

Forages and Pastures: Dairy and Livestock

660 Effect of organic grain supplementation on production, body weight, body condition score, and profitability of organic dairy cows. B. J. Heins^{1,3}, J. C. Paulson², M. I. Endres³, and R. D. Moon³, ¹University of Minnesota, West Central Research and Outreach Center, Morris, ²University of Minnesota Extension, Willmar, ³University of Minnesota, Saint Paul.

Organic cows (n = 96) were used to evaluate grain supplementation levels during the grazing season (May to September 2012) on production, body weight, body condition score (BCS), and profitability of organic dairy cows. Cows were assigned to one of 3 replicate supplementation groups, 1) no grain supplementation (100% pasture, GRS, n = 32), 2) low grain (2.72 kg/head/day, LOW, n = 32), and 3) high grain (5.44 kg/head/day, HI, n = 32), and calved at the University of Minnesota West Central Research and Outreach Center, Morris, Minnesota from October to December 2011 and March to May 2012. Supplement (organic corn and minerals) was fed with a total mixed ration of corn silage and alfalfa haylage, and at least 30% of diet dry matter intake for LOW and HI cows consisted of organic pasture. Milk production, from daily milk weights, was averaged weekly for cows, and body weight and BCS were recorded bi-weekly. Analysis was with PROC MIXED of SAS, and independent variables for statistical analysis were fixed effects of season of calving (fall or spring), parity (1,2,3+), supplementation group, breed group nested within supplementation group, and week nested with supplementation group, with replicate and cow nested within supplementation group and breed group as a random effect. The GRS (14.6 kg/d) cows had significantly ($P < 0.05$) lower energy-corrected milk than LOW (16.9 kg/d) and HI (16.5 kg/d) cows; however, the LOW and HI cows were not significantly different from each other. The GRS, LOW, and HI cows were not significantly different for body weight across the grazing season; however, GRS (2.98) cows had significantly ($P < 0.05$) lower BCS than HI (3.15) cows. Milk urea nitrogen was significantly ($P < 0.05$) higher for GRS (14.3 mg/dl) than LOW (10.1 mg/dl) and HI (7.3 mg/dl) cows. Income over feed costs was significantly higher ($P < 0.05$) for the GRS (\$3.61/cow/day) cows compared with the LOW (\$2.20/cow/day) and HI (\$0.38/cow/day) cows. Organic dairy cows that consume 100% pasture had lower production, but were more profitable because of higher feed costs for supplemented cows.

Key Words: organic, profitability, pasture

661 Effect of organic grain supplementation on pasture and total mixed ration dry matter intake and fatty acid profiles of organic dairy cows. B. J. Heins^{1,3}, J. C. Paulson², M. I. Endres³, and R. D. Moon³, ¹University of Minnesota, West Central Research and Outreach Center, Morris, ²University of Minnesota Extension, Willmar, ³University of Minnesota, Saint Paul.

Organic cows (n = 96) were used to evaluate grain supplementation levels during the grazing season (May to September 2012) on pasture herbage mass and milk fatty acid profiles of organic dairy cows. Cows were assigned to one of 3 replicate supplementation groups, (1) no grain supplementation (100% pasture, GRS), (2) low grain (2.72 kg/head/day, LOW), and (3) high grain (5.44 kg/head/day, HI), and calved at the University of Minnesota West Central Research and Outreach Center, Morris, Minnesota from October to December 2011 and March to May 2012. Supplement (organic corn and minerals) was fed with a total mixed ration of corn silage and alfalfa haylage, and at least 30% of diet dry matter intake for LOW and HI cows consisted of organic

pasture. Pasture herbage mass was assessed for each replicated group for pre- and post-grazing measurements with an electronic rising plate meter. Milk for fatty acid analyses was collected monthly and analyzed at R-Tech Analytical Laboratory (Arden Hills, MN). Analysis was with PROC MIXED of SAS, and independent variables were fixed effects of supplementation group and date of sample was a random effect. The group of GRS (255 kg/d) cows consumed significantly ($P < 0.05$) more dry matter intake per acre from pasture than LOW (211 kg/d) and HI (214 kg/d) cows. Neutral detergent fiber digestibility of cool-season pasture grasses were highest in June (69.7%) 2012 and lowest in September 2012 (51.3%). Oleic (C18:1) and linolenic (C18:3) acids were higher ($P < 0.05$) in milk of GRS (24.5%, 0.9%) cows compared with milk from LOW (21.6%, 0.7%) and HI (21.6%, 0.7%) cows, respectively. Furthermore, n-3 fatty acid was significantly higher ($P < 0.05$) for the GRS (0.05%) cows compared with the LOW (0.04%) and HI (0.03%) cows; however, the GRS (0.37%) cows had significantly ($P < 0.05$) higher levels of trans fat than LOW (0.21%) and HI (0.22%) cows, respectively. Results indicate that milk from cows that consume 100% pasture compared with pasture and TMR have fatty acid profiles that may provide human health benefits.

Key Words: organic, n-3 fat, herbage mass

662 Cost of corn silage in dairy farms in Viçosa, state of Minas Gerais, Brazil. G. A. Freitas, M. I. Marcondes*, O. G. Pereira, F. L. Araujo, and R. L. Albino, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brasil.*

The costs of corn destined to silage production were evaluated according to the soil preparation system: conventional tillage or no-tillage systems, with or without previous plantation of common beans. Data and samples from 18 dairy farms registered in the Program for the Development of Dairy Farming of the region of Viçosa, state of Minas Gerais, Brazil, were analyzed. All data were collected from September 2009 to April 2010. The farms were assigned to a completely randomized design in a 2 × 2 factorial arrangement. The GLM of the software SAS was utilized to run the analysis using 0.10 as significance level. The pH, concentration of dry matter, crude protein, neutral detergent fiber, in vitro dry matter digestibility, wet yield and dry matter production were evaluated. The economic aspects studied were gross income, effective operating costs, total operating costs, gross margin, net margin, natural matter cost and dry matter cost. Higher level of crude protein was observed in the corn silage produced in the no-tillage system ($P < 0.10$). No effects of plantation systems were observed for any of the other characteristics evaluated ($P > 0.10$). The difference in the corn silage protein observed might be explained by the additional increment of nitrogen in the no-tillage system. There is a higher rate of nitrogen release from residues under conventional tillage during the first 4 weeks, compared with no-tillage, and it can be attributed to the effect of tillage systems on incorporation and physical fractioning of residues. Thus, it is inferred that there was a greater loss of nitrogen to the environment under conventional tillage, which may explain the lower concentration of crude protein in corn silage under this system. The costs of corn silage produced without previous plantation of bean was higher than that with it ($P < 0.10$). However, no differences were observed for their gross margin and net margin because there was a higher production of corn silage without previous plantation compared with corn silage with previous plantations of beans which offset its higher cost.

Key Words: no-tillage, production cost, silage

663 Changes in alfalfa silage fermentation products during aerobic exposure and its impact on dry matter intake by goats. K. Gerlach*, Y. Liao, and K.-H. Stüdekum, *University of Bonn, Bonn, Germany.*

Third-cut alfalfa (*Medicago sativa* L.) was harvested at late-bud stage and, after field-wilting, ensiled either untreated (CON) or treated (TRE) with a chemical additive containing sodium nitrite and hexamine (Kofasil liquid, Addcon Europe, Bonn, Germany; 3.5 l/t). Each treatment was ensiled in a separate round bale, at DM contents (g/kg) of 401 and 385, and at densities of 127 and 133 kg DM/m³ for CON and TRE, respectively. After 5 mo, both round bales were opened, each silage homogenized and exposed to air for 8 d. In 2-d intervals, silages were sampled for chemical and microbiological analyses and stored anaerobically in vacuum-sealed polyethylene bags for use in feeding trials. For both silages, one preference trial was done with Saanen-type wethers (n = 5, body weight 91 ± 12.3 kg), each one lasting 15 d. During the experimental phase, each possible combination of 2 silages (n = 10) was offered to the goats as free choice for 3 h. Data were analyzed using the SAS procedure multidimensional scaling (MDS), ANOVA, and correlation analysis between silage characteristics and DM intake (DMI). At opening, concentrations of lactic, acetic, and butyric acids were 39, 25, and 3 g/kg DM in CON, and 31, 12, and <0.02 g/kg DM in TRE silages. During aerobic exposure, mold counts in CON increased, but silage temperature remained stable. TRE heated (>3.0 °C above ambient) at d 8, possibly due to higher amounts of water-soluble carbohydrates and increasing yeast counts. In both trials, goats showed a strong avoidance for aerobically exposed silages. The 3-h DMI (n = 20) for d 0-silage was 700 g (TRE) and 670 g (CON), it decreased at d 2 (TRE) and d 4 (CON) of aerobic exposure ($P < 0.001$). At d 8, there was a decline ($P < 0.001$) in DMI of 67% (CON) and 58% (TRE) compared to d 0-silages. Concentrations of ethanol and methanol were positively correlated to DMI ($r = 0.78$ and 0.76 , $P < 0.05$). Aerobic exposure of alfalfa silage strongly influenced preference and short-time DMI by goats, although silage temperature, fermentation products and microbiological variables changed only slightly.

Key Words: aerobic deterioration, preference trial, ruminant

664 Effects of stocking rate and monensin supplementation on forage characteristics and performance of beef heifers receiving warm-season grasses. J. M. B. Vendramini*¹, J. D. Sanchez¹, W. L. da Silva¹, R. F. Cooke², P. Moriel¹, and G. Caputti¹, ¹*University of Florida, Ona*, ²*Oregon State University, Burns.*

The objective of this study was to evaluate the effects of stocking rates and monensin supplementation on forage characteristics and performance of beef heifers (*Bos* sp.) receiving warm-season grasses. The experiments were conducted in Ona, FL from June to October 2012. In experiment 1, treatments were the factorial combination of 2 stocking rates [1.2 and 1.7 AU (500 kg LW)/ha] and supplementation with monensin (200 mg/d) or control (no monensin) distributed in a complete randomized design with 3 replicates. The heifers received 0.4 kg of a concentrate supplement (14% CP and 78% TDN) daily. Twelve bahiagrass (*Paspalum notatum*) pastures (1.2 ha) were used as experimental units. Herbage mass (HM) and nutritive value were estimated every 14 d and the heifers were weighed at d 0, 43, and 86. Pastures grazed with greater stocking rates had significant ($P < 0.05$) lesser HM (2,300 vs. 2,800 kg/ha) and herbage allowance (HA, 1.0 vs. 1.8 kg DM/kg LW), however, there was no effect of stocking rates on forage CP (8.5%) and in vitro digestible organic matter (IVDOM, 49.7%). Pastures grazed by heifers receiving monensin or control had similar ($P > 0.10$) HM, HA, CP, and IVDOM. Average daily gain was not affected by stocking rate

($P = 0.63$) or monensin supplementation ($P = 0.94$, mean = 0.44 kg/d). In experiment 2, 20 4 heifers (380 ± 18 kg BW) were distributed in 8 drylot pens for forage DM intake and total DM intake measurements. Treatments were supplementation with monensin (200 mg/d) or control (no monensin) in a completely randomized design with 4 replicates. The adaptation period was 10 d followed by 7 d collection. All animals received 0.4 kg of concentrate supplement daily. Ground stargrass (*Cynodon nlemfuensis*) hay (11% CP, 51% IVDOM) was offered and adjusted to allow 10% refusals. There was no difference in total DM intake ($P = 0.64$, mean = 2.1% BW) or forage DM intake ($P = 0.61$, mean = 2.0% BW) between treatments. Monensin supplementation may not improve performance of beef heifers with limited energy intake grazing warm-season grass pastures.

Key Words: monensin, stocking rate, warm-season grass

665 Evaluation of different dietary supplements for cattle consuming ryegrass baleage. L. V. Durst*, B. J. Rude, and S. H. Ward, *Animal and Dairy Sciences, Mississippi State University, Starkville.*

The objectives of this study were to evaluate the digestibility and CP retention of ryegrass baleage supplemented with hay or soybean hull pellets. Crossbred steers (n = 12, BW 247 ± 20.8 kg) were halter broken, and allowed to adapt to ryegrass baleage for a period of 14 d. Following the adaptation period, the steers were placed in individual metabolism crates for a total of 10 d. All 12 steers had ad libitum access to ryegrass baleage (DM = 51%; CP = 16%, DM basis) and were allotted to 3 treatments: (1) no supplement (NS); (2) hay (H; CP = 13%, DM basis); (3) soybean hull pellets (SH; CP = 7%, DM basis), with 4 steers per treatment group. Sample collections were for 7 d following a 3-d adaptation to crates. Data was analyzed using the GLM procedures of SAS with steer as the experimental unit. Dry matter intake was different ($P = 0.0465$) with steers fed NS (4.49 kg/d) and H (4.60 kg/d) consuming less than those fed SH (5.39 kg/d). However, DMI was not different ($P = 0.4146$) when BW was accounted for ranging between 1.7 and 2.1% BW/d. Apparent digestibility of DM was not different ($P = 0.9222$) and ranged between 73 and 74%. There was no difference for apparent OM digestibility ($P = 0.9266$) which ranged from 74 to 76%. Apparent CP digestibility did not differ ($P = 0.3679$) and ranged from 60 to 65%. No difference was found for apparent NDF digestibility ($P = 0.9087$) with a range from 78 to 79%. Apparent hemicellulose digestibility did not differ ($P = 0.5982$) and ranged from 78 to 81%. Apparent fat digestibility was not different ($P = 0.9936$) with a range between 84 and 85%. Amount of protein retained was not different ($P = 0.7322$) and ranged between 11 and 20 g/d. The data collected indicated there was no effect of supplementing a fiber source to cattle consuming ryegrass baleage. This may be attributed to ryegrass being more mature when harvested for baleage.

Key Words: ryegrass baleage, digestibility, beef cattle

666 Using weekly pasture cover measurements to monitor growth and utilization. J. R. Seymour and T. W. Downing*, *Oregon State University, Corvallis.*

Managing pastures on grazing dairies is a continuous challenge because pasture quality, quantity and growth rate are changing daily. Using weekly pasture cover measurements have been demonstrated in New Zealand and Ireland to provide useful information to manage pastures allowing managers to estimate daily growth rates, feed inventories and feed budgeting. The objectives of this project were to document weekly pasture growth, forage quality and utilization and to understand how to

use this information to make management decisions on US dairies. Two dairies were studied for a year. Pastures were measured and mapped and total standing dry matter was estimated weekly in all 65 pastures using a calibrated rising plate meter. Measurements started with the grazing season in the spring in March and continued until the end of November. Weekly grazing wedges were developed and printed for each farm and were used to make grazing decisions that week. Paddocks grazed and residual pasture covers were recorded daily and forage cover measurements were measured weekly and entered into management software. Paddock grazing and residual heights were also included in the electronic recordkeeping. Dry matter yields ranged from 12671 to 22066 ± 2902 kg/ha. Daily growth rates ranged from 5 to 137 kg/ha a day throughout the season and averaged 83.1 ± 32.3 for Farm 1 and 53.7 ± 27.6 for Farm 2. Weekly pasture quality samples were taken and analyzed with season long energy values averaging 12.15 ± 0.822 MJ/kg for Farm 1 and 12.58 ± 0.77 MJ/kg for Farm 2. Monitoring weekly growth and cover provides valuable information for the grazing dairy. Pasture quality and productivity in Oregon is comparable to some of the most productive pastures reported from around the world.

Key Words: rising plate meter, pasture cover, pasture energy values

667 In vitro NDF digestibility and its correlation with chemical components of tropical grasses under intensive rotational grazing strategies. J. C. Lopes*¹, R. B. Reis², and D. K. Combs¹, ¹Department of Dairy Science, University of Wisconsin-Madison, Madison, ²Escola de Veterinária, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil.

This study was conducted to determine the in vitro NDF digestibility (IvNDFD) and its correlation with chemical components of the main tropical grasses produced under intensive rotational grazing practices in Brazil. One-hundred six samples of *Brachiaria brizantha* (n = 22); *Brachiaria hybrida* (n = 6); *Cynodon dactylon* (n = 13); *Cynodon nlemfuensis* (n = 4); *Panicum maximum* (n = 31) and *Pennisetum purpureum* (n = 30) were collected from research paddocks from the Southeast region of Brazil. All grasses were grown on highly fertilized soils and managed with intensive rotational grazing practices. Grasses were hand-clipped at the cutting height of 95% of sward canopy light interception. Samples were shipped to the University of Wisconsin-Madison, and analyzed sequentially for NDF, ADF and lignin. In vitro NDF digestibility was analyzed for 24-, 30-, and 48-h. Data were analyzed as a split-plot in time using a mixed procedure of SAS. Pearson correlation coefficients were used to describe relationships between IvNDFD and NDF and lignin. Average NDF content ranged from 60 to 63% of DM across grass species. Mean IvNDFD differed due to time of incubation ($P < 0.0001$) and were 37 ± 13, 45 ± 13 and 61 ± 13% of NDF at 24-, 30- and 48-h, respectively, across forages species. Comparison of mean IvNDFD estimates indicated that *C. dactylon* and *C. nlemfuensis* had high IvNDFD; *B. hybrida* and *P. maximum* were intermediate in IvNDFD; and *P. purpureum* and *B. brizantha* had lowest NDF digestibility estimates. Lignin was not significantly correlated to IvNDFD of tropical grasses. A negative relationship between IvNDFD and NDF content was only observed for *C. dactylon*. Our findings indicate that fertilized tropical forages with short defoliation intervals can be relatively high in fiber digestibility. Forage species had a significant effect on IvNDFD. These data also suggest that NDF digestibility in tropical grasses may not be correlated to the same chemical components related to digestibility in temperate grasses and it possibly differs within species of tropical grasses.

Key Words: tropical grass, NDF digestion, in vitro

668 Days of rest affects forage mass and quality in a rotational stocking system. J. C. Emenheiser*¹, B. F. Tracy¹, A. E. Tanner¹, D. Fiske², W. S. Swecker, Jr.³, W. M. Clapham⁴, and R. M. Lewis¹, ¹Virginia Polytechnic Institute and State University, Blacksburg, ²Shenandoah Valley Agricultural Research and Extension Center, Steeles Tavern, VA, ³Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, ⁴USDA-ARS Appalachian Farming Systems Research Center, Beaver, WV.

Forage growth is a key dynamic in rotational stocking systems. We evaluated effects of stockpiling and rest on forage mass and quality in rotational stocking. Twelve 6.47-ha fescue-clover pastures (block) were stocked with equivalent beef cattle units between March and November in 2008 to 2011. Each block consisted of 8 paddocks with variable rest durations. Each year, an alternating half of the paddocks were stockpiled from August to November and stocked in winter. Forage samples were collected mid-monthly; May to November samples were used (7 periods). Average daily temperature (TEMP, °C) and precipitation (PREC, cm) were obtained by period. Days since last grazed (REST) were calculated for paddocks. Dry matter mass (MASS; kg) and CP and ADF contents (g/kg MASS) were measured. A linear mixed-model with block, period, stock, and period by stock interaction as fixed effects was fitted. Covariates were REST, TEMP and PREC; their interactions with period and stock, singly and together, also were fitted. Year nested within block and residual were random effects. Block only defined variation in CP ($P < 0.02$). The REST ranged from 1 to 110 d and was right-skewed with mean 28.8 (±26.0) d. The TEMP was parabolic with a low of 9.3 (November) and high of 22.2°C (August). The PREC ranged from 0.19 (August) to 0.36 cm (May), and varied across periods and years. Mean MASS was 7573 ± 5261 kg/ha. Means for CP and ADF were 132 ± 4 and 338 ± 6 g/kg, respectively. For MASS, REST corresponded with an increase of 49 ± 19 kg/ha per d ($P < 0.001$); there was no interaction of REST with period ($P = 0.18$), stock ($P = 0.05$), or their combination ($P = 0.49$). For CP and ADF, such interactions were evident ($P < 0.04$). The CP content (g/kg of MASS) also was affected by REST ($P < 0.001$). In May to July, CP content in non-stockpiled (0.63 ± 0.51) and stockpiled (0.17 ± 0.43) paddocks increased with REST. In August to November, CP content increased 0.46 ± 0.52 in non-stockpiled, but decreased 0.12 ± 0.45 in stockpiled, paddocks with REST. Forage mass accumulated at a similar rate irrespective of period or stockpiling, likely reflecting influences of weather patterns across a grazing season.

Key Words: rotational stocking

669 Effects of pasture management and energy supplement on ingestive behavior of grazing cattle. J. R. R. Dorea¹, L. R. D. Agostinho Neto¹, V. N. Gouvea¹, D. F. A. Costa*¹, A. V. Pires¹, L. G. R. Pereira², and F. A. P. Santos¹, ¹University of Sao Paulo, Piracicaba, Sao Paulo, Brazil, ²Empresa Brasileira de Pesquisa Agropecuária, Juiz de Fora, Minas Gerais, Brazil.

The objective of this trial was to evaluate the effect of 2 pre-grazing canopy heights and 2 levels of energy supplementation on ingestive behavior of Nelore steers grazing a well-managed tropical grass during the rainy season. Treatments consisted of control (mineral supplement only) and a medium level of energy supplementation (0.6% of BW of fine ground corn) combined with 2 pre-grazing heights (25 and 35 cm), using a common stubble height of 15 cm. Eight 48-mo-old rumen-cannulated steers (300 kg BW ± 7.40) were assigned to 2 4x4 Latin squares and allocated to 2 ha of *Brachiaria brizantha* pasture. Ingestive behavior was evaluated in a 24h observation period in which grazing, rumination and resting activities were monitored every 5 min. Bite and ingestion rates were also evaluated. Grazing time decreased when 25 cm

canopy height and energy supplementation were used (44.5 and 71.0 min, respectively). The rumination time was not affected by energy supplementation and pre-grazing canopy height. However, there was an increase in resting time when the pre-grazing canopy height was 25 cm. This could decrease energy expenditure for maintenance resulting in an increased animal performance. The ingestion rate was greater for 25 cm pre-grazing height suggesting a higher harvest efficiency; however no effects were observed for energy supplementation. The bite rate was also higher on 25 cm pre-grazing height and, as for ingestion rate, it could result in an increased harvest efficiency consequently resulting in greater dry matter intake. The use of the pre-grazing canopy height of 25 cm and of a medium level of energy supplementation resulted in improvements on harvest efficiency.

Table 1. Effects of pasture management (M) and supplementation (S) on grazing, rumination and resting times, ingestion and bite rates

	M, cm		S, % BW		P-value			SEM
	25	35	0	0.6	M	S	M × S	
Grazing time, min	390	434	447	376	*	*	*	29.23
Rumination time, min	392	441	401	431	NS	NS	NS	36.43
Resting time, min	607	502	543	566	*	NS	NS	35.05
Ingestion DM rate, g of DM/min	15.15	8.38	12.24	11.29	*	NS	NS	3.03
Bite rate, bites/min	29.72	19.59	23.41	25.90	*	NS	NS	3.69

* $P < 0.05$.

Key Words: pasture management, energy supplement