size similar to chewed material. Forages (2.5 g wet) were incubated *in vitro* at 39°C for 24 h with McDougals buffer, rumen liquor (obtained from a Friesian cow fed good quality lucerne hay) and cysteine sulphate reducing agent. Triplicate bottles of each forage were removed after 0, 2, 4, 6, 8, 10, 12 and 24 h of incubation and sub-sampled for ammonia, VFA and pH determination. 100 mm x 100 mm dacron bags containing 30 g of each forage were placed in the rumen of the cow. Duplicate bags were removed at 0, 2, 6, 12, 24 and 72 h, hand-rinsed in cold water, dried at 60°C for 48 h and residues were analysed by NIRS to estimate nutrient content. Kinetic parameters of DM and nutrient disappearance over time were predicted by fitting data from bag residues to a non-linear model (Orskov and McDonald, 1979). Estimates of DM solubility (%DM) and fractional DM degradation rates (h⁻¹) were: temperate grasses (48, 0.09); legumes (42, 0.14); tropical grasses (29, 0.06); silages (45, 0.10); herbs (40, 0.25). High nitrogen legumes released up to 43% of plant-N over 24 h. Low nitrogen tropical grasses released a maximum of 8% of the plant-N after 6 h, and losses of plant-N decreased thereafter. These data will be used as a scientific basis for formulating forage-based rations in which the components complement each other in terms of their digestion and fermentation characteristics. Such rations may then be incorporated into New Zealand grazing systems to optimise the nutrient supply for high-producing dairy cows.

Key Words: Forages, *in vitro*, *in sacco*

922 Condensed tannins in legumes increase milk production of dairy cows. S.L. Woodward*, E.B.L. Jansen, and P.J. Laboyrie, *Dexel Ltd, Hamilton, New Zealand.*

New Zealand dairying relies on ryegrass (RG)-white clover pastures. *Lotus corniculatus* is an alternative legume species which, when grazed by lactating dairy cows, results in higher milk yield than either RG or white clover. It was thought that condensed tannins (CT) contributed to this increase. CT (phenolic compounds in some legumes including *Lotus*) bind to plant proteins and reduce microbial degradation of soluble protein to ammonia. This increases non-ammonia nitrogen flux to the abomasum and small intestine, and absorption of amino acids from the small intestine. Three indoor feeding trials were conducted to determine what proportion of milk yield and milk composition changes were due to CT in *Lotus*, and what proportion was due to factors common to all legumes. Friesian dairy cows in mid- to late-lactation (125-226 days in milk) were fed either RG or *Lotus*, and were drenched with either polyethylene glycol (PEG) solution or water. CT bind to PEG in preference to plant proteins thereby rendering the CT inactive. Comparing cows on RG (21.4%DM; 17.4% crude protein; 10.7 MJ ME/kg DM; 0% CT) or *Lotus* (16.0%DM; 23.7% crude protein; 11.6 MJ ME/kg DM; 2.63% CT) diets with CT-inactivated cows (+PEG) allowed effects of CT in *Lotus* to be quantified. Higher milk yield of cows fed *Lotus*

was due to a combination of legume factors (higher intake and forage quality), and CT effects, which contributed 42% of the increase in yield. CT also contributed 65% of the increase in milk protein concentration and 100% of the increase in conversion efficiency, but did not contribute to the increase in intake or decrease in milk fat concentration. *Lotus* has potential as a forage for dairy cows, although its low herbage yield compared with traditional forages necessitates further investigation of management options for inclusion of *Lotus* into the farm system. Table: Means (30 cows) and SEDs of combined data from all three trials.

	RG	RG+PEG	Lotus	Lotus+PEG	SED
Milk yield (kg/cow/d)	12.87	12.70	18.88	16.22	0.58
Intake (kgDM/cow/d)	15.05	14.69	17.03	16.98	0.65
Fat (%)	4.74	4.70	4.48	4.46	0.12
Protein (%)	3.22	3.19	3.48	3.30	0.05
Efficiency (ml FCM/MJ ME)	139	136	166	137	8

FCM: fat corrected milk

Key Words: Dairying, Tannins, Milk

923 Nutrient composition of forages in Arkansas, 1985-1999. G. V. Davis*, M. S. Gadberry, and T. R. Troxel, *University of Arkansas Cooperative Extension Service, Little Rock, AR.*

The objective of compiling a statewide forage database was to determine the average nutrient composition and variability of forages produced in Arkansas. The database consists of 11,592 forage samples (10,246 hay, 1,001 pasture and 345 silage) collected from 1985 to 1999. Forage samples were analyzed for 1 to 15 nutrients. These included DM, N, ADF, NDF, P, K, Ca, Mg, Na, S, Fe, Mn, Zn, Cu and Se. The mean \pm SD CP and TDN levels (% DM) of bermudagrass (n = 3,007), fescue (n = 904), mixed grass (n = 2,394) and all hays (n = 8,316) were, respectively; 12.4 \pm 3.5, 60.0 \pm 6.2; 11.2 \pm 3.0, 53.8 \pm 4.7; 11.1 \pm 3.1, 52.9 \pm 4.7; and 12.0 \pm 3.8, 56.8 \pm 6.6. For beef cows and calves, TDN was deficient in a higher percentage of hays (P < 0.05) than CP. Bermudagrass hay contained greater (P < 0.05) levels of CP and TDN, but lower (P < 0.05) levels of P and Mg than fescue or mixed grass hays. Fescue and mixed grass hays did not differ (P > 0.05) in CP, ADF, NDF or TDN concentrations. Mixed grass hay contained greater (P < 0.05) levels of Ca but less (P < 0.05) S than bermudagrass. Fescue hay had less (P < 0.05) Cu and Zn than bermudagrass or mixed grass hays. Sodium was the most deficient mineral in all hays. Only 6 to 10% of the hays analyzed for Na contained adequate levels for beef cows and calves. Trace minerals Se, Cu, and Zn were deficient in 60, 52 and 41% of the samples, respectively.

ASAS/ADSA Growth and Development: Ruminant Growth and Mammary Development

925 Effects of a dairy calf starter containing yeast culture on daily grain intake, weight gain, structural growth, and rumen development in dairy calves. K. E. Lesmeister* and A. J. Heinrichs, *The Pennsylvania State University, University Park, Pennsylvania.*

The effects of supplemental yeast culture on daily grain intake, weight gain, structural growth, and rumen development were analyzed using 75 Holstein calves (38 male and 37 female) fed one of three grain starters containing a yeast culture (*Saccharomyces cerevisiae*, Diamond V Mills, Inc.) at 0 (C), 1% (1Y), or 2% (2Y) of the ration in a randomized block design. Calves were placed on trial at 2 1 d of age and maintained on trial for 42 d. A non-medicated milk replacer (20% CP, 20% fat) was fed in two equal feedings totaling 10% of birthweight until abrupt weaning at 35 d on trial. Grain and water were provided daily on an ad-lib basis, with grain intake (GI) being measured daily. Measurements of bodyweight (BW), wither height (WH), hip height (HH), hip width (HW), and heart girth (HG) were recorded at 0, 7, 14, 21, 28, 35, and 42 d on trial. Incidences of scours were recorded daily (DS). Two calves per treatment were slaughtered at 42 d, weights of empty stomach compartments (CE) were recorded, and rumens sampled for analysis of papillae length (PL), papillae width (PW), wall thickness (WT), and papillae/cm² (PC). No differences were observed between sexes for all variables. Average daily GI was greater (P = 0.029) for 2Y (0.687 kg/d) than for C (0.602 kg/d). Average daily gain was numerically greater for 2Y (0.340 kg/d) compared to C (0.304 kg/d) and 1Y (0.287 kg/d). Average daily change in HW was greater (P = 0.013) for 2Y (0.064 cm/d)

A lower percentage of the hays were deficient in P, Ca, Mg and S. Fe, Mn and K were deficient in 2% or less of the hays. Wheat, ryegrass, legume-grass and fescue pastures tended to contain greater levels of CP and TDN than the other pasture forages analyzed. Bermudagrass, corn, and sorghum-sudan silages contained greater (P < 0.05) levels of TDN than the other silages. This information was provided to county Extension agents, cattle producers, and cattle-related industries to promote forage testing by cattle producers and provide general feeding recommendations whenever a forage test was unavailable.

Key Words: Hay, Pasture, Forage composition

924 Frontal grazing for cattle management on annual ryegrass pasture. H. Lippke*¹, T. D. A. Forbes¹, R. V. Machen², and B. G. Warrington¹, ¹Texas Agricultural Experiment Station, Uvalde, TX, ²Texas Agricultural Extension Service, Uvalde, TX.

An experiment was conducted to develop a modified frontal grazing system (FGS) based on center pivot irrigation machinery and to compare that system to a traditional continuously stocked management system (CGS) with respect to (a) ADG by yearling steers grazing ryegrass (*Lolium multiflorum*) and (b) livestock production/unit land. In the FGS, a break wire was attached to the towers of the outer 98 m of a 244-m center pivot. Concentric rings of temporary fence restrained lateral movement of the steers, while a manually advanced back fence restricted the cattle to a 15 to 20-degree arc of the circle. Pivot towers were advanced at a rate such that 30% of the ryegrass leaf lamina remained with the ungrazed plant residue. The CGS was lightly stocked initially at 593 kg animal weight/ha. The FGS was initially stocked with 1038 kg animal weight/ha. With the onset of spring growth, cattle were added to both systems so that at the mid-point of the 156-d grazing season, the CGS and the FGS supported 1094 and 1989 kg animal weight/ha, respectively. As an additional measure to control forage growth, 25% of the CGS and 20% of the FGS was de-stocked during the month of March, harvested as high-moisture hay, and restocked in mid-April. Average daily gain for steers on the CGS (1.22 kg) was greater (P < .01) than ADG for steers on the FGS (1.08 kg). Animal production/unit land was greater (P < .01) for the FGS (834 kg/ha) than for the CGS (668 kg/ha). If the animal production potential of the hay harvested from these systems is included, the FGS again produced more (P < .01) gain than the CGS (873 vs 746 kg/ha). Frontal grazing offers instant flexibility in cattle management and sufficient promise of higher productivity to be further evaluated in comparison with an array of stocking densities under continuous grazing.

Key Words: Grazing system

than for C (0.052 cm/d). A trend (P = 0.128) for PC from the caudal ventral rumen wall was also observed between C and 2Y (938.75 vs. 711.06 papillae/cm²). No treatment differences were observed for BW, WH, HH, HG, DS, CE, PL, PW, and WT. These data suggest that the addition of yeast culture in a dairy calf grain starter at 2% of the ration positively influenced average daily grain intake, ADG, hip width, and rumen papillae/cm².

Key Words: Dairy Calves, Intake, Rumen Development

926 Calf serum IgG concentrations affects weaning performance. R. C. Vann* and J. F. Baker, *University of Georgia, Tifton, GA/USA.*

The objective of this study was to determine if calf serum IgG concentrations at 24 h of age affects growth performance to weaning. Calves were born in January or February in two consecutive years and weighed monthly beginning in March until weaning in early September. Colostrum samples were collected from Angus (n=94) and Polled Hereford (n=38) cows at the Tifton location and crossbred (n=112) cows at the Alapaha location within 8 h after parturition and serum samples collected from their calves at 24 h of age. The serum and colostrum immunoglobulin (Ig) concentrations were determined using radial immunodiffusion (RID) kits. Calf serum IgG concentrations were classified as Superior (S) Ig concentration (above 1600 mg IgG/100 ml), Average